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Effect of seed treatments on seed germination and seedling growth of Indian Olive (*Elaeocarpus floribundus*)

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ABSTRACT

Indian olive (Elaeocarpus floribundus) is propagated by seeds. Although germination and seedling growth is a major concern in this crop as seeds remain dormant for long time. There are various methods like scarification, stratification, chemical treatment, biological and irradiation etc. for breaking the seed dormancy of Indian olive. However there is very few scientific reports regarding overcoming the dormancy of Indian olive seeds. Keeping this view, Indian olive seeds has been collected and stored for 2 months followed by seed treatment. Seeds were treated with seven different types of chemicals (HCl @ 5%, H_2SO_4 @5%, GA_3@500 ppm, soaking in water, Benzyl adenine@100 ppm, thiourea@1% and KNO_3 0.5%) and planted in poly bags filled with growing media (sand: garden soil: FYM=1:1:1). Maximum germination was recorded in the seeds treated with Benzyl Adenine@100 ppm followed by H_2SO_4@5%, whereas highest speed of germination was noticed in H_2SO_4 @5% followed by Benzyl Adenine @100 ppm. The maximum average height of the seedlings (12.26 cm) and average number of leaves (6.86) was recorded in Benzyl Adenine treatment @100 ppm followed by H_2SO_4@5%. Biggest leaf size and greater seedling girth was also observed under Benzyl Adenine treatment @100 ppm. Seedling survival was also better under BA @100ppm treatment.

***Key wards*:** Indian olive, seed treatments, seed germination and seedling growth.

INTRODUCTION

Indian olive (*Elaeocarpus floribundus*) belongs to the family Elaeocarpaceae. The tree is found in eastern Himalayas up to 3,000 ft and in the evergreen forests of North Kanara and western coast down to Travancore (Bhowmick, 2011). The fruit is somewhat similar to the fruit shape of olive, so it also known as Indian olive or 'Jalpai' in Bengali. The olive fruits are famous for medicinal property possessing an array of bioactive phytochemicals (Sircar and Mandal, 2017). It is a tropical and subtropical, evergreen, medium size, hard seeded fruit crop. Seed is the most natural resource of plant reproduction, preservation of genetic viability, transportation and propagation of flora. Indian Olive is generally propagated by seeds but seed germination rate is very low due to seed dormancy. Large scale plantation in agro forestry, social forestry and home garden is limited due to poor seed germination and deferred nursery establishment. Seed dormancy is a major concern in germination due to hard seed coat. To overcome dormancy of Indian olive seeds different pre-sowing chemical treatments is commonly followed (Basavaraj and Prabhuling, 2020). It may be overcome either by pre-treatment of seed by scarification, stratification etc. However, out of these methods seed treatment is the easiest way to enhance seed germination by breaking the dormancy and then seed treatment can ensure success in seed germination. Considering the importance of seed treatment, the present experiment has been carried out to study the effect of chemical pretreatment on germination and seedling growth of Indian olive.

MATERIALS AND METHODS

The experiment was conducted at Horticulture farm, Department of Horticulture and Post-Harvest Technology, Palli Siksha Bhavana, Visva-Bharti, Sriniketan, West Bengal during the year 2022. Mature fruits of *Elaeocarpus floribundus* were

collected from a single plant from New-alluvial zone, Habra-1 block under district North 24 Parganas, West Bengal. Pulps of the fully mature ripe fruits were removed by scraping and seeds were then properly washed. Washed seeds have been dried under shed for 7 days and stored for 2 months in perforated polythene packet under ambient condition. After 2 months of storage, the seeds were soaked in different treatment solutions, then washed in plain water and then placed in petri-dish with moist filter paper under laboratory condition for 24 hours during January, 2022. Different treatment were i) HCl @ 5% for 6 hours then washing and again soaking in normal water for 12 hours (T_1), ii) H_2SO_4 @ 5% for 6 hours then washing and again soaking in normal water for 12 hours (T_2), iii) GA_3 500ppm for 24 hours (T_3), iv) KNO_3 @ 5% for 24 hours (T_4), v) Benzyl Ademine (BA) @ 100ppm for 12 hours (T_5), vi) Thio-urea @ 1% for 24 hours (T_6) and vii) control untreated (T_7). Treated seeds were sown immediately in polybags (12cm x 10 cm) containing media comprising of garden soil, sand and FYM at a ratio of 1:1:1 at a depth of 5 cm. The experiment was laid out in completely randomized design (C.R.D.) with seven treatments and all the treatments were composed of three replications each with 50 seeds. All the polybags were then kept under shade. Light irrigation was given with rose can after sowing. Regular watering to the poly bags has been done with rose can at an interval of 7 days to ensure good germination.

Regular weeding and application of pesticide and fungicide have been carried out to get healthy seedling. The count of germinated seedlings was taken at an interval of one day after 70 days of seed sowing and up to when germination ended (120 days after sowing). In the present experiment data with respect to different plant growth parameters has been recorded at 150 days after seed sowing. Observations like seedling height, number of leaves per seedling, chlorophyll content of leaves, leaf length and leaf width were taken. SPAD (Soil Plant Analysis Development) chlorophyll meter was used to measure leaf chlorophyll content. The percentage of germination was calculated on the basis of total numbers of seeds sown and total numbers of germinated seeds.

RESULTS AND DISCUSSION

Seed Germination

Significant variation was observed in the seed germination as effected by pre sowing chemical treatments of Indian olive seeds. The highest germination percentage (56.69) was observed in the seeds treated with Benzyl Adenine (BA)@100ppm (T_5). The most used frequently cytokinins are N-(Phenyl methyl)-7H-purin-6-amine (benzyladenine; 6-Benzyladenine or 6-Benzylaminopurine or BAP) and kinetin (Kn) or 6-furfurylaminopurine. The cytokinins regulate growth and effect on germination rate in a variety of ways in different plants (El-Ghamery and Mousa, 2017; Graeber *et al*., 2012). They are active in all germination cycles (Chiwocha *et al*., 2005; Nikolic *et al*., 2006; Riefler *et al*., 2006). The germination percentage was 56.69% which signifies that the chemical was able to break seed germination to a great extent as compared to other chemicals. The lowest germination was observed in seeds treated with GA_3 @ 500ppm (T_3) which showed germination percentage of 13.32%. The findings of the present experiment corroborate with the findings of Parab *et al.* (2017) where pre sowing papaya seed treatment with Benzyl Adenine showed better result.

Days to first germination

Seeds treated with H_2SO_4 (T_2) took significantly minimum time (73.27 days) to start germination while KNO_3 (T_4) treatment of seeds took maximum time (84.62 days) to start the germination. Treatment of Indian olive seeds with HCl (T_1) as well as GA_3 (T_3) also improved the earliness of germination (74.13 and 74.47 days respectively) in the present experiment. On contrary little late germination (82.19 days) was observed in control treatment (T_7). Perhaps the stratification effect of HCl over the hard seed coat of Indian olive triggered the quick germination. But late germination in case of KNO_3 treatment may be due some inhibitory effect of nitrate ions in the solution (Graeber *et al*., 2012).

Germination duration

Shortest span of germination (16.28 days) of Indian olive seeds was observed under thio-urea

Table 1: Effect of seed chemical treatment on germination and seedling growth in *Elaeocarpus floribundus*

Treatments	Germination (%)	Days to 1st germination	Germination duration	Seedling height (cm)	No of leaves per plant	Chlorophyll content (spad)	Leaf length (cm)	Leaf width (cm)
T_1	23.37	74.13	34.24	11.52	5.38	39.48	7.53	2.56
T_2	40.16	73.27	16.72	10.68	6.86	54.73	7.18	2.84
T_3	13.32	74.47	34.19	6.72	3.47	39.46	4.14	1.54
T_4	30.16	84.62	32.41	10.16	4.19	48.92	7.02	2.71
T_5	56.69	78.38	22.13	12.26	5.12	87.13	7.38	2.83
T_6	20.14	78.67	16.28	9.72	4.85	37.14	7.19	3.06
T_7	13.34	82.19	25.17	8.39	4.54	95.65	6.52	2.64
SE±M	0.71	2.6	1.2	0.5	0.3	4.5	0.27	0.4
$CD_{(0.05)}$	2.13	8.1	3.3	1.45	0.8	13.6	0.8	1.1

T_1: HCl @ 5% for 6 hours then washing and again soaking in normal water for 12 hours

T_2: H_2SO_4 @5% for 6 hours then washing and again soaking in normal water for 12 hours

T_3: GA_3 500ppm for 24 hours

T_4: KNO_3 @ 5% for 24 hours

T_5: Benzyl Ademine (BA) @ 100ppm for 12 hours

T_6: Thio-urea @ 1% for 24 hours and

T_7: Control (untreated)

treatment (T_6) which was closely followed by H_2SO_4 treatment of seeds (T_2) which required 16.72 days. On contrary wide span of germination (34.24) was observed under HCl treatment (T_1) which was statistically *at par* with that of GA3 treatment (T_3) (34.19 days). Benzyl adenine treatment also reduced the duration of germination (22.13 days) of Indian olive seeds in the present experiment.

Plant height and number of leaf per plant

The highest plant height (12.26 cm) was observed in the seeds treated with Benzyl Adenine (BA) @100ppm (T_5) which was followed by treatment with HCL (T_1) and H_2SO_4 (T_2) it may be due to the long duration of plant growth under these two treatments as HCl and H_2SO_4 has showed faster germination while BA has showed little bit late germination. Due to the maximum time of plant growth the plant height of T_1 and T_2 statistically similar with the plant height of T_5. Results were also observed with seeds treated with HCl @ 0.5% (T_1) showing height of 11.5 cm. Lowest plant height was observed in seeds treated with GA_3 @ 500ppm(T_3) showing height of 6.72cm. In the case of pre sowing treatment of Maringa seeds highest seedling growth was observed in Benzyl adenine100 mgl^{-1} (El Dayem *el al.,* 2021). Number of leaves per plant varied from 3.47 (T_3) to 6.86 (T_2).

Leaf chlorophyll content

In the case of leaf chlorophyll content of the present experiment as the control treatment exhibited the maximum chlorophyll content and in the other treatments chlorophyll content was lower. Thus, the result indicates that all the chemical pre-treatments have some inhibitory effect on chlorophyll development during the successive development of seedlings. The leaf chlorophyll content of Indian olive seedling has been recorded in Data every 3 days after 1 month of germination. Highest chlorophyll content (95.65 SPAD unit) was found from control treatment (T_7) which was statistically similar with T_5 (87.13 SPAD unit). Lowest Chlorophyll content was found in seeds treated with Thiourea @ 1% (T_6) showing chlorophyll content of 37.16 SPAD unit.

Leaf length and width

A significant variation was observed between leaf length and leaf width of the Indian olive seedlings in the present experiment. Leaf length of the seedlings varies between 4.14cm (T_3) to 7.53cm (T_1). Leaf length of T_5 (7.38 cm) was at par with T_1. Leaf width was between 1.54 cm (T_3) to 3.06 cm (T_6). Leaf width of T_5 (2.83 cm) was statistically similar with T_6.

CONCLUSION

From the findings of the present experiment, it can be concluded that for better germination of Indian olive seeds the seed treatment with Benzyl Adenine @100 ppm for 12 hours was most effective as well as in breaking the dormancy. Seed treatment with H_2SO_4 @ 5% can also improve seed germination of Indian olive significantly. Benzyl adenine also increases plant height compared to the other treatments.

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