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Research Note

Effect of pre sowing seed treatments on germination and seedling growth parameters of *Hydnocarpus pentandra* (Buch. Ham.) Oken

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Abstract
An experiment was carried out to standardize seed propagation techniques in *Hydnocarpus pentandra* (Buch. Ham.) Oken at Division of Plant Genetic Resources, ICAR-Indian Institute of Horticultural Research, Bengaluru during 2018-19. Seeds were extracted from the fully matured fruits and treated with different treatments like GA_3, Kinetin, Ethylene and KNO_3. Seed coat removed seeds were used for the treatment. Among the different treatments, seeds treated with GA_3 350 ppm showed maximum germination, the minimum number of days taken to initiate germination, maximum number of leaves and seedling height. The dry weight and fresh weight of the plant is also highest in this treatment. Maximum number of leaves, fresh and dry weight of roots was highest in KNO_3 1.0 per cent treatment.

Keywords
Hydnocarpus pentandra, Seed germination, GA_3, Seed coat, Seedling vigour

Hydnocarpus pentandra (Buch. Ham.) Oken is an important medicinal tree belonging to family Flacourtiaceae. It is commonly known as Chaulmoogra in Hindi. It is endemic in Western Ghats of India. Due to overexploitation of this plant, its population decreased in its natural habitation. It is included in Red Data Book as a vulnerable tree. It is an evergreen tree grows up to 10 meters tall. Flowering occurs from January to April and fruit set from September to March (Varghese *et al*., 2016). Natural seed germination percentage is very low probably due to hard seed coat (Kumar *et al.,* 2015 a, b).

Seeds are the economic part of this plant. Oil extracted from the seeds is called chaulmoogra oil. It is mainly used in leprosy treatment. The seed oil contains 'Hydnocarpin' a flavonolignan which are responsible for antimicrobial, antibacterial, antileprotic, antitubercular, antipsoriatic, antirheumatic, hypolipidemic, antidiabetic, anticancer, anti-inflammatory, alterative, stimulant and antioxidant activities. Seed oil is helpful in the treatment of rheumatism, sprains and bruises, sciatica, arthritis and chest complaints (Shyam *et al*., 2013). Seed oil is also mentioned in Sushruta Samhita for anti-ageing properties (Vaidya, 1968).

Matured fruits were collected from the plants grown in the Field Gene Bank, Division of Plant Genetic Resources, ICAR–Indian Institute of Horticultural Research, Bengaluru. Seeds were separated from the fruits, thoroughly washed and air-dried. The seed coat was removed before seed treatment. These seeds were used for the experiment. The seeds were treated with various hormones like GA_3,

Kinetin, Ethylene and KNO_3. The treatments were as follows: T_1- Control (water-soaked), T_2 - GA_3 350 ppm, T_3 – GA_3 450 ppm, T_4 - KNO_3 1%, T_5 - KNO_3 2%, T_6 - Kinetin 20 ppm, T_7 - Kinetin 30 ppm, T_8 - Ethylene 25 ppm and T_9 - Ethylene 50 ppm. There were nine treatments with three replications and 20 seeds were used in each replication. The seeds were soaked in above treatments for overnight and thoroughly washed with water and air-dried for half an hour. The pretreated seeds were sown in protrays. Here coco peat is used as media for germination. The protrays were kept inside the shade net. Seeds were watered daily and following observations were taken; germination percentage, rate of germination, days have taken to initiate germination, number of leaves, seedling height, fresh weight of shoot and root, dry weight of shoot and root. The data were analyzed statistically as per the method suggested by Panse and Sukhatme (1967).

Effect of pretreatments on germination: In the present study, all the treatments were significantly superior over control in respect of germination percentage (**Table 1**). Seeds treated with GA_3 350 ppm recorded the highest germination percentage (62.43%) followed by KNO_3 1.0 per cent (53.3%) but in the sum it was only 24.0 per cent. And also early germination was found in the seeds treated with GA_3 450 ppm (35 days) followed by KNO_3 1.0 per cent (37.66 days) when compared to control (46.66 days) while the rate of germination was also maximum in GA_3 350 ppm treatment. GA_3 is having a capacity of removing seed coat dormancy and it promotes germination at a higher speed (Chauhan *et al*., 2017). Similar results were obtained in the same crop when GA_3 was used at the concentration of 300 ppm (Vidyasagaran *et al*., 2017) and in *Pyracantha crenulata* (Joshi *et al*., 2010).

Table 1. Effect of pre-sowing treatments on seed germination of *Hydnocarpus pentandra* (Buch. Ham.) Oken

Treatment	Number of days taken for germination	Rate of germination	Germination percent
T_1 – Control	46.66	0.51	24.00
T_2 - GA_3 350 ppm	35.00	1.74	62.43
T_3 - GA_3 450 ppm	40.33	1.09	44.40
T_4 - KNO_3 1%	37.66	1.41	53.33
T_5 - KNO_3 2%	43.66	0.90	37.40
T_6 - Kinetin 20 ppm	44.66	0.61	28.20
T_7 - Kinetin 30 ppm	43.00	0.70	31.50
T_8 - Ethylene 25 ppm	42.33	0.72	28.50
T_9 - Ethylene 50 ppm	43.33	0.80	32.73
Mean	41.85	0.94	38.05
S. Em ±	0.95	0.05	0.80
C D @ 5 %	2.70	0.15	2.29

Effect of pre-sowing treatments on seedling parameters: Seedling parameters of all the treatments were statistically analyzed (**Table 2**). Among the treatments, maximum shoot and root length were found in GA_3 350 ppm treatment (19.03 cm and 11.43 cm respectively) followed by KNO_3 1.0 per cent treatment. Same trend was observed in case of seedling vigour. Similarly maximum vigour was obtained in *Ulmus willichiana* when treated with GA_3 at 100 ppm (Masoodi and Masoodi, 2000). But maximum number of leaves were found in KNO_3 treatment (11.23) followed by GA_3 350 ppm (10.53). This may be due to the greater accumulation of photosynthates in seedlings. The increase in the number of leaves might be due to the promotion of physiological processes and stimulatory action of KNO_3 to form new leaves at faster rate and accelerated translocation of food material in the tissue which created an ideal condition for the development of new leaf primordia. Similar results were reported by Bhambota and Kaul (1966) in citrus and Padma and Reddy (1998) in mango.

Table 2. Effect of pre-sowing treatments on seedling parameters of *Hydnocarpus pentandra* (Buch. Ham.) Oken at 120 days after sowing.

Treatment	Shoot length (cm)	Root length (cm)	Number of leaves	Seedling vigour
T_1 – Control	12.13	7.60	7.63	562.93
T_2 - GA_3 350 ppm	19.03	11.43	10.53	2028.63
T_3 - GA_3 450 ppm	17.00	10.56	10.43	1233.20
T_4 - KNO_3 1%	17.73	11.20	11.23	1591.56
T_5 - KNO_3 2%	16.00	9.96	8.56	1031.50
T_6 - Kinetin 20 ppm	13.13	9.43	9.20	629.66
T_7 - Kinetin 30 ppm	13.70	8.56	9.36	657.20
T_8 - Ethylene 25 ppm	12.53	8.16	8.43	641.16
T_9 - Ethylene 50 ppm	13.03	8.56	8.50	717.96
Mean	14.92	9.50	9.32	1010.42
S. Em ±	0.21	0.19	0.17	27.35
C D @ 5 %	0.59	0.54	0.47	77.94

Effect of pre-sowing treatments on fresh and dry weight of shoot and root: Maximum fresh and dry weight of shoot was found in GA_3 350 ppm treatment (3.86 cm and 2.08 cm respectively) followed by KNO_3 1.0 per cent (3.49 cm and 1.80 g respectively) at 120 days after sowing. In the case of fresh and dry weight of root, GA_3 350 ppm showed maximum values followed by KNO_3 2.0 per cent (Table 3). The increased vegetative growth in turn resulted in the production of higher dry matter in plants. The increase in plant dry weight due to priming treatments indicated that the photosynthetic activity and efficiency of the leaves have been increased which contributed to dry matter production. The results are in agreement with the earlier findings of Khaninejad *et al*. (2012) in *Capparis spinosa*, Pratibha (2014) in papaya.

Table 3. Effect of pre sowing treatments on fresh and dry weight of shoot and root of *Hydnocarpus pentandra* (Buch. Ham.) Oken at 120 days after sowing.

Treatment	Fresh weight of shoot (g./plant)	Dry weight of shoot (g./plant)	Fresh weight of root (g./plant)	Dry weight of root (g./plant)
T_1 - Control	1.53	1.01	0.95	0.48
T_2 - GA_3 350 ppm	3.86	2.08	1.90	1.04
T_3 - GA_3 450 ppm	2.44	1.44	1.34	0.78
T_4 - KNO_3 1%	3.49	1.80	1.79	0.86
T_5 - KNO_3 2%	2.19	1.72	1.85	0.97
T_6 - Kinetin 20 ppm	1.82	1.30	1.24	0.67
T_7 - Kinetin 30 ppm	2.36	1.54	1.53	0.71
T_8 - Ethylene 25 ppm	2.00	1.25	1.32	0.68
T_9 - Ethylene 50 ppm	1.79	1.12	1.14	0.59
Mean	2.39	1.47	1.45	0.75
S. Em ±	0.16	0.08	0.07	0.03
C D @ 5 %	0.46	0.23	0.20	0.09

GA_3 350 ppm was best treated with respect to germination per cent and all other seedling parameters followed by KNO_3 treatment. Kinetin and Ethylene treatments were slightly increased by the germination per cent and other parameters as compared to the control.

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