International Journal of Applied Agricultural Research
ISSN 0973-2683 Volume 11, Number 1 (2016) pp. 51-56

http://www.ripublication.com

# Seed germination studies in *Celastrus Paniculatus* Willd: A threatened medicinal plant

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**Abstract**

*Celastrus paniculatus* Willd. is an important Ayurvedic medicinal plant gaining popularity in the primary healthcare systems and in herbal drug formulations. Its seed oil is reported to be beneficial in stimulating intellect and sharpening memory. This work has been undertaken to study the effect of different growth regulators on seed germination of this endangered medicinal plant species, *Celastrus paniculatus* Willd.. Various growth parameters were recorded for seed germination and significantly higher results for Rate of germination (0. 78), Plant vigour (2082. 74), Plant height (22. 10cm), number of leaves (7. 83) fresh weight (136. 58 mg) and Dry weight of plant (59. 16 mg) was noticed in seeds treated with $GA_3$ 400ppm.

## Introduction

*Celastrus paniculatus* Willd. (Family-*Celastraceae)* commonly known as Malkanguni, Jyotishmati, Intellect tree and Bitter sweet, is an important Indian medicinal deciduous forest climber, growing in Sub Himalayan tracts up to 2000m in Central India, Western Ghats, Eastern Ghats extending to Rajmahal hills in Bihar and Orissa upto 1500m elevation (Wealth of India, 1992). The oil extracted from seeds has tranquilizing effect, besides it is already reported to be a effective central muscle relaxant. It is also anti-emetic, anti-ulcerogenic and adaptogen with memory enhancing properties (Handa, 1998). In Indian traditional system of medicine, *Celastrus* is used as an appetizer, laxative, emetic, aphrodisiac, brain tonic and also used for the treatment of cough, asthma, leprosy, paralysis, leucoderma, rheumatism, gout, liver cancer and head ache.

(Vaidyarathnam, 1994). Kumar and Guptha (2002) confirmed the antioxidant property of *C. paniculatus* Willd.

Over exploitation of this species in order to meet the growing demand by pharmaceutical industry has resulted in depletion of its population in the forests. The seeds have been found to exhibit erratic germination behaviour and under natural conditions have been found to germinate after remaining dormant for one or two years. Consequently, the cultivation and improvement of this valuable medicinal plant is seriously handicapped. Realizing the threat of extinction there is a need to develop propagation protocols, conservation strategies and improve commercial cultivation of this plant. Moreover, its cultivation and multiplication will meet the increasing demand of seed oil in pharmaceutical industry.

## Materials and methods

The experiments were conducted during the year 2014 between the months of June and September. The experimental site was located at Department of Plantation spices, Medicinal and Aromatic Crops, College of Horticulture, Mudigere which is located in the hill zone of Karnataka at $15^0$ 46′ North latitude, $76^0$ 4′ East longitude and at an altitude of 982 meters above mean sea level.

## Seed collection

The required seed material was collected from Indian Institute of Horticultural Research (IIHR), Bengaluru in July 2014. The red mucilaginous arils covering the seed surface were removed. The seeds were treated with mercuric chloride 0. 1% for 10 minutes, washed with water and oven dried at $50^0$C for 24h. The extracted seeds are subjected to 11 different pre-soaking treatments which include control, $GA_3$ at 300, 350, 400ppm, $KNO_3$ at 1. 0%, 1. 5%, 2. 0%, $H_2SO_4$ at 0. 5%, 1. 0% and HCl 0. 5%, 1. 0% with 100 seeds per treatment in three replications; complete randomized design was followed and observations for parameters like days to initiate germination, days taken for 50 per cent germination, rate of germination, plant vigour, plant height, number of leaves, shoot length, root length, fresh weight of plant and dry weight of plant were recorded.

The experiment was carried out in polyhouse under partial shade condition (50% shade). This structure helps in maintaining the higher temperature and relative humidity (An average temperature of $29^0$C; relative humidity of 75% and light intensity of 3500 lux was recorded inside the poly house during the period of experimentation), which in turn increases seed germination and also increases rooting in the cuttings. The data were analysed statistically as per the method suggested by Panse and Sukhatme(1985).

## Result and Discussion

The data pertaining to various germination and growth parameters as influenced by different growth regulators for seed propagation of *C. paniculatus* Willd. are presented in Table 1 and table 2.

There was significant influence of treatments on germination and growth parameters such as days to initiate germination, days taken for 50 per cent germination, rate of germination, plant vigour, plant height (cm) and number of leaves. The growth regulator treatment increased the overall germination and growth parameter values as compared to control. Significantly minimum days to initiate germination (24. 75), days taken for 50 per cent germination (61. 66) and rate of germination (0. 78) was registered in $GA_3$ 400ppm which was on par with $GA_3$ 350ppm against control (86. 50, 145 and 0. 15 respectively) (Table 1). This may be due to instigative action of $GA_3$ for germination of seeds. $GA_3$ induces the *de-novo* synthesis of proteolytic enzymes like a-amylase and ribonuclease. Amylases in turn hydrolyse starch in the endosperm, providing the essential sugars for the initiation of growth processes (Copeland and Mc-Donald, 1995). $GA_3$ treatment is also known to overrule the photo dormancy, thermo-dormancy, dormancy imposed by incomplete embryo development, mechanical barriers and presence of germination inhibitors (Diaz and Martin, 1971).

Among different growth regulator treatments maximum plant vigour (2082. 74), plant height (22. 10 cm), number of leaves (7. 83), shoot length (15. 09 cm) and root length (6. 47 cm) was also recorded in seeds treated with GA3 400ppm when compared to control (258. 86, 8. 95cm, 3. 66, 6. 25 and 3. 06 respectively) (Table 1 and 2). Gowda *et al.* (2003) reported that $GA_3$ 400 ppm considerably improved germination (48%) than control (12%) in *Embelia tsjeriam-cottam.* Lalithkumar (2008) obtained higher germination per cent of 77. 9, 74. 9, 82. 0 and 71. 0 per cent against control (51. 0, 43. 0, 38. 0 and 31. 9 per cent), in tulsi, ashwagandha, periwinkle and kalmegh, respectively, when the seeds were treated with $GA_3$ at 250 ppm. This may be due to $GA_3$ 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).

Different concentrations of $GA_3$ caused significant difference over control with regard to fresh weight and dry weight of plant. The maximum fresh weight (136. 58 mg) and dry weight (59. 16 mg) of plant was noticed in plants treated with $GA_3$ 400ppm when compared to control (33. 75 mg and 16. 41 mg respectively) (Table 2). Similar results were also obtained by Masoodi and masoodi, 2000 for *Ulmus wallichiana*, an endangered tree species. This is also due to the effect of gibberellic acid in inducing the formation of hydrolytic enzymes which in turn might have increased carbohydrates accumulation thereby increasing the fresh weight and dry weight of plant (Bhattacharjee *et al*. 1994).

**Table 1:** Effect of different pre sowing treatments on growth parameters as influenced in *Celastrus paniculatus* Willd. seeds.

| Treatments | Days to initiate germination | Days taken for 50 per cent germination | Rate of germination (%) | Plant vigour | Plant height (cm) | Number of leaves |
|---|---|---|---|---|---|---|
| $T_1$-Control | 86.50 | 145.00 | 0.15 | 258.86 | 8.95 | 3.66 |
| $T_2$-$GA_3$ 300ppm | 38.75 | 87.116 | 0.42 | 1435.26 | 15.783 | 5.66 |
| $T_3$-$GA_3$ 350ppm | 30.91 | 75.75 | 0.53 | 1752.81 | 18.83 | 6.83 |
| $T_4$-$GA_3$ 400ppm | 24.75 | 61.66 | 0.78 | 2082.74 | 22.10 | 7.83 |
| $T_5$-$KNO_3$ 1.0% | 71.83 | 123.916 | 0.18 | 422.59 | 12.83 | 4.16 |
| $T_6$-$KNO_3$ 1.5% | 62.91 | 102.41 | 0.17 | 586.99 | 14.58 | 4.83 |
| $T_7$-$KNO_3$ 2.0% | 61.25 | 85.41 | 0.34 | 714.42 | 14.78 | 6.16 |
| $T_8$ – $H_2SO_4$ 0.5% | 41.33 | 78.91 | 0.54 | 1100.30 | 16.26 | 5.83 |
| $T_9$-$H_2SO_4$ 1.0% | 38.16 | 70.66 | 0.63 | 1292.16 | 18.33 | 6.66 |
| $T_{10}$-HCl 0.5% | 67.00 | 101.75 | 0.16 | 474.90 | 11.86 | 4.08 |
| $T_{11}$-HCl 1.0% | 50.00 | 86.33 | 0.19 | 730.76 | 13.90 | 4.58 |
| Mean | 52.12 | 92.62 | 0.37 | 986.52 | 15.29 | 5.48 |
| S.Em± | 4.29 | 0.33 | 0.08 | 19.02 | 0.29 | 0.13 |
| CD @ 5% | 8.58 | 0.96 | 0.23 | 57.08 | 0.87 | 0.41 |

**Table 2:** Effect of different pre sowing treatments on growth parameters as influenced in *Celastrus paniculatus* Willd. seeds.

| Treatments | Shoot Length (cm) | Root length (cm) | Fresh weight of plant (mg) | Dry weight of plant (mg) |
|---|---|---|---|---|
| $T_1$-Control | 6.25 | 3.06 | 33.75 | 16.41 |
| $T_2$-$GA_3$ 300ppm | 11.28 | 4.54 | 90.16 | 38.41 |
| $T_3$-$GA_3$ 350ppm | 14.13 | 5.86 | 111.08 | 47.75 |
| $T_4$-$GA_3$ 400ppm | 15.09 | 6.47 | 136.58 | 59.16 |
| $T_5$-$KNO_3$ 1.0% | 8.53 | 4.16 | 58.41 | 23.41 |
| $T_6$-$KNO_3$ 1.5% | 9.60 | 5.03 | 51.50 | 25.58 |
| $T_7$-$KNO_3$ 2.0% | 9.53 | 5.03 | 59.08 | 30.75 |
| $T_8$ – $H_2SO_4$ 0.5% | 10.95 | 5.60 | 71.91 | 36.41 |
| $T_9$-$H_2SO_4$ 1.0% | 12.42 | 6.10 | 91.75 | 41.91 |
| $T_{10}$-HCl 0.5% | 7.93 | 3.76 | 53.75 | 25.91 |
| $T_{11}$-HCl 1.0% | 9.40 | 4.33 | 68.58 | 32.41 |
| Mean | 10.46 | 4.90 | 75.14 | 34.37 |
| S.Em± | 0.17 | 0.066 | 0.35 | 0.30 |
| CD @ 5% | 0.51 | 0.19 | 1.07 | 0.92 |

**Summary**

Among the different germination inducing treatments, *C. paniculatus* Willd. seeds treated with gibberellins responded well with high seed germination and vigourous seedling growth. All the germination and growth parameters like rate of germination, shoot length, root length, plant vigour fresh and dry weight of seedlings were recorded maximum in $GA_3$ 400 ppm followed $GA_3$ 300 ppm. The commencement of germination and 50 per cent germination was also recorded early in the same treatment.

The results of the present investigation will be helpful for large scale multiplication of this important endangered species and it will also help for large scale cultivation and supply of required raw material to pharmaceutical industries.

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