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DORMANCY BREAKING OF ASH GOURD SEED THROUGH DIFFERENT PHYSICAL AND CHEMICAL METHODS

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ABSTRACT

Rahman MS, Sarker PC, Islam MN, Shaheb MR, Sarker MH (2014) Dormancy breaking of ash gourd seed through different physical and chemical methods. *Int. J. Sustain. Crop Prod.* 9(2), 1-6.

Seed dormancy of ash gourd due to thick seed coat lowers the seed germination. In this study we applied different physical and chemical methods to break dormancy of ash gourd seed in the Laboratory of Seed Technology Division, Bangladesh Agricultural Research Institute, Gazipur, Bangladesh during the period from September 2009 to May 2010. The experiment was conducted by laying out in a complete randomized design using seed germinator and oven dryer for germination and vigor tests. The two factorial experiment was subjected to the following treatments *viz.*, factor A: three storage periods *viz.*, S_1: 1 month, S_2: 4 month and S_3: 7 months storage of seeds and factor B: seven physical and chemical seed treating methods *viz.*, T_1: hitting the seeds on a pucca (concrete) floor from 1 meter height at 10 times, T_2: cooling in deep freeze for 2 days, T_3: cooling in deep freeze for 4 days and T_4: cooling in deep freeze for 6 days, T_5: 0.2% KNO_3, T_6: 0.4% KNO_3, T_7: 0.6% KNO_3, and T_8: control treatments were tested. Results revealed that physical and chemical methods, storage period and their interactions showed significant influence on releasing seed dormancy in terms of seed germination. Studies indicated that maximum seed germination (78.67%) was observed with the treatment of 0.4% KNO_3 up to 7 months storage of seeds along with maximum vigor index (2.13) of ash gourd.

Key words: *seed dormancy, KNO_3, ash gourd, seed germination, vigour index*

INTRODUCTION

Ash gourd (*Benincasa hispida*), a popular cucurbitaceous vegetable in Bangladesh, is usually grown in summer but it can be grown in a wide range of environment except a very few winter months in our country. Previous study revealed that seed germination of ash gourd is very low and seed dormancy is one of the reasons for low germination (Robinson and Deckers, 1997; Malik *et al.* 2001; Nerson 2007; Doody and Conor, 2011; Bian *et el.* 2013). Dormancy prevents the seeds to germinate after harvest for few months or even years (Ganar 2003). Initially, it was found that dormancy in this crop extends up to 10-11 months as revealed by the storage studies on bulk seeds and dormancy was universally present in the seeds produced in both the seasons (Ganar 2003). Seed maturation in cucurbits usually continues until the fruit starts yellow with senescence. The cucurbit seed exhibits dormancy in freshly harvested cucurbit seeds which can be broken by a month or more of after ripening (Robinson and Deckers, 1997). The quality of seed in fleshy fruited species is enhanced when they acquire maximum dry weight (Demir and Ellis, 1992) and seeds continue to develop and mature in the fleshy fruits until they get extracted from fruits (Ahmed *et al.* 1987).

Germination percentages of several vegetable species have been shown to increase after seed treatment with chemicals and various osmotica (Staub *et al.* 1989). It was also plausible that the seeds of many species of cucurbits are non-endospermic and germination is epigeal. Dormancy can be severe problem in some cucurbit species (Malik *et al.* 2001). The beneficial effects of KNO_3 were also supported by Renuga Devi and Jacqueline (1995) in bitter gourd. The benefit of seed treatment leads to increased germination and ensures uniform seedling emergence. Overall seed treatment to break seed dormancy leads to improved plant population and thus higher productivity (Sridhar *et al.* 2013). Seed dormancy of ash gourd is a common problem reported by many researchers and field workers (Robinson and Deckers, 1997; Malik *et al.* 2001; Ganar 2003). It is a great problem of vegetable growers as they have to spent more money for purchasing more seed to maintain adequate plant stand in their field, side by side seed traders fall in trouble in selling their seeds of good variety. Some techniques like seed coat puncture, scarification, seed treating with boric acid, bavistene, KNO_3, hydrochloric acid, sulphuric acid, chilling treatment, hot water treatment etc. are reported in many cucurbits and legumes that reduce seed dormancy (Devi and Selvaraj, 1994; Sinha *et al.* 1993; Paul *et el.* 2008). Seed dormancy is most common in wild flora mainly for survival purposes under unfavorable environmental conditions (Bewley 1997; Geneve 2003; Baskin and Baskin, 2004). Saleem *et al.* (2014) reported that seed soaking in water for 12 hours has the potential to improve maximum germination and enhanced growth of bitter gourd. The terms seed priming and seed conditioning (Khan 1992) represent a series of treatments applied to a given seed lot in order to break dormancy and to improve its germination and emergence. The germination ability of cucurbit seeds is related both to external and internal factors. Nerson (2007) asserted that the failure of cucurbit seeds to germinate some times may have no relation to seed quality but may also be due to the lack of specific requirements and this is probably the case in conditional dormancy which is typical for some cucurbits. Priming treatments can improve germination, especially when applied to poor quality seeds, or under stressful environments (Nerson 2007). Cucurbit seeds may also be primed to decrease other environmental germination

limits. For example, imbibed cucumber seeds are sensitive to chilling temperature and by priming them for a short time in high temperature they become tolerant (Jennings and Saltveit, 1994). Methods to break seed dormancy or development of genotypes with good, uniform and quick germinability are important for crop husbandry as well as ex situ regeneration (Bharathi and Jhon, 2013). However, the literature about the breaking of seed dormancy of ash gourd are lacking in Bangladesh which needs to be developed. Therefore, the present study was undertaken to find out appropriate technique of breaking seed dormancy of ash gourd.

MATERIALS AND METHODS

Experimental site and materials

The experiment was conducted in the Laboratory of Seed Technology Division, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, Bangladesh during September 2009 to May 2010. The variety of ash gourd was BARI Chalkumra-1. Freshly collected seeds of ash gourd were dried well (moisture content around 8%) and stored in a tin container with polythene bag under ambient condition for several months at ambient temperature were used in the experiment. The experiment was conducted by laying out in a complete randomized design using seed germinator and oven dryer for germination and vigor tests.

Experimental treatments and brief description of the seed treating methods

The two factorial experiment was conducted with the following treatments *viz*., factor A: three storage periods *viz*., S_1: 1 month, S_2: 4 month and S_3: 7 months storage of seeds and factor B: seven physical and chemical seed treating methods *viz*., T_1: hitting the seeds on a pucca (concrete) floor from 1 meter height at 10 times, T_2: cooling in deep freeze for 2 days, T_3: cooling in deep freeze for 4 days and T_4: cooling in deep freeze for 6 days, T_5: 0.2% KNO_3, T_6: 0.4% KNO_3, T_7: 0.6% KNO_3, and T_8: control were tested in this experiment. The temperature of deep freeze was around 5^oC. KNO_3, is a widely adapted dormancy breaking chemical agent and it is comparatively cheap compared to other seed treating chemical and also available in the urban market in Bangladesh. To prepare these, potassium nitrate (KNO_3) test solutions were prepared by dissolving 20 g of KNO_3 in distilled water and volume was made up to 1000 ml. From the stock solution, further dilutions were made according to the requirement of three different concentrations 0.2(%), 0.4(%), 0.6(%) by using distilled water.

Working procedures

Seeds of different months of storage were subjected to break dormancy by the above mentioned physical and chemical methods. The physical methods were accomplished by hitting the seeds on a pucca (concrete) floor at around $25\text{-}30^0C$ for 3 hours that was followed by 10 times, cooling in deep freeze for 2 days, cooling in deep freeze for 4 days and cooling in deep freeze for 6 days. The temperature of deep freeze was around 5^oC. For chemical treatment, seeds were soaked in KNO_3 solution at three different concentrations of 0.2(%), 0.4(%), 0.6(%) for 24 hrs. All the methods were imposed at every 1, 4 and 7 months of storage of seeds. Hundred seeds in four replicates, for every treatment were used and tested for germination and vigor index. Data on germination percentage, seedling length, seedling dry weight, vigor index etc. were recorded on the treated seedlings grown inside seed germinator (Model D-7440, Seed Buro Equipment Company, Jackson BLVD, Chicago, USA). Daily radicle emergence was recorded for 14 consecutive days to record of seed germination and the temperature was 28 ± 2^oC during the germination period. Seedlings of ash gourd were dried in an oven (Model: Oven type, SSG/A Seed buro equipment Company, Jackson BLVD, Chicago, USA), at 70^0C for 72 hours.

Data recording

i) Seed germination (%)

The seeds were tested for germination by adopting BP method as per ISTA (1999). The germinated seedlings were evaluated on the final day of germination test. Seed germination percent data were transformed following Arc-Sine transformation and the total germination was expressed as per cent on the basis of number of normal seedlings obtained.

ii) Seedling vigour index

Seedling Vigour Index (SVI) was measured and calculated by adopting the method suggested by Abdul-Baki and Anderson (1973) and expressed in whole number.

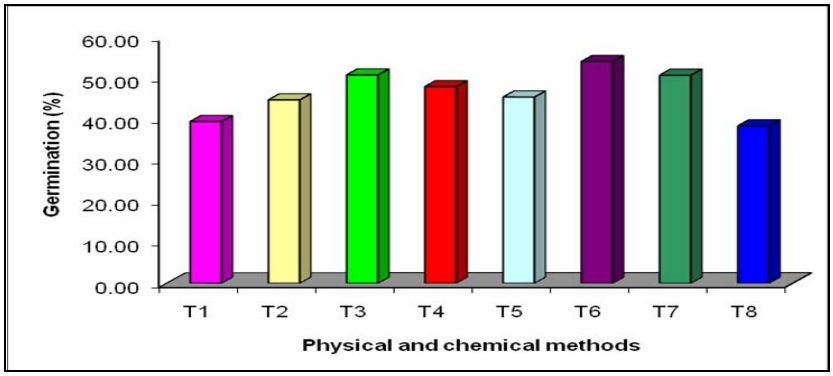
Statistical analysis

Recorded data were analyzed statistically with the help of MSTAT C software. Treatment means were compared following Duncan's Multiple Range Test (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

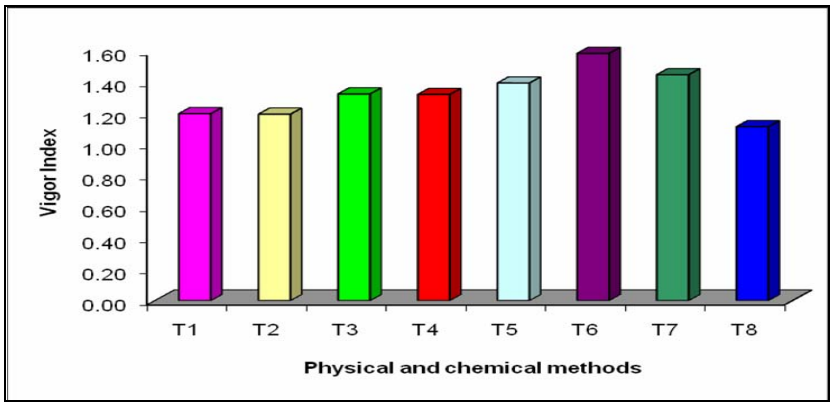
Effects of physical and chemical methods on the seed germination and vigor index

Seed treating physical and chemical methods were found significant variations on seed germination as well as vigor index of ash gourd (Fig. 1 and 2). The maximum seed germination percentage (54%) was observed in case of 0.4% KNO_3 treatment which was 25.19% higher than control treatment (40.88%) (Fig. 1). Boonchoo *et al*. (2006) noted 66% germination percentage by 0.2% KNO_3 compared to 39% in control. On the contrary, the maximum (1.59) vigor index was observed in seeds treated with 0.4% KNO_3 which was 34.82% higher than control treatment (1.12) (Fig. 3) and they also asserted that KNO_3 improved germination index and seedling growth rate in wax gourd seed.



T_1: Hitting the seeds on a pucca floor from 1 meter height for10 times, T_2: Cooling in deep freeze for 2 days, T_3: Cooling in deep freeze for 4 days, T_4: Cooling in deep freeze for 6 days, T_5: 0.2% KNO_3, T_6: 0.4% KNO_3, T_7: 0.6% KNO_3 and T_8: Control (ambient temp.)

Fig. 1. Effect of physical and chemical seed treating methods on seed germination of ash gourd



T_1: Hitting the seeds on a pucca floor from 1 meter height for10 times, T_2: Cooling in deep freeze for 2 days, T_3: Cooling in deep freeze for 4 days, T_4: Cooling in deep freeze for 6 days, T_5: 0.2% KNO_3, T_6: 0.4% KNO_3, T_7: 0.6% KNO_3 and T_8: Control (ambient temp.)

Fig. 2. Effect of physical and chemical seed treating methods on vigor index of ash gourd

Effect of storage period on seed germination and vigor index

Results observed that seed germination (SG) percentage and vigor index of ash gourd seeds were influenced significantly at different periods of storage (Fig. 3 and 4). Results revealed that the seed germination was observed maximum (64.40%) at 7 months of stored seed while the minimum SG (21.17%) was recorded in the seeds of 1 month storage (Fig. 3). Interestingly, the SG percentage was increased gradually with the increasing of storage period and it might be due to decrease of seed dormancy with the advancement of storing time at ambient temperature. However, the increment of seed germination percentage after 7 months of storage was 204.20% higher compared to 1 month after storage. The results are in conformity with the findings of Ganar *et al*. (2004) who observed the maximum percentage of germination at 7 months of storage of ash gourd seed. Study suggested that the vigor index was observed minimum (0.82) in the seeds of 1 month storage and increased gradually with the increasing of storage period. Finally, after 7 months storage seed showed maximum

vigor index and it was 1.69 (Fig. 4). The reason for increasing germination and vigor index might be due to the elimination of dormancy of the ash gourd seeds with the increase of their storage period.

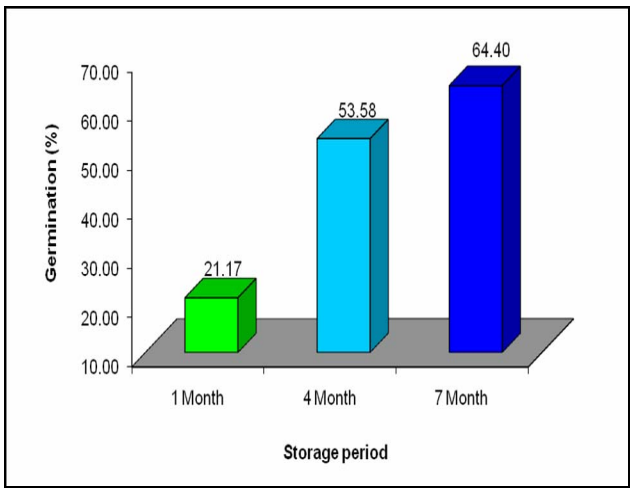


Fig. 3. Effect of storage period on seed germination of ash gourd

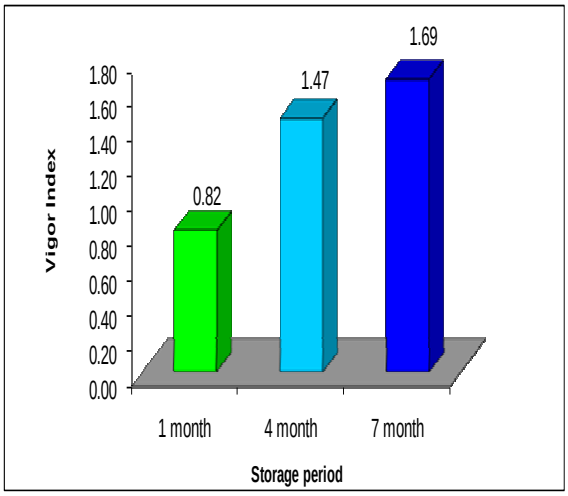


Fig. 4. Effect of storage period on vigor index of ash gourd

Combined effect of physical and chemical methods and storage period on seed germination and vigor index

Research results found that seed germination and vigor index were varied significantly due the combined effect of seed treating methods and storage period (Table 1 and 2). Maximum seed germination percentage (78.67%) was observed in the application of 0.4% KNO_3 with 7 months storage of seeds and this was statistically similar with the treatment 0.6% KNO_3 applied in the seeds of same storage period (Table 1). But the minimum seed germination percentage (16%) was observed from the treatment 0.2% KNO_3 applied in 1 month of storage seeds which was statistically similar at par with other treatments of same storage period except cooling treatments. The increment of seed germination of 0.4% KNO_3 after 7 months storage was 4.81 times more compared to control treatment at same storage period. Fonseka and Fonseka (2011) reported that priming of seeds in 0.3% KNO_3 or in household vinegar (pH -3.7) for a 2 hours period induced higher germination of 90 and 80%, respectively and therefore, to achieve higher percentage of germination from seed stored for one year, it is recommended to prime seeds before planting using house hold vinegar or KNO_3 treatment. Lay *et al.* (2013) reported that seed extraction from complete yellow or orange fruits, GA_3 and KNO_3 treatments can enhance the germination and other seed quality parameters in papaya. The possible fact for better percent germination by priming may be that it stimulates series of biochemical change in the seed that are essential to initiate the emergence process like break down dormancy, hydrolysis, metabolism of growth inhibitors, imbibitions, activation of enzymes (Ajouri *et al*. 2004; Pukacka and Rajajczak, 2005). The results are in agreement with the findings of Mathad *et al.* (2013) who alluded that good seed treatment helps in getting good germination, plant establishment, and crop protection in early stage of crop growth.

Table1. Combined effect of physical and chemical methods and storage periods on germination of ash gourd seed

Treatment	**Germination (%)**		
	1 month	**4 month**	**7 month**
T_1	18.67 (25.54) j	47.33 (43.45) gh	52.17 (46.32) ef
T_2	26.00 (30.63) i	49.33 (44.60) fg	58.67 (49.98) c
T_3	28.00 (31.93) i	57.33 (49.20) cd	66.93 (54.72) b
T_4	28.67 (32.35) i	53.67 (47.09) de	61.33 (51.54) c
T_5	16.00 (23.56) j	52.33 (46.32) ef	67.73 (55.33) b
T_6	18.00 (25.09) j	65.33 (53.91) b	78.67 (62.53) a
T_7	17.67 (24.82) j	58.67 (49.97) c	75.67 (60.43) a
T_8	16.33 (23.78) j	44.67 (41.92) h	54.00 (47.28) de
CV (%)	3.13		

*Figures in parenthesis indicate arc sine values

T_1= Hitting the seeds on a pucca floor from 1 meter height for10 times, T_2= Cooling in deep freeze for 2 days, T_3= Cooling in deep freeze for 4 days, T_4= Cooling in deep freeze for 6 days, T_5= 0.2% KNO_3, T_6= 0.4% KNO_3, T_7= 0.6% KNO_3 and T_8= Control (ambient temp.)

Table 2. Combined effect of physical and chemical methods and storage periods on vigor index of ash gourd

Treatment	Vigor Index		
	1 month	**4 month**	**7 month**
T_1	0.75 jk	1.32 fgh	1.53 de
T_2	0.85 ijk	1.27 gh	1.77 ef
T_3	0.90 ij	1.40 efgh	1.68 cd
T_4	0.96 i	1.44 efg	1.57 de
T_5	0.76 jk	1.54 de	1.89 b
T_6	0.82 ijk	1.81 bc	2.13 a
T_7	0.82 ijk	1.68 cd	1.85 b
T_8	0.69 k	1.26 h	1.40 efgh
CV (%)	6.97		

T_1= Hitting the seeds on a pucca floor from 1 meter height for10 times, T_2= Cooling in deep freeze for 2 days, T_3= Cooling in deep freeze for 4 days, T_4= Cooling in deep freeze for 6 days, T_5= 0.2% KNO_3, T_6= 0.4% KNO_3, T_7= 0.6% KNO_3 and T_8= Control (ambient temp.)

Like wise, the maximum vigor index (2.13) was observed in 0.4% KNO_3 with 7 months storage and it was 52.14% higher than control treatment with same storage period (1.40) (Table 2). But the minimum vigor index (0.69) was observed from the control treatment with 1 month storage which was statistically at par with other treatments of same storage period except cooling seeds in deep freeze for 4 and 6 days. Results revealed that maximum seed germination could occur when seeds are treated with 0.4 percent KNO_3 up to seven months of storage along with maximum vigor index (BARI 2011).

CONCLUSION

Pre-sowing seed treatments for breaking dormancy of ash gourd result in higher germination and earlier seedling emergence, strong growth, early flowering, maturity and high yields. However, from the findings, considering seed germination percentage and vigor index of ash gourd, seed treatment with 0.4% KNO_3 might be induced higher percentage of germination from seed. Thus, it might be recommended that ash gourd seeds should be primed as seed treatment with 0.4% KNO_3 to break dormancy before sowing in the field for better plant establishment, growth and yield of ash gourd.

REFERENCES

Abdul-Baki AA, Anderson JD (1973) Vigour determination in soybean seed by multiple criteria. *J. of Crop Sci.* 13, 630-633.

Ahmed SMA, Rashid M, Hossain AKMA (1987) Effect of maturity and post harvest ripening of fruits on viability of eggplant seed. *Bangladesh J. Agric* 12, 246-250.

Ajouri A, Asgedom S, Becker M (2004) Seed priming enhances germination and seedling growth of barley under conditions of P and Zn deficiency. *J. Pl. Nutri. Soil Sci*. 16(2), 630-636.

BARI (2011) BARI Annual Research Report (2010-11). Published by Bangladesh Agricultural Research Institute (BARI). http://www.bari.gov.bd/annual_ report/6 fa52af46d2ab1d5aad7222c15ad e328.pdf.

Baskin JM, Baskin CC (2004) A classification system for seed dormancy. *Seed Sci. Res.* 14, 1-16.

Bewley JD (1997) Seed germination and dormancy. *The Plant Cell.* 9, 1055-1066.

Bharathi LK, Jhon KJ (2013) Momordica genus in Asia-An overview. XVII, 147p. http://www.springer.com/978-81-322-1031-3.

Bian L, Yang L, Wang JA, Shen HL (2013) Effects of KNO_3 pretreatment and temperature on seed germination of *Sorbus pohuashanensis*. *J. Forestry Res.* 24(2), 309-316.

Boonchoo T, Manee R, Loyma D, Photchanachai S (2006) Effect of hot water treatment and KNO_3 on the release from dormancy of wax gourd seed. *Agril. Sci. J.* 37, 195-198.

Demir I, Ellis RH (1992) Development of peeper (*Capsicum annum*) seed quality. *Annals of Applied Biol.* 121, 365-399.

Devi JR, Selvaraj JA (1994) Effect of presowing treatment on germination and vigour in bitter gourd (*Momordica charantica* L.) cv. Co. 1. *Seed Res.* 22, 64-65.

Doody C, Conor OR (2011) Effect of long-phase stratification treatments on seed germination in ash. Annals of Forest Sc. (EDP Sciences). 68(1), 139.

Fonseka HH, Fonseka RM (2011) Studies on deterioration and germination of bitter gourd seed (*Momordica charantia* L.) during storage. *Acta Hort. (ISHS)* 898, 31-38.

Ganar HD (2003) Dormancy behaviour, planting value and field emergence in ash gourd and bitter gourd seeds. *Ph.D thesis*, IARI, New Delhi.

Ganar HD, Kant K, Dadlani M, Sihohi PS, Tomar BS (2004) Effect of after ripening and seasons on seed Quality of ash gourd (*Benincasa hispida* (Thunb.) Cogn.). *Seed Res.* 32(2), 145-148.

Geneve RL (2003) Impact of temperature on seed dormancy. *Hort. Sci.* 38, 336-341.

Gomez KA, Gomez AA (1984) Statistical procedures for Agricultural Research. 2nd edn. John Wiley and Sons, New York, 194.

ISTA (1999) International rules for seed testing. International Seed Testing Association. Seed Science and Technology. Zurich, Switzerland.

Jennings P, Saltveit ME (1994) Temperature effects on imbibition and germination of cucumber (*Cucumis sativus*) seeds. *J. American Soc for Hort. Sci.* 119, 464-467.

Khan AA (1992) Preplant physiological seed conditioning. *Hort. Review.* 13, 31-181.

Lay P, Basvaraju GV, Sarika G, Amrutha N (2013) Effect of seed treatments to enhance seed quality of papaya (*Carica papaya* L.) cv. Surya. *Global J. Biol. Agric. Health Sci.* 2(3), 221-225.

Malik IJ, Ellington TL, Wehner TC, Sanders DC (2001) Seed treatment effects on emergence of luffa sponge gourd. *Cucurbit Gen. Cooper. Rep.* 24, 107-109.

Mathad RC, Vasudevan SN, Mathad NC, Patil SB (2013) Traditional seed treatment and storage methods of northeastern region of Karnataka. *Asian Agri-History.* 17(3), 233–239.

Nerson H (2007) Seed Production and Germinability of Cucurbit Crops. *Seed Sci. and Biotechnol.* 1(1), 1-10.

Paul D, Paul NK, Basu PK (2008) Seed germination response of *Rauvolfia serpentina* benth. to certain physical and chemical treatments. *J. Bio-Sci.* 16, 129-131.

Pukacka S, Ratajczak E (2005) Production and scavenging of reactive oxygen species in *Fagus sylvatica* seeds during storage at varied temperature and humidity. *J. Plant Physiol.* 162, 873-885.

Renuga Devi J, Jacqueline A (1995) Seed pelleting and soil types on germination and vigour of seeds in ashgourd and rib ed gourd. *Madras Agric. J.* 82(2), 75-77.

Robinson RW, Deckers WDS (eds.) (1997) Cucurbits CAB International, 116-117.

Saleem MS, Sajid M, Ahmed Z, Ahmed S, Ahmed N, Islam MSU (2014) Effect of seed soaking on seed germination and growth of bitter gourd cultivars. *IOSR J. Agric. Vet. Sci.* 6(6), 07-11.

Sinha SK, Jha BN, Varshney SK (1993) Effect of various treatments on harseededness in kasurimethi (*Trigonella corniculata* L.). *Seed Res.* 21, 114-116.

Sridhar S, Kumar SA, Thooyavathy RA, Vijayalakshmi K (2013) Seed Treatment Techniques, Centre for Indian Knowledge Systems, Chennai Revitalising Rainfed Agriculture Network, 14. http://www.ciks.org/6.SeedTreatmentTechniques.pdf (Last assessed date-23 July 2014).

Staub JE, Wehner TC, Tolla GE (1989) The effects of chemical seed treatments on horticultural characteristics in cucumber (*Cucumis sativus* L.). *Scientia Hort.* 38, 1-10.