

INFLUENCE OF DIFFERENT CONCENTRATIONS OF GA₃ ON SEED GERMINATION IN *Corynandra felina* (L.f.) Cochrane & Iltis.

ABSTRACT:

Corynandra felina (L.f.) Cochrane & Iltis [= *Cleome felina* L.f.] is an endemic medicinal herb of Peninsular India with considerable therapeutic potential. However, its propagation is restricted by poor and erratic seed germination resulting from seed dormancy, leading to inadequate field establishment. The present study investigated the effect of different concentrations of gibberellic acid (GA₃) on seed germination in *C. felina*. Seeds were pre-soaked in GA₃ solutions at concentrations of 0.5, 1.0, 1.5, and 2.0 mg L⁻¹ for 24, 48, and 72 h before sowing under laboratory conditions. Germination percentage and mean germination time were recorded to evaluate the effectiveness of the treatments. GA₃ significantly enhanced seed germination compared with the untreated control. Among the treatments tested, 1.0 mg L⁻¹ GA₃ applied for 72 h produced the highest germination percentage (18.5%). Although higher GA₃ concentrations also improved germination relative to the control, they did not provide additional benefits and were associated with a slight reduction in germination performance. The findings demonstrate that an optimum concentration of GA₃ effectively alleviates seed dormancy and enhances seed germination in *Corynandra felina*. The optimized protocol developed in this study provides a practical approach for improving propagation, supporting ex situ conservation, and facilitating the sustainable utilization of this endemic medicinal species.

Keywords: *Corynandra felina*; gibberellic acid (GA₃); seed dormancy; seed germination; endemic medicinal plant

1. INTRODUCTION:

Corynandra felina (L.f.) Cochrane & Iltis [= *Cleome felina* L.f.], a member of the family Cleomaceae, is commonly known as the cat spider flower. The species is endemic to Peninsular India and has been reported from several parts of the region (Sundararagavan, 1993; Kundu *et al.*, 2007; Rawat *et al.*, 2008). Owing to its diverse pharmacological properties, *Corynandra felina* occupies an important place in traditional medicine. The entire plant has been used as an astringent (Nadkarni, 1954), while its seeds have been administered as a vermifuge in traditional medicinal practices (Baillon, 1874). Previous studies have demonstrated that extracts of the whole plant possess antidiabetic and antihyperglycaemic activities (Nagarajan *et al.*, 2005). Furthermore, the ethanolic leaf extract has been reported to exhibit significant anticancer potential (Mahimadoss *et al.*, 2014). In addition, the species has

been shown to possess anti-inflammatory, antimicrobial, and anticancer properties, highlighting its considerable therapeutic value (Vijayashalini and Abirami, 2018). The increasing medicinal importance of *Corynandra felina* has resulted in extensive harvesting from natural populations by local herbal practitioners. Continuous and unregulated collection, coupled with habitat degradation, has substantially reduced its natural populations, making the species increasingly vulnerable and emphasizing the need for effective conservation and propagation strategies.

Seed germination represents a crucial phase in the plant life cycle, determining successful seedling establishment, population regeneration, and long-term survival. However, the conservation and large-scale propagation of *Corynandra felina* are hindered by poor and erratic seed germination, primarily due to seed dormancy. Dormancy restricts timely germination and consequently reduces seedling establishment under natural conditions. Various seed pretreatment methods, particularly the application of plant growth regulators, have been successfully employed to overcome dormancy and improve germination in several medicinal plant species. Among these, gibberellic acid (GA₃) is one of the most effective growth regulators, promoting germination by inducing the synthesis of hydrolytic enzymes such as α -amylase, facilitating the mobilization of stored food reserves, and stimulating embryo growth. In view of these considerations, the present study was undertaken to investigate the effect of different concentrations of GA₃ on seed germination and early seedling growth in *Corynandra felina*, with the objective of developing an efficient protocol for enhancing propagation and supporting the conservation of this valuable endemic medicinal species.

2. MATERIAL AND METHODS:

2.1.Plant Material and Seed Collection

Healthy one-month-old plants of *Corynandra felina* (L.f.) Cochrane & Iltis were collected from Gopalapuram, Hanamkonda District, Telangana, India (18.0212° N, 79.5359° E). The collected specimens were identified and authenticated, and voucher plants were established and maintained in the Botanical Garden, Department of Botany, Osmania University, Hyderabad, Telangana, India (17.4135° N, 78.5287° E). Mature black seeds were harvested from fully ripened fruits of *Corynandra felina*. The seeds were shade-dried for 72 h and subsequently stored in screw-capped glass bottles at room temperature until further use.

2.2. GA₃ Treatment and Germination Experiment

Prior to sowing, the seeds were soaked in aqueous solutions of gibberellic acid (GA₃) at concentrations of 0.5, 1.0, 1.5, and 2.0 mg L⁻¹ for three treatment durations: 24, 48, and 72 h.

Untreated seeds served as the control. Following treatment, the seeds were sown in medium-sized pots containing a sterilized potting mixture of vermicompost, red soil, and sand in a 2:1:1 ratio. Each pot was sown with 50 seeds, and every treatment was replicated three times. The pots were maintained under suitable environmental conditions, and germination was monitored regularly throughout the experimental period.

2.3. Germination Assessment

Seed germination percentage was calculated using the following formula:

$$P = (G/T) \times 100$$

Where,

P = Germination % age

T = Total number of seeds sown

G = Number of germinated seeds

The mean germination percentage for each treatment was calculated from three independent replicates and used for statistical analysis.

3. RESULTS:

3.1. Effect of GA₃ on Seed Germination

The effect of different concentrations of gibberellic acid (GA₃) on the *in vivo* germination of *Corynandra felina* seeds was evaluated after seed soaking for 24, 48, and 72 h. Germination percentage increased progressively with increasing treatment duration and varied according to GA₃ concentration (Table 1; Fig. 1 and 2). Untreated (control) seeds exhibited a low germination percentage of 4.3%, indicating the presence of seed dormancy. In contrast, GA₃ treatment significantly improved germination compared with the control. Among the concentrations tested, 1.0 mg L⁻¹ GA₃ was the most effective, producing germination percentages of 11.7%, 16.4%, and 18.5% after 24, 48, and 72 h of treatment, respectively. The highest germination (18.5%) was recorded following treatment with 1.0 mg L⁻¹ GA₃ for 72 h. Lower GA₃ concentration (0.5 mg L⁻¹) resulted in comparatively lower germination percentages of 5.7%, 6.2%, and 10.0% after 24, 48, and 72 h, respectively. Increasing the concentration beyond the optimum (1.5 and 2.0 mg L⁻¹) did not further enhance germination. Seeds treated with 1.5 mg L⁻¹ GA₃ showed germination percentages of 9.7%, 12.8%, and 14.4%, whereas those treated with 2.0 mg L⁻¹ exhibited 6.2%, 8.2%, and 10.2% germination after 24, 48, and 72 h, respectively. Overall, seed germination improved with increasing soaking duration up to 72 h, and 1.0 mg L⁻¹ GA₃ proved to be the optimum concentration for overcoming seed dormancy and enhancing germination in *Corynandra felina*. Higher GA₃

concentrations did not confer additional benefits and instead resulted in a slight decline in germination percentage.

Table 1. Effect of different concentrations of GA₃ and soaking durations on the *in vivo* seed germination percentage of *Corynandra felina*.

Treatment	GA ₃ Conc. (mg L ⁻¹)	% of germination		
		24 Hrs	48 Hrs	72 Hrs
Control	-	4.3		
GA ₃	0.5	5.7	6.2	10
	1.0	11.7	16.4	18.5
	1.5	9.7	12.8	14.4
	2.0	6.2	8.2	10.2

Values represent the mean germination percentage .Each experiment done with 50 seeds and each experiment repeats three times.



Fig. 1. a). Field grown *Corynandra felina* plant
 b). Mature open fruit with seeds c). Mature seeds d, e & f). Seedlings

DISCUSSIONS :

Seed germination is the first and one of the most critical stages in the life cycle of a plant, determining successful seedling establishment and subsequent population regeneration (Bewley, 1997). However, germination is often influenced by seed dormancy, a physiological condition in which viable seeds fail to germinate even under favourable environmental

conditions (Bewley and Black, 1994). Dormancy serves as an adaptive mechanism that prevents premature germination but also poses a major challenge for the propagation and conservation of many medicinal and endemic plant species. The seed coat contributes to dormancy by restricting the uptake of water and oxygen and by mechanically limiting radicle emergence. Various pre-sowing treatments, including water soaking, mechanical scarification, and the application of plant growth regulators, have been widely employed to overcome dormancy and improve germination (Madushani *et al.*, 2019). Among plant growth regulators, gibberellic acid (GA₃) is recognized as one of the most effective dormancy-breaking agents. GA₃ promotes seed germination by counteracting the inhibitory effects of abscisic acid (ABA), stimulating embryo growth, and inducing the synthesis of hydrolytic enzymes, particularly α -amylase, which mobilize stored food reserves required for embryo development (Debeaujon and Koornneef, 2000). Consequently, exogenous application of GA₃ has been reported to improve germination in several plant species (El-Barghathi and El-Bakosh, 2005). Information on seed dormancy and germination biology within the genera *Cleome* and *Corynandra* remains limited. Previous investigations have reported generally poor germination in several species of these genera (Ochuodho and Modi, 2007; Raboteaux and Anderson, 2010). Physiological dormancy has been documented in *Cleome lutea*, *C. serrulata*, and *C. hassleriana* (Cane, 2008), suggesting that dormancy is a common characteristic within the group. Such dormancy may result from factors including a relatively hard seed coat, incomplete embryo development, or hormonal regulation mediated primarily by abscisic acid (ABA) (Bewley and Black, 1994). The present investigation demonstrated that GA₃ treatment significantly enhanced seed germination in *Corynandra felina* compared with untreated seeds. Seeds exposed to GA₃ initiated germination within three days, whereas untreated seeds began germinating only after seven days, indicating that GA₃ effectively accelerated the germination process. Similar observations have been reported by Balaguera-Lopez *et al.* (2008), who demonstrated that GA₃ treatment hastened seed germination in dormant seeds. The untreated control exhibited a low germination percentage (4.3%), confirming the presence of strong seed dormancy in *Corynandra felina*. Both GA₃ concentration and soaking duration markedly influenced germination. Among the treatments evaluated, soaking seeds in 1.0 mg L⁻¹ GA₃ for 72 h resulted in the highest germination percentage (18.5%). Lower concentrations were less effective, while concentrations above the optimum (1.5 and 2.0 mg L⁻¹) failed to produce further improvement and slightly reduced germination. These findings suggest that an optimal level of GA₃ is required to stimulate

germination, whereas excessive concentrations may not provide additional physiological benefits.

The enhanced germination observed following GA₃ treatment is likely attributable to improved penetration of the hormone into the seed tissues and activation of metabolic processes associated with embryo growth (Mathur *et al.*, 1971). Gibberellins are known to promote the expression of hydrolytic enzymes, accelerate reserve mobilization, and facilitate radicle protrusion, thereby overcoming physiological dormancy. Similar mechanisms have been reported in *Arabidopsis thaliana*, where GA₃ effectively releases seed dormancy and promotes germination (Ouyang *et al.*, 2000). Overall, the findings of the present study demonstrate that pre-soaking *Corynandra felina* seeds in 1.0 mg L⁻¹ GA₃ for 72 h is the most effective treatment among those tested for improving seed germination. This protocol offers a practical and efficient approach for enhancing the propagation, cultivation, and ex situ conservation of this endemic medicinal species.

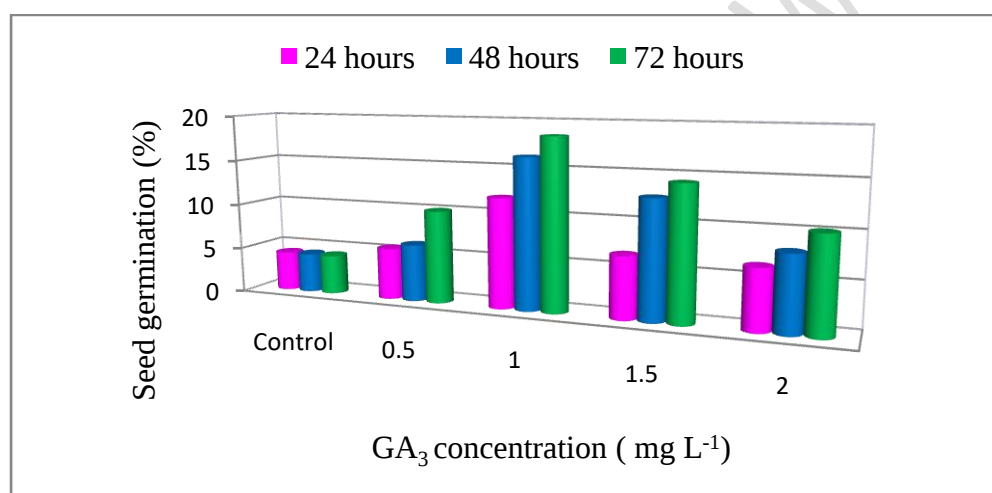


Fig. 2 Effect of GA₃ concentration on *in vivo* seed germination in *Corynandra felina*

CONCLUSIONS:

The present study demonstrated that gibberellic acid (GA₃) effectively enhances the *in vivo* seed germination of *Corynandra felina*. Untreated seeds exhibited a low germination percentage (4.3%), confirming the presence of pronounced seed dormancy; whereas seeds treated with 1.0 mg L⁻¹ GA₃ achieved the highest germination percentage (18.5%). The results indicate that GA₃ is effective in breaking seed dormancy and promoting germination, when applied at an optimum concentration. Among the treatments evaluated, soaking seeds in 1.0 mg L⁻¹ GA₃ for 72 h proved to be the most effective protocol for improving germination.

These findings provide a simple, economical, and reliable method for enhancing seed propagation of *Corynandra felina*. The optimized GA₃ treatment can be employed for large-scale multiplication, *ex situ* conservation, and sustainable utilization of this endemic medicinal species. Further studies on additional dormancy-breaking techniques and field establishment of seedlings may help develop comprehensive conservation strategies for *Corynandra felina*.

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