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# Propagation studies on Gloriosa superb

S. Anandhi • K. Rajamani • M. Jawaharlal

Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore-641 003, Tamil Nadu, India.

\*Corresponding author E-mail: sanandhijasmin@gmail.com

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**Abstract.** Studies on seed germination in glory lily revealed that seeds soaked in hot water for 1 h was found to be the best treatment with a maximum germination of 32.75%, and with an earlier germination (48.35 days) and better vigor index (565.92), when compared to other chemical or growth regulator treatments. Effect of certain growth regulators (GA<sub>3</sub>, kinetin, ethrel) on the sprouting tuber of glory lily was assessed and ethrel at 500 ppm recorded a maximum sprouting percentage (100%), an earlier sprouting of tubers (6.33 days), maximum plant height (99.32 cm) and a maximum number of leaves per plant (34.04) and plant girth (1.81 cm).

Keywords: Glory lily, seed treatment, growth regulator, tuber, germination, sprouting.

# INTRODUCTION

Gloriosa superba L. (Colchicaceae) is an important medicinal plant, native to Tropical Asia and Africa. It is highly valued in modern medicine due to the presence of colchicine and colchicoside which are used in treatment of gout and rheumatism. It is commercially propagated by tubers which are 'V' or 'L' shaped sourced from the wild especially from the forest areas and hillocks. It has been reported that more than 500 tonnes of wild tubers are collected every year and used for planting in Tamil Nadu alone. About 800 kg of tubers are required to plant in one acre. The cost involved towards planting material (Rs.250 to 300/kg of tubers), alone accounts to 2.0 lakhs at Rs 250 per kg of tuber prevailing for the last three years. Seed germination is erratic and takes three weeks to three months (Azhar and Sreeramu, 2004). But the sprouting of tubers is irregular and in a period of 30 days they sprout to an extent of 60%. Hence, this experiment was aimed at standardizing the seed treatment methods and the effect of growth regulators on sprouting of tubers of G. superba.

# MATERIALS AND METHODS

Dried seeds of G. superba collected from Mulanur of

Thirupur district were used for standardizing the seed treatment. To test the effect of hot water soaking on seed germination, 250 ml of hot water (heated up to  $100^{\circ}$ C) and then taken away from the heat source. The seeds were immersed in hot water. After an hour, seeds were taken out and soaked in water overnight. Similarly, seeds were soaked in chemicals *viz.*, GA<sub>3</sub> (100 and 250 ppm), thiourea and potassium nitrate at various concentrations (0.5, 1.0 and 1.5 %) for an hour. Treated seeds were sown in the raised beds at a distance of 10 cm between the lines in the beds. Seeds of 100 numbers were sown in each treatment with the replication of four.

To standardize the effect of growth regulator on sprouting of tubers of G. superba were collected from farmer's field, Mulanur of Tirupur district. The experiment was carried out adopting Completely Randomized Design comprising seven treatments with three replications. These tubers with sprouts were soaked in different growth regulators viz., kinetin (25 and 50 ppm), GA<sub>3</sub> (100 and 200 ppm) and ethrel (250 and 500 ppm) for one hour. After that, the tubers were planted in the medium size pots filled with pot mixtures containing sand, red Yard Manure earth and Farm (FYM) (1:2:1). Observations were recorded for two months after planting.

#### **Observations recorded**

#### Days for germination

The average number of days taken for germination of the seedling was recorded.

#### Germination percentage

The number of seeds germinated were counted and expressed in percentage.

#### Number of days taken for sprouting of tubers

Number of days required for sprouting was recorded and the mean value was expressed.

# Sprouting percentage

Number of tubers that produced healthy sprouts was recorded and the mean value was expressed in percentage.

# Plant height (cm)

The height of the plant from the ground level to the growing point of the main stem was measured at periodical intervals and the mean was expressed in centimeters.

# Number of leaves

The total number of leaves per plant in tagged plants was counted at regular intervals and the mean expressed in number.

# Stem girth (cm)

The girth of the plant was measured at periodical intervals and the mean was expressed in centimeters.

# Vigour index

Vigour index were computed by using the following formula and expressed as whole number (Abdul and Baker, 1973).

Vigour index = germination percentage × seedling length (cm)

Where, seedling length = root length (cm) + shoot length (cm)

#### Statistical analysis

The data obtained from different experiments were analysed by the 'F' test for significance following methods described by Panse and Sukhatme (1985). Wherever necessary, the percent values were transformed to angular (Arc-sine) values before analysis.

The critical differences (CD) were calculated at 5% probability level. The data were tested for statistical significance.

#### **RESULTS AND DISCUSSION**

Dormancy is a condition where seeds will not germinate even when the environmental conditions (water, temperature and aeration) are favourable for germination. Poor and delayed seed germination in G. superba was reported and the germination was erratic which took three weeks to three months (Azhar and Sreeramu, 2004). The water impervious seed coat protects the seed from germination during the harsh condition until the rainy season. In the present study, various dormancy-breaking treatments like soaking in hot water and various chemicals were tried and the results revealed that hot water treatment imposed for an hour recorded the (32.75%), higher germination percentage earlier germination (48.35 days), and with a vigor index (565.92) (Table 1). Soaking of seeds in hot water could have helped in enhancing the seed germination by softening the hard seed coat and facilitating leaching out of the germination inhibitors, if any present in the seed. Similar increase in germination consequent to hot water soaking has been earlier reported in Sesbania rostrata (Sarker et al., 2000), Tephrosia purpurea and Abrus precatorius (Singh et al., 1984).

Although, other treatment such as thiourea, KNO<sub>3</sub>, GA<sub>3</sub> also increases the germination percentage, it was not as high as in hot water treatment. This implies that hard seed coat is the prime factor for seed dormancy in glory lily. Further, hot water soaking treatments also enhanced the quality of seedlings as evidenced by higher shoot length, root length, vigour index besides recording lesser days for germination. Hence, this practice can be recommended to nursery.

Induction of better seed germination on treatment with growth regulators and other chemicals as compared to control where no germination was recorded might be due to the antagonistic effect on growth inhibitors and also enhancement of the rate of metabolism during germination (Verma and Tondon, 1988). Thus, among all the seed treatments, soaking the seeds in hot water for one hour was the most effective for inducing better germination of seeds in Glory lily.

*G. superba* is propagated mainly during the rainy season (June-July) by V-shaped tubers. Vegetative propagation is very slow as the maximum number of daughter tubers produced per year is two. Sprouting of

Treatments	Seed treatments (one hour soaking)	Germination percentage (%)	Days for germination (days)	Shoot length (cm)	Root length (cm)	Vigour index
T <sub>1</sub>	Control	0.00 (0.45)	0.00	0.00	0.00	0.00
T <sub>2</sub>	Hot water soaking	32.75 (34.88)	48.35	11.12	6.15	565.92
T <sub>3</sub>	Thiourea - 0.5%	11.00 (19.17)	52.95	10.51	5.48	175.94
$T_4$	Thiourea – 1.0%	7.50 (15.88)	57.55	10.68	5.80	123.67
T <sub>5</sub>	Thiourea – 1.5%	8.00 (16.16)	60.80	10.76	5.78	132.32
T <sub>6</sub>	KNO <sub>3</sub> – 0.5%	13.75 (21.72)	55.00	10.62	5.78	225.63
T <sub>7</sub>	KNO3 – 1.0%	16.25 (23.57)	56.75	10.65	5.63	264.71
T <sub>8</sub>	KNO₃ – 1.5%	15.25 (22.75)	49.80	10.84	5.43	248.27
T9	GA <sub>3</sub> – 100 ppm	12.20 (20.47)	50.15	11.05	6.45	214.43
T <sub>10</sub>	GA <sub>3</sub> – 250 ppm	19.50 (24.93)	48.45	11.78	6.94	365.23
Mean		13.47 (20.00)	47.99	9.80	5.34	231.42
SE (d)		1.9905	0.9920	0.2186	0.1959	40.7236
CD (0.05)		4.0842	2.0356	0.4486	0.4020	83.5600

Table 1. Effect of seed treatments on seedling characters of glory lily.

Values in parenthesis are arcsine transformed

**Table 2.** Effect of growth regulators on plant characters of *Gloriosa superb*.

Treatment	Growth regulator	Sprouting percentage (%)	Days for sprouting (days)	Plant height (cm)	No. of leaves per plant	Stem girth (cm)
T <sub>1</sub>	Kinetin 25 ppm	60.00 (50.76)	7.22	39.11	24.5	0.93
T <sub>2</sub>	Kinetin 50 ppm	73.33 (59.20)	9.66	27.65	13.53	0.80
T₃	GA₃ 100 ppm	80.00 (67.85)	7.44	59.86	28.11	0.97
$T_4$	GA₃ 200 ppm	86.66 (72.07)	6.66	86.22	33.88	1.35
T₅	Ethrel 250 ppm	66.66 (59.78)	6.88	56.87	26.11	0.57
T <sub>6</sub>	Ethrel 500 ppm	100 (89.37)	6.33	99.32	34.04	1.81
T <sub>7</sub>	Control	53.33 (46.91)	10.44	21.57	27.10	0.56
Mean		74.28 (63.717)	7.8071	55.8019	27.74	0.99
SE (d)		11.5436	0.5483	20.4899	6.4551	0.3454
CD (0.05)		24.7613	1.1761	43.9513	13.8464	0.7408

the tubers is irregular and reaches about 60% in 30 days (Krause, 1988).

The effect of various growth regulators (GA<sub>3</sub>, kinetin, ethrel) on sprouting of tubers was studied (Table 2). It was found that ethrel at 500 ppm concentration gave the highest sprouting percentage (100%) and days for sprouting (6.33 days). Similar reports were earlier reported in Gloriosa (Rajaram et al., 2002; Suh, 1989; Puja et al., 2003)

Treatment of tubers with  $GA_3$  200 ppm recorded higher sprouting rate of 86.66%, with earliness in sprouting (6.66 days). According to Groot and Karssen (1987), gibberellins, either endogenous or exogenous, were considered to be an important factor in inducing sprouting. The effect of gibberellic acid in inducing the formation of hydrolytic enzymes may be a factor which might have regulated the mobilization of reserves, ultimately resulting in early sprouting with  $GA_3$ . This is also in close conformity with reports of Bhattacharjee et al. (1994) who reported that  $GA_3$  (10 to 100 ppm) at all concentrations recorded earlier sprouting of bulbs of tuberose. The present investigation also showed that ethrel 500 ppm significantly increased the plant height, number of leaves and girth of the plant followed by GA<sub>3</sub> at 200 and 100 ppm. Similar result was reported by Puja (1999), who reported that tubers treated with 500 ppm ethrel gave better vegetative growth and tuber yield. Increased vegetative growth and tuber yield were observed in *G. superba* due to treatment with ethrel at 500 ppm. The results are in accordance with the findings of Jayachandran and Sethumadhavan (1979) in ginger who reported that 200 ppm of ethrel resulted in maximum leaf production.

The increased plant height recorded by  $GA_3 200$  ppm in the present study might be due to its role in cell division and cell enlargement and are largely controlled by endogenous level of gibberellic acid which has been proved in number of crops. The increased cell division and cell elongation reflected in increased plant height was observed in hybrid lilies (Gorden et al., 1980).

Tallest plants with more number of leaves were produced in gladiolus when the corms were treated with 300 ppm  $GA_3$  as reported by Rajesh and Ajaykumar (2007).

Similar results were obtained with  $GA_3$  in day lily (Das et al., 1992), *Lilium longiflorum* (Sujatha and Bhattacharjee, 1992), gladiolus (Bhattacharjee, 1984) and in Zephyranthes (Sujatha and Bhattacharjee, 1990).

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