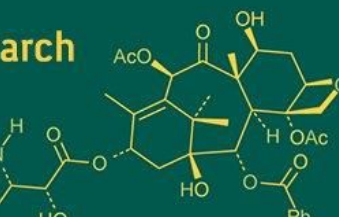
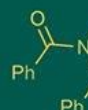


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Assessing the influence of hydropriming and organic priming agents on seed germination of aonla (*Phyllanthus emblica* Linn.) genotype BSR-1

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Abstract

Aonla seeds have long term dormant phase, which makes germination extremely difficult. Aonla's rising nutritional and therapeutic value has made efficient propagation essential. Because of their inherent dormancy, aonla seeds exhibit semi-orthodox storage behaviour and can survive until they come into contact with ideal environmental circumstances for germination. Hence it is necessary to identify efficient methods for artificial breaking of seed dormancy. Aonla genotype BSR-1 was used for the experiment which consists of treatments. *i.e.*, Treatments were; control (no soaking-T₁), water soaking for 12 hours (T₂), water soaking for 24 hours (T₃), Hot water treatment at 60 °C and immersing in it for 12 hours (T₄), Hot water treatment at 60 °C and immersing in it for 24 hours (T₅), Soaking in 10% cow urine for 12 hours (T₆), Soaking in 10% cow urine for 24 hours (T₇), Soaking in 20% cow urine for 12 hours (T₈), Soaking in 20% cow urine for 24 hours (T₉). The results proved that aonla seeds treated with hot water treatment at an initial temperature of 60 °C and immersing in it for 24 hours (T₅) significantly improved germination, with the highest germination percentage (57.78%), the earliest germination (10.67 days), and the fastest attainment of 50% germination (13.33) days. And treatment T₉ where aonla seeds were treated with 20% cow urine for 24 hours exhibited better seedling performance across all growth parameters, with highest shoot length (11.17 cm at 30 DAS and 27.57 cm at 60 DAS) and stem girth (1.53 mm at 30 DAS and 2.72 mm at 60 DAS). Furthermore, the same treatment recorded highest number of roots per seedling (25.36), root length (12.83 cm) and root girth (4.38 mm).

Keywords: Aonla, BSR-1, dormancy, hydropriming, organic priming, seed germination

1. Introduction

Aonla (*Phyllanthus emblica* Linn.) is a significant minor fruit crop which is a member of the Phyllanthaceae family and grows in arid regions and wastelands. It has been grown since ancient times and is indigenous to tropical southeast asia, importantly central and southern India. In India it goes by several names such as Aonla, Nelli, Amla, Amlika, Dhatri, Emblica and Usuri (Firminger, 1947) [7]. It was planted on more than 91,000 hectares and produced more than 9.8 lakh tonnes of fruit during the 2023-2024 cropping season, demonstrating its growing significance among minor fruit crops (Devkate *et al.*, 2025) [5]. Aonla can be successfully produced in a variety of wasteland conditions, including saline and sodic soils, ravines, dry and semi-arid areas, and marginal soils (Varun *et al.*, 2023) [18]. In India, it has been used medicinally and therapeutically from ancient times and is considered as magical fruit (Choudhary *et al.*, 2016) [3]. Aonla is widely used in the preparations of many value added products such as chyawanprash, pickles, candies, churna and murabba. It is one of the three main ingredients of the well known Ayurvedic remedy Triphala, which is used to treat a variety of digestive issue. Aonla is high in calcium, phosphorus, iron, and magnesium and one of the best natural sources of vitamin C (600 mg/100 g) (Varun *et al.*, 2023) [18]. The fruits contain antioxidant activity which can be used as natural antioxidant supplements in food processing and nutraceutical industries (Radha & Mathew, 2007) [14]. In addition to the fruit, the leaves, bark, and even seeds have a variety of uses. Srimathi *et al.* (2000) [17] reported that even under ideal germination conditions, freshly collected aonla seeds do not germinate because of seed dormancy.

Hence the present study employed BSR-1 (Bhavanisagar-1), a high-yielding aonla genotype developed in Bhavanisagar, Tamil Nadu, to evaluate the methods to break seed dormancy. Increasing the germination rate and germination percentage of this plant may facilitate commercial propagation using seeds rather than cuttings. Seed dormancy can be caused by internal (physiological) factors affecting the embryo, physical characteristics such as a thick, hard testa, or improper handling or storage that leads to secondary dormancy. To break the dormancy, these seeds could need pre-sowing treatments. Hydropriming and organic priming offer a cost effective strategy to increase seed germination by dormancy constraints, therefore the current study aimed to evaluate the effectiveness in breaking the dormancy of aonla seeds BSR-1.

2. Materials and Methods

This experiment was conducted during 2025-2026 in the Division of Horticulture, School of Agricultural Sciences, Karunya Institute of Technology and Sciences, Karunya North Farm in controlled environment. Fully ripe aonla fruits (BSR-1) were gathered from Dindigul. The fruits were cut open to obtain stones which were then shade dried for two to four days. The stones were split opened after drying and the seeds were extracted. Seed viability was assessed using distilled water, in which the seeds that floated were removed, and totally submerged seeds were chosen and primed before planting. The experiment was conducted in completely randomized design (CRD) with nine treatments and three replications.

Treatment details

Notations	Treatments
T ₁	Control (without soaking)
T ₂	Water soaking for 12 hours
T ₃	Water soaking for 24 hours
T ₄	Hot water treatment at 60 °C and immersing in it for 12 hours
T ₅	Hot water treatment at 60 °C and immersing in it for 24 hours
T ₆	Soaking in 10% cow urine for 12 hours
T ₇	Soaking in 10% cow urine for 24 hours
T ₈	Soaking in 20% cow urine for 12 hours
T ₉	Soaking in 20% cow urine for 24 hours

The observations recorded include days for initiation of germination, time taken for 50% germination (days), germination percentage (%), shoot length, shoot girth, number of roots, root length and root girth. The data obtained from the experiment were analyzed using standard statistical methods as described by Panse and Sukhatme (1985).

3. Results and Discussion

3.1 Germination Parameters

Significant difference was observed between treatments for germination parameters in the current study (Table 1). Treatment T₅, which employed hot water (60 °C) treatment with continuous soaking for 24 hours, produced a greater germination percentage (57.78%), an minimum days of germination (10.67 days), and a quicker achievement of 50% germination (13.33 days) in. These findings could be explained by the way heat scarification softens the hard seed

coat and partially breaks seed dormancy while increasing the permeability of the seed coat and speeding up water intake. The metabolic processes necessary for embryo growth and germination were probably started by this increased imbibition. Hot water treatment has been shown to be beneficial for many hard seeded species. As per Varun *et al.*, (2023) aonla seeds treated with hot water at 60 °C for 30 seconds decreased germination time and enhanced germination percentage when compared to control. Similar findings were found in Barathkumar (2019) ^[2], Devkate *et al.*, (2025) ^[5] in aonla, Akinola *et al.* (2000) ^[1] in wild sunflower seeds, Pawshe *et al.* (1997) ^[13] in custard apple seeds, Msanga and Maghembe (1986) ^[9] in flat crown albizia (*Albizia schimperana*), Gray (1962) ^[8] in subabul (*Leucaena glauca*) seeds. The current study's prolonged soaking period after hot water exposure may have further improved seed hydration and resulted in more rapid and reliable aonla seed (BSR-1) germination.

Table 1: Effect of organic and hydropriming treatments on germination parameters of aonla (*Phyllanthus emblica* Linn.) genotype BSR-1 (Bhavanisagar-1)

Tr.no	Treatments	Initiation of germination	50% germination	Germination percentage
T ₁	Control (without soaking)	21.33	24.33	25.90
T ₂	Cold water treatment for 12 hours	15.33	19.33	45.94
T ₃	Cold water treatment for 24 hours	13.67	17.33	47.84
T ₄	Hot water treatment at 60 °C and immersing in it for 12 hours	11.33	14.00	52.77
T ₅	Hot water treatment at 60 °C and immersing in it for 24 hours	10.67	13.33	57.39
T ₆	Soaking in 10% cow urine for 12 hours	19.67	23.00	30.97
T ₇	Soaking in 10% cow urine for 24 hours	16.33	20.00	36.90
T ₈	Soaking in 20% cow urine for 12 hours	18.67	22.33	34.92
T ₉	Soaking in 20% cow urine for 24 hours	15.33	19.67	44.03
SE (d)		0.471	0.609	0.544
C.D		0.998	1.288	1.151

3.2 Shoot growth parameters

The present study showed significant difference between the nine treatments for the shoot growth parameters taken

during 30 and 60 DAS (Table 2). Soaking of aonla seeds (BSR-1) in 20% cow urine for 24 hours (T₉) has recorded the highest shoot length and shoot girth of the seedlings at

30 and 60 DAS (11.17 cm and 27.57 cm respectively for shoot length and 1.53mm and 2.72 mm respectively for shoot girth). Up to 30 and 60 days after seeding, these impacts were apparent. As sharma (2021) ^[15] mentioned the presence of growth promoting components in cow urine, such as auxins, essential nutrients, minerals, and other physiologically active substances, may be the cause of the greater shoot length and girth observed in Treatment T₉. The seed's rapid vegetative growth was probably supported by these bioactive components, which also promoted food intake, accelerated cell division and elongation, and increased metabolic activity. The thickening of the stem, which increased the length and girth of the shoots, may also have been promoted physiologically active substances found in cow urine, such as growth regulators, minerals, and trace elements according to Munoz (1988) ^[10]. The current results

align with previous studies on other fruit crops where Deeksha *et al.* (2023) ^[4], found that the most effective pre-sowing method used to ensure getting maximum stem girth in custard apples was soaking seeds in 20% cow urine for 24 hours. These results align with previous studies of Sharma *et al.* (2021) ^[15] in papaya seedlings, Shinde and Malshe (2015) ^[16] in khirmi (*Manilkara hexandra* L.) seedlings, Pal *et al.* (2019) ^[11] in Karonda. Higher concentrations of cow urine have been shown to have an excellent impact on plant growth in methi and bhindi, and they further improved some phenotypic traits in pot culture settings. These results complement the current study and indicate that soaking aonla seeds (BSR-1) in 20% cow urine for 24 hours can improve early seedling growth in aonla (BSR-1) and function as a natural growth promoting agent.

Table 2: Effect of organic and hydropriming treatments on growth parameters of aonla (*Phyllanthus emblica* Linn.) genotype BSR-1 (Bhavanisagar-1)

Tr.no	Treatments	Shoot length		Shoot girth	
		30 DAS	60 DAS	30 DAS	60 DAS
T ₁	Control (without soaking)	8.23	21.65	1.21	1.81
T ₂	Cold water treatment for 12 hours	10.03	24.86	1.32	2.37
T ₃	Cold water treatment for 24 hours	10.27	25.74	1.36	2.42
T ₄	Hot water treatment at 60 °C and immersing in it for 12 hours	9.58	23.90	1.27	2.13
T ₅	Hot water treatment at 60 °C and immersing in it for 24 hours	9.79	24.15	1.35	2.26
T ₆	Soaking in 10% cow urine for 12 hours	10.49	25.93	1.39	2.47
T ₇	Soaking in 10% cow urine for 24 hours	10.87	27.11	1.48	2.66
T ₈	Soaking in 20% cow urine for 12 hours	10.71	26.28	1.42	2.59
T ₉	Soaking in 20% cow urine for 24 hours	11.17	27.57	1.53	2.72
SE (d)		0.105	0.188	0.014	0.025
C.D		0.223	0.399	0.030	0.053

3.3 Root growth parameters

Among the different treatments, 20 percent cow urine for 24 hours (T₉) recorded higher root length (12.83 cm), greater number of roots per seedling (25.36) and better root girth (4.38 mm) in aonla seeds (BSR-1) as mentioned in Table 3 which was significantly different from the other treatments. The increased root length, number of roots, and root girth observed under cow urine treatment may be attributed to the presence of bioactive constituents in cow

urine such as iron, urea, uric acid, hormones like oestrogen and progesterone, and other essential nutrients (Dilrukshi, 2009) ^[6]. These compounds likely enhance metabolic activity, stimulate root initiation, and promote cell division and elongation, resulting in better root development and overall seedling vigour. Similar findings were reported by Varun *et al.* (2023) in aonla, Pal *et al.* (2019) ^[11] in karonda, Deeksha *et al.* (2023) ^[4] in custard apple.

Table 3: Effect of organic and hydropriming treatments on root parameters of aonla (*Phyllanthus emblica* Linn.) genotype BSR-1 (Bhavanisagar-1)

Tr. no	Treatments	Number of roots	Root length	Root girth
T ₁	Control (without soaking)	16.44	9.06	2.09
T ₂	Cold water treatment for 12 hours	22.11	10.81	3.11
T ₃	Cold water treatment for 24 hours	22.47	11.08	3.46
T ₄	Hot water treatment at 60 °C and immersing in it for 12 hours	18.81	10.04	2.50
T ₅	Hot water treatment at 60 °C and immersing in it for 24 hours	19.78	10.55	2.91
T ₆	Soaking in 10% cow urine for 12 hours	23.96	11.49	3.69
T ₇	Soaking in 10% cow urine for 24 hours	25.09	12.37	4.07
T ₈	Soaking in 20% cow urine for 12 hours	24.58	11.92	3.84
T ₉	Soaking in 20% cow urine for 24 hours	25.36	12.83	4.38
SE (d)		0.249	0.158	0.170
C.D		0.528	0.334	0.361

Conclusion:

The results showed that Hot water treatment at 60 °C and immersing in it for 12 hours (T₅) has greatly enhanced the germination parameters, with the earliest sprout (10.67 days), highest 50% germination (13.33 days), and highest germination percentage (57.39%) in aonla genotype (BSR-

1). And the highest shoot length (11.17 cm at 30 DAS and 27.57 cm at 60 DAS), stem girth (1.53 mm at 30 DAS and 2.72 mm at 60 DAS), number of roots per seedling (25.36), root length (12.83 cm), and root girth (4.38 mm) of aonla seeds (BSR-1) exhibited better seedling growth when treated with 20% cow urine for 24 hours.

Competing interests

The authors confirm that this study has no competing interests.

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