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Short Communication

EFFECT OF NaCl ON SEED GERMINATION IN FIVE LEGUME CROPS.

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ABSTRACT

The seeds of *Dolichos bilflorus* Roxb., *Lens esculenta* Moench., *Phaseolus aconitifolius* Jacq., *Phaseolus aureus* Roxb., and *Trigonella foenum graecum* Linn. were germinated under saline conditions at 2.5 to 300 mM levels of NaCl. The germination was studied / reported after every 24 h for five days. The emergence of radicle was considered as the criterion for seed germination.

It was observed that the germination remained unaffected in Moth bean (*P. aconitifolius*) and Mung (*P. aureus*) at all levels of salinity. On the other hand there was stimulation in germination in Horse gram (*D. biflorus*), Lentil (*L. esculenta*) and Fenugreek (*T. foenum graecum*) at lower salt regimes (up to 50 mM NaCl). However, it was inhibited due to higher levels of salt concentration in the medium. From the results it appears that fenugreek is salt sensitive while *Phaseolus* species are tolerant to saline conditions during germination. The horse gram and lentil seem to be moderately salt tolerant.

Keywords: Germination, Salinity, Dolichos bilflorus, Lens esculenta, Phaseolus aconitifolius, Phaseolus aureus, Trigonella foenum graecum

1. INTRODUCTION

Seed germination is one of the most important events in the life cycle of higher plants. When a viable seed is soaked, water is taken up, that initiates respiration, protein synthesis and other metabolic activities. Seed germination is the sum total of all the physiological processes occurring inside the seed which starts with the imbibitions of water and ends with emergence of embryonic root [1]. Seed germination is the emergence of radicle from seed coat. Germination is a dynamic process involving several biochemical pathways. The important environmental conditions required for germination including water, O_2, temperature, and sometimes some specific quality of light [2].

There is not always a positive correlation between salt tolerance at germination and during the later stages of growth. Some of the crop species are very tolerant to salts during later stages of growth are quite sensitive during germination and vice versa [3].

Numerous minor grain legumes are cultivated on smaller scales. The legumes have received less attention in spite of their high nutritive value and wide range of adaptability. In present investigation five minor grain legumes namely *Dolichos biflorus* Roxb., *Lens esculenta* Moench., *Phaseolus aureus* Roxb. and *Trigonella foenum graecum* Linn. have been studied.

Horse gram (*D. biflorus* Roxb.), is grown in wide range of soil except alkaline bands, and under low rain fall. It is extensively grown on about 2 million hectares in peninsular India with production of half a million tones feed and fodder for cattle and horses. Lentil (*L. esculenta*, Moench), is a cool season crop grown on about 0.9 million hectares area in India with production of 0.45 million tones. Unripe pods are used as a green vegetable.

Moth bean (*P. aconitifolius* Jacq.) – it is the draught resistant Kharif pulse and is largely grown either alone or subsidiary to millets or cotton. It is useful against wind erosion in sandy areas. Mature pods are consumed as green vegetable. The whole grain (23% protein) is used as pulse. In India about two million hectares land is under cultivation of this legume with a total production of 0. 3 million tonnes per year. Green gram (*P. aureus* Roxb.) – this pulse is grown as alone or mixed kharif crop. It is also cultivated in Rabi season as mixed cropping. It grows well on deep, well drained loams in the alluvial soils of peninsular and southern India. The grains are used as pulse. The straw and husk is used as fodder for cattle. It covers an area of about 2. 5 million hector with a production of about 0. 8 million tones. Fenugreek (*T. foenum graecum* Linn.) – it is rich in minerals and vitamin A and C. The leaves of this plant are used as green vegetable. The seeds are used in the spices and also have a medicinal value.

In the present investigation an attempt has been made to test the local cultivars of these legumes for their salt tolerance during germination.

2. MATERIAL AND METHODS

The seeds of *Dolichos biflorus* Roxb., *Lens esculenta* Moench., *Phaseolus aureus* Roxb., *P. aconitifolius* Jacq. and *Trigonella foenum graecum* Linn. were collected from local

market. The healthy seeds were selected and surface sterilized with 0.1% $HgCl_2$ solution for 2-3 minutes. The seeds were washed thoroughly with Distilled Water and germinated in sterilized petri-dishes on filter papers (Whatman No 1).The seeds were subjected to 2.5 to 300 mM concentrations of NaCl and distilled water. The filter paper was kept moist by adding the respective salt solutions. The germination was recorded at 24 h interval for 5 days. The radicle emergence was taken as the criterion for germination.

3. RESULTS AND DISCUSSION

The effects of different concentrations of NaCl on germination percentage of *Dolichos biflorus* Roxb., *Lens esculenta* Moench., *Phaseolus aconitifolius* Jacq., *Phaseolus aureus* Roxb. and *Trigonella foenum graecum* Linn. have been recorded in tables 1 to 5. It is evident that the germination % at 120 h at the salt regimes up to 50mM NaCl not affected. However the process was delayed as well as inhibited in *D.biflorus* and *L. esculenta* at the higher salt concentrations (i.e. 100mM and above). The germination percentage in moth bean (*P. aconitifolius*) and Mung (*P. aureus*) remain unaffected at the higher salinity levels.

Table 1: Effect of NaCl salinity on germination in *D. biflorus*

Treatment NaCl (mM)	Germination %				
	24 h	48 h	72 h	96 h	120 h
Control	73.0	78.0	91.5	96.0	97.0
2.5	71.5	87.5	96.0	97.5	97.5
5.0	63.0	83.5	83.5	90.0	90.0
10.0	72.5	80.0	94.5	96.5	96.5
25.0	67.0	71.5	85.0	94.0	94.0
50.0	54.0	72.5	82.0	91.0	91.0
100.0	18.0	49.0	49.5	60.0	60.0
200.0	09.5	28.0	33.0	40.0	40.0
300.0	-	-	-	-	-

Table 2: Effect of NaCl salinity on germination in *L. esculenta*

Treatment NaCl (mM)	Germination %				
	24 h	48 h	72 h	96 h	120 h
Control	36.0	86.0	94.5	95.0	96.5
2.5	33.0	76.5	94.0	97.5	98.0
5.0	36.5	69.5	82.0	94.0	96.5
10.0	28.5	77.5	92.5	97.0	98.0
25.0	24.5	55.0	77.0	88.5	92.0
50.0	18.0	32.5	63.0	85.0	88.0
100.0	19.0	34.5	46.5	68.5	80.5
200.0	04.0	14.0	17.0	17.0	17.0
300.0	02.0	07.0	08.0	08.0	09.0

Table 3: Effect of NaCl salinity on germination in *P. aconitifolius*

Treatment NaCl (mM)	Germination %				
	24 h	48 h	72 h	96 h	120 h
Control	90.0	94.0	96.0	97.5	97.5
2.5	83.0	88.0	90.0	94.5	92.5
5.0	88.5	91.5	93.0	94.0	94.0
10.0	88.0	90.0	91.5	93.0	93.0
25.0	86.0	89.0	92.5	94.5	94.5
50.0	82.0	83.5	87.5	91.5	91.5
100.0	78.5	84.5	84.5	84.5	85.5
200.0	68.5	79.0	80.0	84.5	94.5
300.0	75.0	77.0	78.0	81.5	81.5

Table 4: Effect of NaCl salinity on germination in *P. aureus*

Treatment NaCl (mM)	Germination %				
	24 h	48 h	72 h	96 h	120 h
Control	95.5	99.5	99.5	100.0	100.0
2.5	98.5	99.5	100.0	100.0	100.0
5.0	97.5	99.0	100.0	100.0	100.0
10.0	97.0	99.5	100.0	100.0	100.0
25.0	97.5	100.0	100.0	100.0	100.0
50.0	94.0	97.0	99.5	100.0	100.0
100.0	85.5	93.5	97.0	97.0	97.5
200.0	88.0	92.0	96.0	96.5	96.5
300.0	76.0	89.5	96.0	96.0	96.0

Table 5: Effect of NaCl salinity on germination in *T. foenum graecum*

Treatment NaCl (mM)	Germination %				
	24 h	48 h	72 h	96 h	120 h
Control	70.0	86.0	98.0	98.0	98.0
2.5	72.0	92.5	96.5	98.0	98.0
5.0	73.5	92.5	97.5	98.0	98.0
10.0	59.0	83.5	92.5	95.0	95.0
25.0	63.0	80.5	96.0	97.5	97.5
50.0	63.0	89.5	94.0	96.5	96.5
100.0	32.0	43.0	62.5	73.5	73.5
200.0	00.0	00.0	00.0	08.0	08.0
300.0	00.0	00.0	00.0	00.0	00.0

Germination in mung is independent of the type of salinity. However salt delayed germination and also affects seedling growth [4]. The effect of NaCl, Na_2SO_4, $MgCl_2$, and $CaCl_2$ on seed germination of *P. antidotale* has been studied and found the decrease in germination percentage with increase in salt concentration and it varies with salt used and the specific ions involved [5]. The germination in *P. aureus* is delayed and

decreased with increasing salt concentration. Present observations also confirm these findings [6]. There is an increase in germination percentage in *P. aconitifolius* at low salt level concentrations. However salinity concentrations above 100 mM up to 300 mM NaCl inhibit the germination [7]. The effect of salinity on germination of *P. typhoides* seeds is noted however the germination is not affected by salt, but the process is delayed, accumulation of proline [8]. Similar delay due to salinity was found in *Crotalria juncea* [9].

The germination percentage in 2.5 and 5 mM salt conditions was increased above control within 24 and 48 h of germination in fenugreek (*T. foenum graecum*) and decreased with further increase in salt concentrations. The germination percentage falls down from about 90% in 50 mM NaCl to about 73 % in 100 mM salt treatment in this species. The higher salt concentrations (200 and 300 mM) inhibited the germination in the species.

Six soyabean cultivars for salt tolerance during germination were studied and reported that the variations in seed germination and emergence may be due to inherited differences as well as the differences in chloride ion concentration [10]. Decrease in germination percentage of *Hordeum vulgare* with increase in salinity level [11]. Rate of germination in barley is retarded by external NaCl but germination percentage is apparently independent of NaCl. It was found that salinity completely inhibits germination beyond 150 mM NaCl in *C.juncea* [12]. Salinity inhibited the germination percentage and delayed the process in Chickpea [13].

The effect of NaCl salinity on germination percentage and the seedling growth in number of ground nut varieties have been studied. The germination percentage in some varieties of ground nut is considerably influenced by salt, in some varieties it is not affected by both lower as well as higher salt concentrations while in some salinity enhances germination and it is inhibited only at the highest salinity level [14].

4. CONCLUSION

Present investigation showed that among the studied legumes fenugreek is highly sensitive, *L esculenta* and *D. biflorus* are intermediate and *P. aureus* and *P. aconitifolius* seem to be most tolerant to salinity during germination. The salt stress delayed, reduced germination percentage.

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6. REFERENCES

1. Evenari M.. *Israeal Proc. Int. Seed. Test Ass,*1961; **26**:597-658.
2. Lang A. *Encyl. Plant Physiol.*, 1965; **XV/2:**848-893.
3. Berstein L., Hayward HE. *Annu. Rev. Plant Physiol*,1958; **9**:25-46.
4. Sheoran IS, Garg OP. *Physiolo. Plant*, 1979; **46**:147-150.
5. El – Mansy HL, Bond CA. *Annu. Res. Rep. Kuwait Inst. Sci. Res*, 1978; 26-34.
6. More SD, Ghonsikar CP. *J. Maharashtra Agric. Univ*, 1982; **7**(3): 245-246.
7. Khot SB. Physiology of Germination Under saline Conditions. M. Phil. Thesis submitted to Shivaji University, Kolhapur (India), 1986.
8. Reddy MP, Vora AB. *Indian J. Plant physiol*, 1985; **28**(2):190-195.
9. Khot SB. Physiology of Germination Under saline Conditions. M. Phil. Thesis submitted to Shivaji University, Kolhapur (India), 1986.
10. Abel GH, Mackenzie AJ. *Crop Sci*, 1964; **4:**151-161.
11. El-Shourbagy, Nabih M, Abdulla OA. *Phyton (Horn)*, 1979; **17**(1/2):79-86.
12. Sung, JM. *J. Agric. Assoc. China New SER*, O, 1981; **113**:41-47.
13. Murumkar, VV. Physiological studies in chickpea (*Cicer arietinum* L.). Ph. D. Thesis submitted to Shivaji Univeristy, Kolhapur (India), 1986.
14. Karadge, BA, Chavan, PD. *Biovigyanam,* 1980; **7**(2):137-144.