Original Research Article

ENHANCEMENT OF VIGOUR STATUS THROUGH HYDRO AND LEAF EXTRACT PRIMING AND HUMID INVIGORATION IN RIBBED GOURD (COH 1) AND BITTER GOURD (CO 1)

ABSTRACT

The present study focused on the evaluation of priming with water and various botanical leaf extract and followed by humid invigoration as a means to improve seed germination and seedling vigour of ribbed gourd (COH 1) and bitter gourd (CO 1). The seeds of these gourds were primed with water and various leaf extracts at 2% concentration viz., Pongam (*Pongamia pinnata* L.), Neem (*Azadira chtaindica*),Moringa (*Moringa oleifera*), Curry leaf (*Murraya koenigii*), Notchi (*Vitex negundo*). Coconut (*Cocos nucifera*), Hena (*Lawsonia inermis*), and Guava (*Psidium guajava*). Unpimed seeds taken as contrrol. The study revealed that highest seed and seedling quality characters like germination percentage, speed of germination, seedling length, dry matter production, vigour index I and vigour index II were recorded in hydro primed with water followed humid invigoration. Among the leaf extracts moringa shows better seedling growth of above parameters. Minimum value of this parameter was recorded in henna leaf extract priming with humid invigoration in both ribbed gourd and bitter gourd gourd..

Keywords : Botanical leaf extrct, Seed priming, Humid invigoration, Bitter gourd, Ribbed gourd

INTRODUCTION

Gourds are a remarkable crop in the world that comes under the Cucurbitaceae family which originated in Africa's tropical and subtropical areas. Gourds are highly adaptive in both tropical and subtropical regions. 83% of the production area was covered by Asia, 3% by Africa, and 2% by Central America (Dhillon et al., 2020). In 2022, the bitter gourd was cultivated on about 0.109 M ha with a productivity of 12 t/ha and ribbed gourd was cultivated on about 0.01 M ha with average production and productivity of 0.12 M MT and 12.5 T, respectively (India Stat 2022). Bitter gourd, often known as bitter melon or bitter apple. Bitter gourd referred to as a "gold mine of functional bioactive components" due to the presence of approximately 228 distinct bioactive substances found in various *M. charantia* sections (Nagarani et al., 2014) The ridged gourd is also referred to as Chinese okra, ribbed gourd, silk squash. Ridged gourd seeds have purgative, emetic, and anthelmintic properties, while the fruits have demulcent and diuretic qualities (Nadkarni, 1996).

Seed priming is a physiological seed quality enhancement treatment. During priming, imbibitions take place in a controlled manner (Harris et al., 1999) (phase I). This controlled imbibition activates the hydrolytic enzymes, which lead to the breakage of complex stored products like starch, carbohydrate, and proteins into simple, easily available products (i.e., glucose and amino

acids) (phase II). Then, before the radical protrusion stage, seeds were brought to their original moisture content (phase III) by shade drying for long-term safe storage. Priming activates pre germinative physiological and biochemical processes in advance of field establishment which leads to early emergence during field establishment even under low moisture levels. Some commonly used priming methods are hydro priming, osmo priming, bio priming, chemical priming, matrix priming, nutrient priming, halo priming, thermo priming, etc.

Inclusion of antioxidants, chemicals, PGR, and nutrients during priming improves seed performance and early plant growth and development, especially in harsh environments such as extreme temperatures or salty conditions. (Pill and FINCH-SAVAGE, 1988; Taylor and Harman, 1990; Afzal et al., 2011; Bakht et al., 2011) However, the use of chemical components in seed priming is costly for resource-limited farmers, and large-scale utilisation is also not possible. Seed priming with specific photochemicals can be a cost-effective and environmentally conscious alternative to such chemicals.Some tree and crop water extracts have been found to have beneficial functions for crop growth and yield (Chung and Miller, 1995; Ahmed and Nimer, 2002; Farooq et al., 2008). This leaf extracts have more than hundreds of bioactive compounds which mainly include secondary metabolites viz., alkaloids, phenols, glycosides, and essential oils viz., terpenes, tannins, eugenol, cineol, kaempferol, etc. This bio active compounds possess varies activity in plant system viz., antioxidant, antibacterial, antifungal, larvicidal, anticarcinogenic, hypoglycemic, anti-lipid peroxidative, hypolipidemic and antihypertensive activity (Goutam and Purohit, 1974; Chowdhury et al., 2008). Several studies have been proved that this leaf extract treatment significantly improved the germination and seedling growth of various crops ragi (Prakash et al., 2020), black gram (Tamilmani, 2012), rice (Prakash et al., 2013).

Inorder to extend the beneficial effect of seed priming and also to stimulate various physiological changes in soaked seeds, the seeds after priming were subjected to humid invigouration treatment. During humid invegeraion seeds are placed in a loosely knotted cloth bag and allowed to soak for a certain period of time. The seeds are then placed in a closed container on an elevated platform where humid, dark conditions may be created to aid the invigoration process. Higher relative humidity (>80% RH) during the priming process improves the physiological and physiochemical properties of the seeds, such as increased germination, speed of emergence, dry matter production, seedling length, decline in seed leachates, elevated - amylase activity and sugar content (L. Anilkumar et al., 2019) (Powell AA 2000), (Nath S et al., 1991)

MATERIALS AND METHOD

Bitter gourd (CO1) and ribbed gourd (COH1) seeds were collected from the Department of Vegetable Science, HC & RI, TNAU Coimbatore, and subjected to seed priming treatment with water (hydropriming), and different leaf extracts, viz., pongam (*Pongamia pinnata*), neem (*Azadirachta indica*), coconut (*Cocos nucifera*), henna (*Lawsonia inermis*), guava (*Psidium guajava*), curry leaf (*Murraya koenigii*), Moringa (*Moringa oleifera*), and Notchi (*Vitex negundo*) at 2% w/v concentration. Unprimed seeds are taken as control. Ribbed gourd and bitter gourd seeds were soaked in the above-mentioned solution for 24 hours The seed-to-solution ratio for soaking was 1:2 on a volume-by-volume basis. The seeds are then placed in a loosely knotted wet bag and kept under closed container on an elevated platform where humid, dark conditions may

be created to aid the invigoration process. After completing humid invigoration process seeds were dried under shade conditions to bring them back to their original moisture content.

Leaf extract preparation

Leaves of pongam (*Pongamia pinnata* L.), neem (*Azadirachta indica*), coconut (*Cocos nucifera*), henna *Lawsonia inermis*, guava (*Psidium guajava*), curry leaf (*Murraya koenigii*), moringa (*Moringa oleifera*), and notchi (*Vitex negundo*) will be collected and washed with water. The washed leaves will be shade dried for 4-5 days, followed by sun-drying for 3-5 days. Then the dried leaves will be powdered in a ball mill. 2% of extracts will be prepared with distilled water in a ratio of 2 g per 100 ml of water as weight per volume (Parry et al., 2006).

Fig 1. **Treatment details**

Table 1. Treatment details.

T_1	Control	Humid Invigoration for 12 hrs
T_2	Hydro priming	
T_3	Coconut leaf extract @2 %	
T_4	Pongam leaf extract @2 %	
T_5	Henna leaf extract @2 %	
T_6	Guava leaf extract @2 %	
T_7	Moringa leaf extract @2 %	
T_8	Curry leaf leaf extract @2 %	
T_9	Neem leaf extract @2 %	
T_{10}	Notchi leaf extract @2 %	

After the completion of priming treatment, primed seeds and control seeds were subjected to seed germination tests through the sand method under controlled environmental conditions in a

germination room. Daily observations made up the final count (14 days). At the final count, seedlings that emerged were counted, recorded, and evaluated for their seedling characteristics.

RESULTS

The results showed that among different treatments, seeds of bitter gourd soaked in water (hydro priming) for 24 h followed by 12 hrs humid drying recorded the better seedling performance followed by moringa leaf extract. Hydro priming with humid invigoration shows maximum germination (94 %) followed by moringa leaf extract (90 %). While the control (unprimed seeds) recorded 86 % germination. The lowest germination % (78 %) was recorded in henna leaf extract priming with humid invigoration). All parameters viz., germination per cent, speed of germination, root length (cm), shoot length (cm), dry matter production (g seedlings-10), total seedling length (cm), and vigour index I and vigour index II was found to be higher in hydro priming and lower in henna leaf extract priming. The percentage increase recorded over control was 45, 13, 5, 34, 8, 18, 46, respectively and over the henna LE extract was 21, 58, 25, 15, 29, 18, 43,57, respectively

Similar to bitter gourd, ribbed gourd also had greater seedling performance under hydro priming followed by moringa leaf extract priming. Hydro priming with humid invigoration shows maximum germination (92 %) followed by moringa leaf extract priming (90 %). While the control (unprimed seeds) recorded only 82 % germination. Lowest germination per cent (76 %) recorded in henna LE priming followed by guava LE (80 %). Hydro priming with humid invigoration shows higher germination percentage, with an increase of 12 % over the control and an increase of 21 % over the henna leaf extract. Speed of germination, root length (cm), shoot length (cm), dry matter production (g seedlings-10), total seedling length (cm), and vigour index I and vigour index II was also found to be higher in hydro priming and lower in henna leaf extract priming. The percentage increase recorded over control was 32, 46, 14, 12, 28, 37, 21, respectively and over the henna LE priming was 32, 46, 14, 12, 28, 37, 21 respectively. Other leaf extract also had some promotional effects on physiological parameters viz., germination percent, The root length (cm), shoot length (cm), total seedling length (cm), dry matter production (g seedlings-10) and vigor index over the control in both crops. Among the leaf extract moringa LE showed higher germination percent (88 %) in both crops which was on par with notchi and pungam LE in ribbed gourd. Other parameters like the speed of germination, dry matter production (g seedlings-10), total seedling length (cm), and vigour index I and vigour index II was also found to be highest in moringa LE in both ribbed gourd (3.13,1.127, 26.9, 2367, 99 receptively) and bitter gourd (3.21, 1.524, 36.15, 3254, 137 respectively)

DISCUSSION

Among the varies treatment treatments hydro priming with humid invigoration recorded higher **seed germination (%) and seedling vigour in both crops viz., ribbed gourd (COH 1) and bitter gourd (COH 2).** Hydropeiming is a physiological seed quality enhancement techniquce which significantly improve the seed and seedling quality of several crops which was supporeted by findings of Wardah et al. (2019) in wheat Mohammadi et al. (2014) in maize, Beata et al. (2018) in sugar beetroot, Langeroodi and Noora (2017) et al., (2017) in soybean and Lekić et al.

(2015) in sunflower. Hydro-priming improves seed performance under the favorable condition which leads to higher germination percentages, speed of germination and dry matter production in Brassica sp (Alias et al., 2016) and rice (Farooq et al., 2006) (Forti et al., 2020). Even under unfavorable condition also hydropriming promote germination in different crops viz., green gram (Jisha and Puthur, 2018), maize (Jayesh and Meeta, 2015), rice (Jisha and Puthur, 2014), melon (Casenave and Toselli, 2010), lentil (SAĞLAM et al., 2010). Hydropriming facilitates faster water uptake (imbibition) due to high water potential of pure water leading to early enzyme activation, translocation, and fast utilization of reserved food materials in seed and hydration makes seed coat soft enough for enhanced easy and fast growth of seed embryo (Pandita et al., 2007; Devika et al., 2021). Hydro priming maintain the water content of the tissue leading to activation of hydrolytic enzyme like amylase, lipase for pre-germinative metabolism (Saleem et al., 2014) and leaching out of toxic metabolite effects (Basu, 1994). According Forti et al. (2020) faster germination due to hydropriming was associated with limited lipid peroxidation and significant tocopherols enhancement which provides protection against membrane oxidative damage. Humid invegeration stops germination and allows for the healing of cell membrane damage, which may have increased the germination percentage and vigour of seedlings (Basra and colleagues et al.,2002). Seed humidification has been shown to increase seed germination in sesame [Vijayalakshmi K 2018] , B. juncea and B. campestris [Thornton JM 1993], and cockscomb [Khan MM 2003] RH is a important abiotic facter which influence the production of several plant growth hormone like gibberellins, auxins, cytokine, ethylene. Under higher pH , plant growth hormones like gibberellins, auxins, cytokine were significantly elevated, these lead to improved pollen viability and pollen which have been reported by few authors in plants like lily [Simons DH 1972], avocado [Loupassaki M 1997], aglaonema [Henny RJ 1998] papaya [Cohen E 1980], walnut [Luza JG 1903], Humidity increases ethylene synthesis during priming, which may stimulate endo--mannase activity and aid in endosperm weakening and post-priming germination (Chen and Arora, 2011).

Among the leaf extracts, humid primed with moringa LE showing better seed and seedling quality than other leaf extracts. This might be due to presence antioxidants like ascorbic acid, flavonoids, phenolics and carotenoids (Sinha et al., 2011) as well as the growth-promoting substance such as vitamins C, K, and Ca, cytokinin, and others (Foidl et al., 2001). Zeatin, a type of cytokinin found in moringa leaves that could speed up cell division (Foidl et al., 2001) and Calcium act as enzyme cofactor which trigger the protein synthesis during germination process (Christiansen and Foy, 1979) phenols has major role in activation of root growth of several crops viz maize, barnyard millet, forage sorghum (Nandhakumar, 2010; Shehzad et al., 2012; Suguna, 2012) During priming the embryo of the seed appeared to receive the majority of the mineral nutrients provided by MLEs, which facilitated the emergence of seedlings and eventually, the growth and development of plants. Increase in dry weight might be due to enhanced lipid and enzyme utilization which was activated by bioactive substances like auxin and gibberellins present in moringa leaf extract.

Compare than other leaf extracts henna, guava and coconut leaf extracts, irrespectively showing lower values in seedling parameters viz., speed of germination, root length (cm), shoot length (cm), dry matter production (g seedlings-10), total seedling length (cm), and vigour index I and

vigour index II in both bitter gourd and ribbed gourd. Henna's negative effect on seed germination and seedling growth was previously documented by Kaveriammal et al. (2013) in various crops viz., *V. radiate* (L), *V. mungo* (L), and *A. hypogaea*. Germination of *C. occidantalis* was significantly affected by guava leaf extracts (Namkeleja et al., 2014). It might be due to presence of allelochemicals which led to negative allelopathy effect on seedling growth. Henna and guava leaf contains several allelochemicals such as terpenoids, flavonoids, coumarins, and cyanogenic acids (Chapla and Campos, 2010; Khan et al., 2014) According to (Khan et al., 2014) presence of these allelochemicals significantly lower the germination as well as seedling growth by affecting the hydrolysis of food reserves and cell division during the process of germination. In some instances, they alter membrane permeability, interfere with the production of chlorophyll and synthesis of protein, and deactivate the activity of specific hormones and enzymes (Namkeleja et al., 2014). Terpenoids and other allelochemicals have been shown to disturb the balance of growth hormones *viz.*, auxin gibberellins (Namkeleja et al., 2014). This interruption in normal auxin levels results in the stimulation of lateral shoot growth and the subsequent suppression of vertical growth (Brunn et al., 1992).

Conclusion

From this study, it could be concluded that Hydro priming (24 hrs) followed by humid invigoration significantly improve the seed germination and seedling vigour of ribbed gourd and bitter gourd. There is no influential effect was recorded in seeds primed with varies leaf extract except moringa leaf extract. Instead of promoting they suppressed the seedling growth parameter particularly henna, guava,and coconut leaf extrct highly inhibit the growth of sthe seedling

Table 2: Effect of leaf extract priming on seedling quality parameters of Ribbed gourd (COH 1)

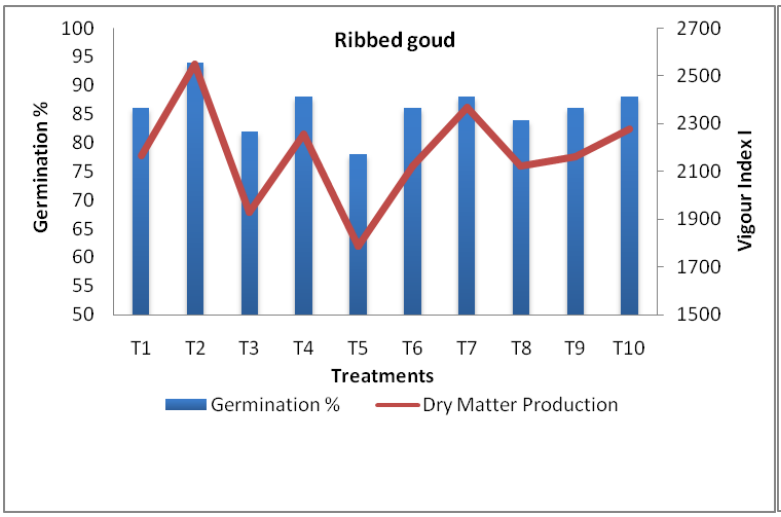
Treatments	Germination (%)	Speed of germination	Root length (cm)	Shoot length (cm)	DMP (g/10 seedings)	Seedling length	Vigour index I	Vigour index II
T1	86 (68.0)	2.67	8.14	17.03	0.862	25.17	2165	74
T2	94 (75.8)	3.87	9.21	17.9	1.156	27.11	2548	108
T3	82 (64.9)	2.9	7.23	16.3	0.882	23.53	1929	72
T4	88 (69.7)	2.98	8.7	16.95	0.957	25.65	2257	84
T5	78 (62.0)	2.45	7.34	15.57	0.895	22.91	1787	69
T6	86 (68.0)	2.84	8.15	16.51	0.993	24.66	2121	85
T7	88 (69.7)	3.13	9.17	17.73	1.127	26.9	2367	99

T8	84 (66.4)	2.76	8.55	16.7	1.102	25.25	2121	92
T9	86 (68.0)	2.89	8.4	16.75	1.089	25.15	2162	93
T10	88 (69.7)	2.84	8.85	17.05	1.115	25.9	2279	98
Mean	**68.3340**	**2.9330**	**8.3740**	**16.8490**	**1.0178**	**25.225**	**2173.6**	**87.400**
SEd	**2.9748 ***	**0.1271 ****	**0.356****	**0.72 (NS)**	**0.043 ****	**1.076 ***	**92.51 ****	**3.74 ****
CD(P=0.05)	**6.6284**	**0.2832**	**0.7952**	**1.6214**	**0.0965**	**2.3993**	**206.127**	**8.3370**

Table 3: Effect of leaf extract priming on seedling quality parameters of Bitter gourd (CO 1)

Treatments	**Germination (%)**	**Speed of germination**	**Root length (cm)**	**Shoot length (cm)**	**DMP (g/10 seedings)**	**seedling lenth**	**Vigour index I**	**Vigour index II**
T1	82 (64.9)	2.69	13.2	16.05	1.517	29.25	2516	130
T2	92 (73.6)	3.54	19.3	18.25	1.704	37.55	3455	157
T3	84 (66.4)	2.96	14.65	16.83	1.351	31.48	2644	113
T4	88 (69.7)	3.02	15.49	18.35	1.487	33.84	2978	131
T5	76 (60.7)	2.53	14.85	16.7	1.367	31.55	2398	104
T6	80 (63.4)	2.61	14.53	15.89	1.345	30.42	2434	108
T7	90 (71.6)	3.21	18.25	17.9	1.524	36.15	3254	137
T8	84 (66.4)	2.85	16.03	16.01	1.325	32.04	2691	111
T9	86 (68.0)	2.89	14.9	15.81	1.356	30.71	2641	117
T10	90 (71.6)	2.96	16.01	17.5	1.367	33.51	3016	123
mean	**67.7130**	**2.9260**	**15.7210**	**16.9295**	**1.4344**	**32.6500**	**2802.70**	**123.1000**
SEd	**3.00 ***	**0.12 ****	**0.67 ****	**0.736 ***	**0.062 ****	**1.40 ****	**118.76****	**5.25 ****
CD(P=0.05)	**6.6912**	**0.2803**	**1.5000**	**1.6407**	**0.1387**	**3.1372**	**264.6325**	**11.7057**

Fig 2. Graphical distribution of Effect on leaf extract priming on seedling quality parameters.



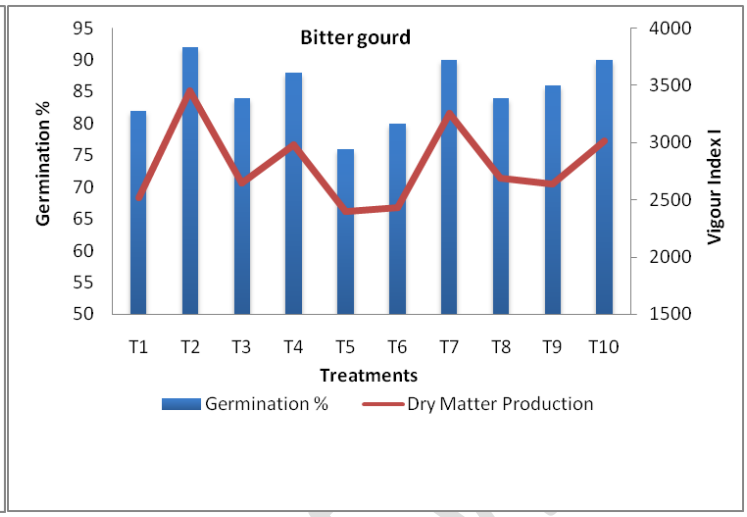
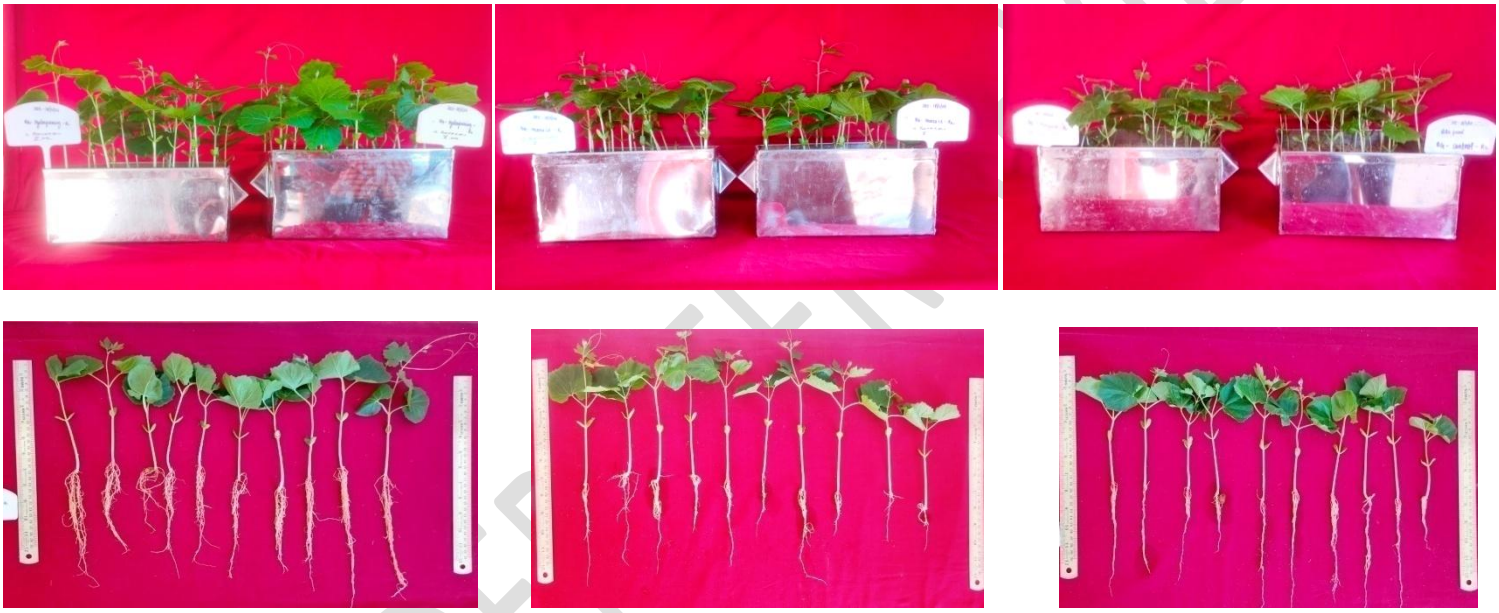


Fig 3.Effect of leaf extract priming on bitter gourd (CO 1)



Bitter gourd hydro priming

Bitter gourd control

Bitter gourd – Henna LE priming

Fig 4.Effect of leaf extract priming on ribbed gourd (COH 1)

Ribbed gourd hydro priming

Ribbed gourd control

Ribbed gourd Henna LE priming

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