

Influence of pre-sowing treatments on seed germination in lesser known tree- Kamala [*Mallotus philippinensis* (Lam.) Mull. Arg.]

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ABSTRACT

The present trial was conducted at College of Forestry, Navsari Agricultural University, Navsari, Gujarat during 2022 to know the influence of pre-sowing treatments on seed germination in *Mallotus philippinensis*. The trial consisting of 14 treatments and 3 repetitions and laid out in a Completely Randomized Design in the nursery condition. Among various pre-sowing treatments, soaking seeds in normal water for 12 hrs + soaking seeds in GA₃ solution @ 50 ppm for 60 min (T₉) recorded maximum germination (48.67 %), mean daily germination (1.62), peak value of germination (2.58), germination value (4.18) and germination rate index (3.69) whereas minimum mean germination time (12.78) was exhibited by soaking seeds in normal water for 12 hrs + soaking seeds in GA₃ solution @ 100 ppm for 60 min (T₁₀). So, soaking seeds in normal water for 12 hrs + soaking seeds in GA₃ solution @ 50 ppm for 60 min (T₉) was found best pre- treatment for germination and this treatment can be useful for large scale seedling production of *M. philippinensis*.

Key words: Germination, LKT species, *Mallotus philippinensis*, Nursery, Pre-sowing treatments

Introduction

Mallotus philippinensis popularly known as Kamala belongs to Euphorbiaceae family, distributed mainly in the tropical and subtropical regions of the world with around 20 species found in India. Monkey face tree is the English name whereas Kampillaka and Sinduri are the common names of *M. philippinensis* (Dholariya *et al.*, 2019). It is found up to 1600 m elevation and grows best in areas where annual day-time temperature is within the range of 25-34 °C

(tolerate 7-45 °C). It prefers a mean annual rainfall in the range of 1,000-2,500 mm (tolerates 600-5,000 mm) while a pH in the range of 5-6.7 (tolerate 4.5-7.5). *M. philippinensis* has a widespread natural distribution, from the southern China to western Himalayas, in India, Sri Lanka and throughout Malaysia, Australia and Melanesia. In India it is widely distributed in the tropical and sub-tropical regions including all over the Punjab, Uttar Pradesh, West Bengal, Assam and from Mumbai and Ceylon (Orwa *et al.*, 2009) *i.e.*, throughout western ghats.

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This tree grows well in full sunlight but withstands considerable shade. Moreover, it is frost hardy and drought resistant in nature. It coppices well and also capable of producing root suckers (Khanna, 2009). *Mallotus* is small to medium-sized evergreen trees can grow up to 25 m tall and diameter up to 50 cm. Flowers are dioecious in nature. Fruits mature in July and August, while flowers bloom in March and April (Gangwar *et al.*, 2014; Behera *et al.*, 2023).

Kamala dye is commercially important and has got great market demand as food colorant to cloth dye and for medicinal purpose. It is utilized as a popular dye-producing plant (Kamala dye) and is significant source of physiologically active chemicals (Gangwar *et al.*, 2014). *M. philippinensis* is an underutilized tree with multiple uses like timber, fodder, medicinal value and other intangible benefits (Dholariya *et al.*, 2019).

Good quality nursery stock is the most important requirement for any successful plantation programme or afforestation. Various pre-sowing seed treatments like irradiation (Singh and Singh, 2005), bioprimering (Moeinzadeh *et al.*, 2010), soaking in water, mineral solutions (Mariappan *et al.*, 2013), growth regulators (Agboola, 2003 and Kumaran *et al.*, 1993) alone or in combination found to hasten germination process, increased germination rate, improved resistance to water and salinity stress and finally increase the tree crop yields (Pandey and Sinha, 1995; Krishnaveni *et al.*, 2010). Hard coated seeds need more time to germinate and thus, direct sowing is not effective (Anon., 1972). Proper pre-sowing treatments of seeds can stimulate germination time and germination process (Azad *et al.*, 2011; Azad *et al.*, 2012). Generally, Kamala reproduced through seeds; however, due to stiff seed coats, natural reproduction is about 30 % effective. Moreover, the rate of germination is frequently low (Sharma and Verma, 2011; Dholariya *et al.*, 2019) and research related to propagation of this lesser known tree (LKT) species is meager. Therefore, looking into the numerous benefits and difficulties in propagation of *M. philippinensis*, present trial was carried out with the objective to enhance the seed germination process in a quick time.

Materials and Methods

The present trial was conducted at Polyhouse, College of Forestry, Navsari Agricultural University, Navsari, Gujarat during 2022. For the trial, matured

fruits were collected from the well developed crown trees distributed at Gadat (20.85 °N, 72.98 °E), Gandevi, Navsari. Collected fruits were dried under shade and seeds were extracted manually after bursting the fruits. The germination media was prepared by proper mixing of soil: sand (1:1) and filled into perforated trays of size 37 cm × 27 cm × 7 cm and 100 seeds per treatment per repetition were sown into the trays and watered regularly. The trial was laid out in Completely Randomized Design (CRD) with fourteen treatments and three repetitions. There are various pre-sowing treatments *i.e.*, T₁: control, T₂ to T₄: soaking seeds in normal water for different durations, T₅ to T₁₂: soaking seeds in normal water for 12 hrs (T₂) + soaking seeds in GA₃ solution for different concentration with different durations and T₁₃ to T₁₄: soaking seeds in cow dung slurry for 24 hrs and for 48 hrs. Observations were recorded starting from the day after sowing and continued up to 30 days on daily basis. Various germination parameters such as Germination percentage, Mean daily germination (MDG), Peak value of germination (PV), Germination value (GV), Mean germination time (MGT) and Germination rate index (GRI) were recorded at 30 DAS (Days After Sowing). The data obtained from the experiment were fed and well arranged in MS Excel and subjected to statistical analysis using OPSTAT software in experimental design CRD (Sheoran *et al.*, 1998). The ANOVA was constructed for further inference. The appropriate standard error of mean [SEm (±)] was calculated in each case and Critical Difference (CD) at 5 per cent level of probability was worked out to compare the treatment means, where the treatment effects were significant (Panse and Sukatme, 1985).

Results

In *M. philippinensis*, important germination parameters such as germination percentage, mean daily germination, peak value, germination value and germination rate index recorded significantly maximum in soaking seeds in normal water for 12 hrs + soaking seeds in GA₃ solution @ 50 ppm for 60 min (T₆) treatment (Fig. 1 and 2). Maximum germination of 48.67 per cent, maximum mean daily germination of 1.62, maximum peak value of 2.58, maximum germination value of 4.18 and maximum germination rate index of 3.69 were recorded in T₆ treatment as compared to other pre-sowing treatments. More-

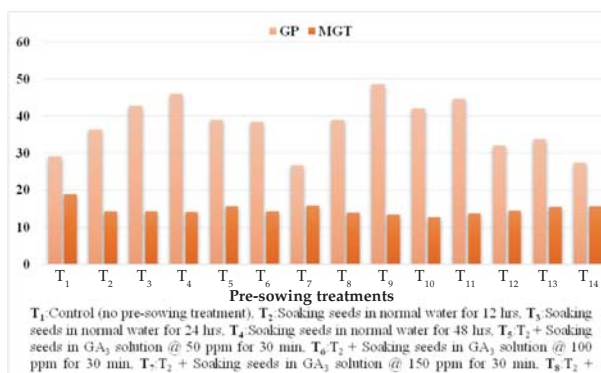


Fig. 1. Influence of pre-sowing seed treatments on germination percentage and mean germination time of *Mallotus philippinensis* recorded up to 30 DAS

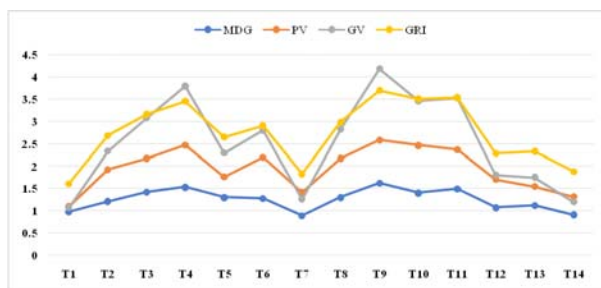


Fig. 2. Influence of pre-sowing seed treatments on mean daily germination, peak value of germination, germination value and germination rate index of *M. philippinensis* recorded up to 30 DAS

over, T₁₀ (12.78) treatment followed by T₉ (13.63) recorded lower mean germination time which indicates, these two treatments took less time to germinate (Fig. 1).

Discussion

Seed germination is the crucial process in reproduction and various seed germination parameters are considered mainly in commercial seedling production. The successful seed germination depends upon the viable embryo, optimum food reserves, very less or absence of germination inhibitory substance in seed coat with proper and optimum germination environment (Manojkumar, 2021). In case of dormancy, seed dormancy breaking treatments varies with species, again the same pre-sowing treatment cannot be useful to obtain good germination in all type of seeds. In present trial maximum germination percentage, mean daily germination, peak value, germination value and germination rate index re-

corded in treatment *i.e.*, soaking seeds in normal water for 12 hrs + soaking seeds in GA₃ solution @ 50 ppm for 60 min (T₉). Here, both water (for 12 hrs) and GA₃ @ 50 ppm (for 60 min) enhanced all the germination parameters due to their synergetic effect (Choudhury and Karmakar, 2020 and Kucera *et al.*, 2005).

It is reported that pre-sowing water treatment alone enhances the seed germination and its attributes in many forest tree species. The seed absorbs enough water by imbibition process when water is in adequate amount. Imbibition is the main process of germination though it is not related to viability of seed. When seeds are formed, plants store food reserves within the seed which provide nourishments to the growing embryo. During the imbibition of water, hydrolytic enzymes are activated which breakdown the food reserve into metabolically useful chemicals and enhance the germination process (Choudhury and Karmakar, 2020; Bradford, 1995). Seeds of *Kalappia celebica* when nicked and soaked in water for 12 hrs recorded maximum germination of 94.67 per cent with lowest MGT of 5.56 and the highest MDG of 0.95 (Tuheteru *et al.*, 2022). Pre-treatment with soaking seeds in water for 12 hrs, resulted in 85 per cent germination in *Maesopsis eminii* and 90 per cent in *Terminalia catappa* (Odoi *et al.*, 2019); whereas in *Dalbergia latifolia*, it was 70 per cent germination with, mean daily germination of 3.33, peak value of 6.35, germination rate of 5.11 and germination value of 21.15 when soaking seeds in water for 12 hrs (Kumar and Chavan, 2018). Similarly, Hasnat *et al.* (2017) in *Canarium resiniferum*; Lamtom and Abdalrasol (2016) in *Ceratonia siliqua*; Al-Barzinji *et al.* (2015) in *Dalbergia sissoo*; Haider *et al.*, (2014) in *Acacia catechu*; Hossain *et al.* (2005) in *Terminalia chebula* recorded maximum germination attributes when treated with water.

Moreover, GA₃ alone at lower or higher concentration with different duration of treatments enhances the seed germination attributes. GA₃ function via activation of enzymes, mobilization of food materials leading to cell division, cell elongation and embryo growth that promotes germination in viable seeds (Khan, 1980); therefore, GA₃ exerts its influence by increasing the growth potential of embryo followed by inducing hydrolytic enzymes (Kucera *et al.*, 2005). During seed germination, embryonic GA₃ is released that triggers the weakness of seed cover by stimulating gene expression involved in cell ex-

pansion and modification as reported in Arabidopsis (Yamauchi *et al.*, 2004). In *Limonia acidissima* maximum germination (78.09 %) recorded when seeds soaked in GA₃ of 100 ppm for 24 hrs (Sabarad *et al.*, 2023); whereas, maximum germination of 67.7 per cent and germination energy of 52.2 per cent recorded in seeds of *Strychnos nux-vomica* treated with GA₃ of 1000 ppm for 24 hrs (Ooha *et al.*, 2022). Similarly, Berry *et al.* (2021) recorded higher germination percentage (98.88%) in *Gmelina arborea* seeds when treated with GA₃ of 200 ppm while Bhat *et al.* (2020) found highest germination of 62.43 per cent in *Hydnocarpus pentandra* when seeds treated with GA₃ of 350 ppm. Other germination attributes such as MDG, PV, GV, MGT and GRI are also enhanced by the treatments of GA₃ in tree species. In *Phytolacca acinosa*, maximum germination index (0.70), maximum mean daily germination (6.69% seeds per day) and minimum mean germination time (6.58 days) recorded in seeds treated with GA₃ (100 ppm) plus scarification (Margay *et al.*, 2023), while seeds of *Morus laevigata* soaked in 1000 ppm GA₃ for 12 hrs recorded highest germination percentage of 87.50 per cent, peak value of 4.29, germination value of 14.00 (Chettri and Singh, 2022). Similarly, Hemalatha and Chaudhary (2021) in *Santalum album*; Maharana *et al.* (2018) in *Gmelina arborea*; Vasantha *et al.* (2014) recorded higher germination attributes when seeds were treated with GA₃.

In the present trial, combined influence of seeds soaking in water for 12 hrs followed by application of 50 ppm GA₃ solution for 60 min enhanced the seed germination attributes in *M. philippinensis*. So, this treatment is useful to produce quality seedlings in large scale of *M. philippinensis* in nursery condition.

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