ISSN 2394 - 7837

ARTICLE

The Effect of Light, Darkness and Salinity on Seed germination of *Vinga radiata* (L.) R. Wilczek.

Sreeja Thankappan*, Sufin, S.S., Vinod, V., Aswathy, A. and Greeshma Mohan

Received 04/07/2018 Accepted 15/08/2018

Abstract

Light, darkness and salinity have significant effect on seed germination and growth. In this study, the influence of light, darkness and salinity on germination of Vigna radiata (green gram) was presented Germination study reveals that darkness have significant effect on the lengthening of shoot and salinity arrested germination of seeds.

Keywords: *Vigna radiata,* germination, bulging

Introduction

Plants produce seeds and seeds develop into new plants as a result the cycle continue to keep the plant species alive and continuity. By using individual species life cycle, the totipotency of an individual species can be traced and genetically variation in various stages of growth and development of an individual species is the one which bring about variants within species and different families and groups in the plant kingdom. One of the potential stages in the life cycle of plants and trees is seed germination despite of other alternatives like cuttings, suckers, grafting, hyphae formed by sporeling of fungal spores and tissues culture. Seed germination is a process in which a seed or spore awakens from dormancy and start to sprout. Germination therefore refers to sprouting of a seed or resumption of plant growth from seed or growth of a sporeling from a spore, for example the growth of hyphae from fungal spores. Dormancy is a condition at which a seed contains an embryonic plant in a resting condition. Both seeds and spores can experience periods of dormancy which is often influenced by external factors as temperature and light.

Both internal and external factors from the environment are declared to affect seed germination. Hormones contained in various developmental stages of the seed and enzymes are some of the internal factors which in one way or another can affect seed germination. The most important external factors which are declared to affect seed germination includes temperature, oxygen or air, water or moisture and sometimes light although most of literature in various research do declare that light have no effect on seed germination instead most of plants are reported to germinate earlier and successfully in the dark place compared to the light place but dark place is not declared in any published scientific research as a factor affecting germination. Another external substance like gibberellic acid and other synthetic hormones which can affect germination significantly are also not reported to be factors affecting seed germination. Many researchers also agree that soil; dormancy period, seed viability and thinness or thickness of the seed coat may affect seed germination and hence are factors for seed germination.

The objective of this study was to evaluate the effect of light, darkness and salinity on seed germination percentage in *Vigna radiata*.

Materials and Methods

Seeds were selected, sterilized and germinated in a petridish. 50 seeds were placed in 5 Petri dishes, ten seeds were germinated in each petridish and 5 replicates were used per treatment, and watered at regular intervals. Fifty seeds were placed in light and another fifty in darkness. In this experiment NaCl solution is used (5%) to test the effect of salinity. Growth parameters were recorded every second day and observed characters were germination percentage and height of sprout.

Results and Discussion

Seeds kept in sunlight and darkness started germination in the second day. But the percentage of germination was 30 in presence of light and 70 in darkness. 100 % germination was observed in darkness in the third day and only 80% germination occurred in light in the eighth day (Fig.1). Length of seedling was 4.5cm in light and 22.0cm in darkness (Table.1). But seeds in 5% NaCl showed absence of germination and only bulging of seeds occurred. The results showed that light caused reduction in the germination

P G Department and Research Centre of Botany, Mahatma Gandhi College, Trivandrum, Kerala , India
*Corresponding Author email: sreejactcri@gmail.com

Table 1. Results of seed germination

Day	Seeds in sunlight		Seeds in darkness		Seeds in NaCl	
	% of germination	Length of seedling (cm)	% of germination	Length of seedling (cm)	% of germination	Length of seedling (cm)
1	-	-	-	-	-	-
2	30	-	70	2.0	-	-
3	30	1.0	100	6.0	-	-
4	40	1.5	-	9.0	-	-
5	40	3.0	-	13.0	-	-
6	70	3.5	-	18.0	-	-

percentage and height of bean sprouts whereas darkness increased seed germination. Germination percentage was strongly decreased with salt stress.

Our results showed that seeds of *Vigna radiata* germinated in darkness rather than in presence of light and in presence of NaCl (5%) germination was inhibited. Oxygen from the atmospheric air and or from the soil is needed in large quantities during germination of the seed. At the dormant stage, the seeds respiratory rate is very low and so oxygen is required in very small quantities. Seeds sown deeply in soil fail to germinate because of little or lack of oxygen. If soil conditions are too wet, an anaerobic condition persists and a seed may not be able to germinate. Oxygen oxidizes the stored food in the seed to release energy which will be used for other metabolic and hydrolytic processes in the seed and rapture of the seed coat (Koning, 1994). Light requirements for seed germination vary with plant species. Some plants such as verbena and phlox require darkness to germinate which is not regarded as a factor while other plants as begonias and geraniums require a good amount of light which is considered as a factor and other plants will germinate in either the light or the dark place. The most scientific reason as to why seeds do not germinate in light is that light is reported to decompose carbonic acid gas, expel oxygen which is a germinating factor and fix the carbon, thus hardening all parts of the seeds which prevent vegetation. Darkness have no effect to carbonic acid gas and the oxygen remain undisturbed to favour germination and hence is more correct to state darkness as a germinating factor and light as a hindering factor. Little plant species which their seeds germinate in light are normally planted near the surface of the soil to receive an adequate amount of light. Other researchers argue that dark place is just a condition for germination but do not clarify as to why or how is a condition while others argue that dark place is just the absence of light but light is reported to have no effect on seed germination instead darkness is reported to influence germination (Neff et al, 2009). The main concern of this research is to justify the potential of darkness as a factor affecting seed germination and not as only the condition or absence of light as other researchers tends to simplify. Washa B. Washa (2015) reported bean germination to be significantly higher in the dark condition than in light condition.

Figure 1. High rate of seed germination in darkness. 2. Very low germination in light. 3. Absence of germination in salt

Soil salinization is one of the major factors of soil degradation. Salinity inhibition of plant growth is the results of osmotic and ionic effects and the different plant species have developed different mechanisms to cope with these effects (Munns, 2002). Reduction in osmotic potential in salt stressed plants can be a result of inorganic ion (Na^+, Cl^- and K^+) and complete organic solute (soluble carbohydrates, amino acids, proline, betaines, etc.) accumulations (Hasegawa et al., 2000). Although the relationship between osmotic regulation and salt tolerance is not clear, there is evidence that the osmotic adjustment appears, at least partially, to be involved in the salt tolerance of certain plant genotypes (Neto et al., 2004). Plant species vary in how well they tolerate salt-affected soils. Some plants will tolerate high levels of salinity while others can tolerate little or no salinity. The relative growth of plants in the presence of salinity is termed their salt tolerance. A high salt level interferes with the germination of seeds. Salinity acts like drought on plants, preventing roots from performing their osmotic activity where water and nutrients move from an area of high concentration. Therefore, because of the salt levels in the soil, water and nutrients cannot move into the plant roots.

Although salinity stress mostly reduces the germination percentage and delays the onset of germination, its effects are modified by interactions with other environmental factors as temperature and light. Salinity can affect germination by affecting the osmotic component, which the ionic component, i.e., Na and Cl accumulation (Zivkovic et al., 2007).

Spartina ciliata seedling growth was more sensitive to salinity than seed germination, with significant reduction for salinities above 130mM NaCI. Although seedlings showed a significant reduction in growth at the highest salinity, the species tolerated salinities up to 130mM NaCl (Cordazzo, 1999).

The effects of salinity on seed germination and plant growth have been studied for more than a century (Darwin 1857). Seed germination and seedling establishment under various salinities have been investigated in many halophytes (Ungar 1962, 1974; Bazzaz 1973; Woodell 1985)

It is known that the effect of salts on plants leads to physiological drought. It can be concluded that salt reduces the water potential of soil solution, which prevents the supply of water by plants. They in the salty soils receiving large amounts of salt in root cells, and thus reduces the water potential, so it increases the absorption of water in physiological drought conditions.

Conclusion

Germination study reveals that in Vigna radiata, darkness have significant effect on the lengthening of shoot after germination and salinity have negative effect on germination of seeds.

Acknowledgement

The authors are grateful to the Principal, Mahatma Gandhi College and Head of the Department for providing the facilities for conducting the above work.

References

1. Bazzaz, F. A. 1973. Seed germination in relation to salt concentration in three populations of *Prosopis farcta*. Oecologia 13: 73-80.
2. Biljana Bojovic, Gorica Đelic, Marina Topuzovic and Milan Stankovic (2010). Effects of NaCl on seed germination in some species from families Brassicaceae and Solanaceae. Kragujevac J. Sci. 32:83-87.
3. Borthwick. H. A. (1957). Light effects on tree growth and seed germination. Ohio Journal of Science: Volume 57 (6):357-364.
4. César Vieira Cordazzo (1999). Effects of salinity on seed germination, seedling growth and survival of *Spartina ciliata* brong. Acta bot. bras. 13(3): 317-322.
5. Darwin, C. (1857). On the action of sea-water on the germination of seeds. Joumal of the Linnean Society (Botany)1: 130-140.
6. Hasegawa, P. M., Bresson, R. A., Zhu, J-K., Bohnert, H. J. (2000): Plant cellular and molecular responses to high salinity. Annu. Rev. Plant Physiol. Plant Mol. Biol., 51, 463-499.
7. Koning, R. E. (1994). Seeds and Seed Germination. Plant Physiology Information Website. http://plantphys.info/plant_biology/seedgerm.shtml.
8. Kumala Dewi and Parmi (2015). The effect of glucose and light quality on seed germination, vitamin E and Chlorophyll content of Green bean sprout (*Vigna radiata* (L.) Wilcz.) The 3rd International Conference on Biological Science 2013, KnE life Sciences. Volume 2:317.
9. Munns, R. (2002): Comparative physiology of salt and water stress. Plant Cell Environ, 28, 239-250.
10. Nawel Nasri, Issam Saidi, Rym Kaddour and Mokhtar Lachaal (2015). Effect of salinity on germination, seedling growth and acid phosphatise activity in Lettuce. American Journal of Plant Sciences, 6:57-63.
11. Neff, M. N., L. Sanderson, and D. Tedor (2009). Light-mediated germination in lettuce Seeds: Resurrection of a classic plant physiology lab exercise. American Biology Teacher 71(6): 367-370.
12. Neto, A.D., Prisco,J. T. and Enas-Filho, J. (2004): Effects of salt stress on plant growth, stomatal response and solute accumulation of different maize genotypes. Brazillian Journal of Plant Physiology, 16, 591-596.
13. Ungar, I. A. 1962. Influence of salinity on seed germination in succulent halophytes. Ecology 43: 763-764.
14. Washa B. Washa (2015). Potential of the Dark as a Factor affecting Seed Germination International Journal of Science and Technology. Volume 5 No.2, 28-36.
15. Woodell, S. R. J. 1985. Salinity and seed germination in coastal plants. Vegeta tio 61: 223-230.
16. Zivkovic S, Devic M, Filipovic B, Giba Z and Grubisic D. (2007): Effect of NaCl on seed germination in some Centaurium Hill. species (Gentianaceae). Arch. Biol. Sci., 59 (3), 227-231.