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Germination Behaviour and Electrolytes Leakage of Seeds of some Plants of Cholistan Desert

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Abstract

This work was conducted (i) to measure the electrical conductance of dry and imbibing seeds, (ii) to monitor the percentage germination and spread of germination of these species at varying temperature conditions and (iii) to find the optimal germination conditions so that some biochemical and biomolecular studies could be carried out in near future. Seeds of different plant species of Cholistan desert such as *Capparis decidua*, *Salvadora oleiodes* and *Prosopis cineraria* were allowed to germinate at various temperature regimes and their percent age germination was monitored. Results show that optimal germination temperatures for *C. decidua* is 20°C (90% germination in 8 days) and for *P. cineraria* (65% in 10 days) and *S. oleiodes* (85% in 4 days) is 30°C. Imbibition of P. cineraria in sand at 25°C has been effective to get 80 percent seeds germinated. Electrical conductance (μS/cm/10 seeds) measured during early hours/days of imbibition has been correlated with the increase in fresh weights of imbibing seeds, though there is decrease in the rate of electrolytes leakage (μS/cm/hour/10 seeds) with increase in imbibitional time. Work is in progress on the biochemical aspects of these early hours/days of seed germination.

Introduction

Cholistan is a vast sandy desert of 2.6 million hectares with little humidity and annual irregular rainfall of 125-250 mm. It hosts a large number of perennial, annual, biannual, herbs, shrubs, trees and grasses of both economic and medicinal importance. The prominent tree species include *Prosopis*, *Tamarix*, *Salvadora*, *Acacia* and *Zizyphus* (Rao *et al*., 1989). These trees have medicinal importance as well as are eaten by camels and livestock; fruit may be eaten by humans. These trees are also important in wood industry. *Capparis decidua* (locally called *dela* or *karir*) is a leafless medicinal shrub which may be effectively used to kill worms and is recommended for gouty and rheumatic conditions. Its unripened fruit are used to make delicious pickles. *Prosopis cineraria* (locally called *jandi*) grows on sandy loamy soils and provides shade for the livestock. Its leaves are used by livestock and fruit as vegetables. Its juice is used as tonic for local peoples. *Salvadora oleiodes* (locally called *jhal* or *peelun*) is an evergreen tree of saline soils. Its fruit which becomes white or red on maturation, is beneficial for enlarged spleen, rheumatism, tumors and lithiesis. Its leaves are good food for camels (Kirtikar and Basu, 1998).

The characteristic feature of the seeds of these trees and shrub is that they possess hard seed testa which often is associated with dormancy problems. Few papers have been published on some biochemical, tissue culture, physiological and ecological aspects of *C. decidua*, *P. cineraria* and *S. oleiodes* (Sharma, 1968; Chopra *et al*., 1971; Prasad and Vankob, 1979; Ifzal *et al*., 1982; Kackar *et al*., 1983; Singh, 1985; Kokab *et al*., 1986; Valenti *et al*., 1992; Shekhawat *et al*., 1993; Nandwani and Ramawat, 1993). Little work has been done on the germination performance of these xerophytic species at different temperature regimes. The present paper describes some of the aspects of seed imbibition and germination.

Materials and Methods

Seeds were collected directly from the plants from Lai Suhanra National Park, Bahawalpur, in May-July, 1996 and stored in sealed plastic jars at room temperature until used. For germination tests, seeds were placed on double-layered filter papers moistened with distilled water in glass petri dishes at the specified temperatures until protrusion of radicle marked the seed to be 'germinated'. For sand experiments, sterile sand was used. Moisture contents were determined by standard method. Kjeldhal method was used to determine total nitrogen content and proteinous nitrogen in the dry seeds. Rate of imbibition and electrical conductivity (E.C.) were measured at 25°C. 10 dry seeds were soaked in 10 ml of double distilled water (of E.C. < 10μS/cm) for the given time with occasional shaking. E.C. was measured by pre-calibrated conductivity meter (Milwaukee-CON 1000).

Results and Discussion

Table 1 shows some of the selected physico-chemical parameters of dry seeds. Weight of dry seeds varies in the range 24 to 34 mg/seed; *P. cineraria* seeds are heavier (34 mg/seed) and also possess higher moisture content (8.5%). Nitrogen and protein contents are the highest in *C. decidua* and the lowest in *S. oleiodes* dry seeds. The electrical conductivity of dry seeds of *S. oleiodes* seeds was 5 times higher than the other two species whilst all other studied parameters had the lowest values among the three species. These results are closely associated with other findings in India (Gupta and Mathur, 1974), though seasonal variations in the chemical composition have also been seen (Singh, 1985).

Table 1: Some physico-chemical parameters of selected plant seeds of Cholisten desert (n = 3). Error is +S.E.M

Species	Weight/seed (mg)	Moisture content (%)	E.C. (µS/cm/10 seeds)	Nitrogen content (mg/g wt.)	Protein content (mg/g wt.)
C. decidua	25.36±3.1	7.30	57.9±11	134.4±8.8	840.0±11
P. cineratia	34.28±3.7	8.50	51.5±9	75.6±4.9	472.5±73
S. oleiodes	24.28±2.3	6.05	263.0±21	33.3±2.1	207.8±55

Table 2: Spread of germination of seeds at varying temperature regimes

Species	Temperature (°C)	Germination (%age mean)	Spread of germination (Days)	
C. decidua	20	90	8-15	(8)
	25	60	10-13	(4)
	30	10	12	(1)
P. cineratia	20	40	7-8	(2)
	25	50	4-8	(5)
	25 (sand)	80	4-6	(3)
	30	65	2-12	(10)
	35	55	1-9	(9)
S. oleiodes	20	10	3	(1)
	25	80	2-3	(2)
	25 (sand)	65	4-6	(3)
	30	85	2-5	(4)
	35	40	2-4	(3)

Figures in parenthesis () represent total number of days during which all seeds germinated (n = 3)

Table 3: Rate of electrolytes leakage (µS/cm/hour/10 seeds) during imbibition

Time (hour)	*C. decidua*	*P. cineraria*	*S. oleiodes*
0.5	274.40	131.60	1059.20
1	146.70	77.70	573.60
2	75.00	42.05	314.75
4	42.25	23.40	195.75
6	31.33	17.05	133.08
24	9.46	7.80	39.37
48	5.88	6.96	19.83
72	4.30	7.25	13.47
Mean	73.67	44.39	293.63
S.E.M.	±33.23	±15.69	±128.0

Figure 1-3 exhibit correlation between the changes in fresh weight and E.C. during the initial hours/days of imbibition. It is apparent from these figures that there is a sharp increase in E.C. during the first 1-2 hours of rapid intake of water. The increase in electrolytes is a general mechanism during imbibition and K^+ or amino acids and other electrolytes come out of the membrane and cell wall due to cellular injuries and other physiological factors (Simon and Harun, 1972). However, the rate of electrolytes leakage (µS/cm/hour/10 seeds) was decreased as the time to imbibition increased (Table 3). The big drop in the rate was during the first 2-4 hours of imbibition. Our

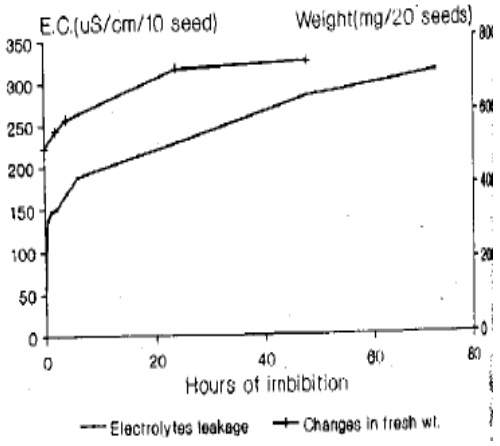

Fig.1: Changes in fresh weight and E.C. during imbibiion of *Capparis decidua*

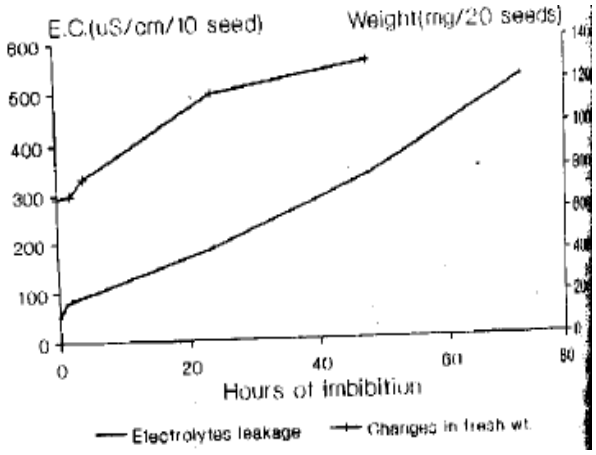

Fig. 2: Changes in fresh weight and E.C. during imbibiion of *Prosopis cineraria*

unpublished results show that K^+ is the predominaut species in the imbibitional leachate.

Results show that temperature has a major effect on percentage seed germination as well as on the spread

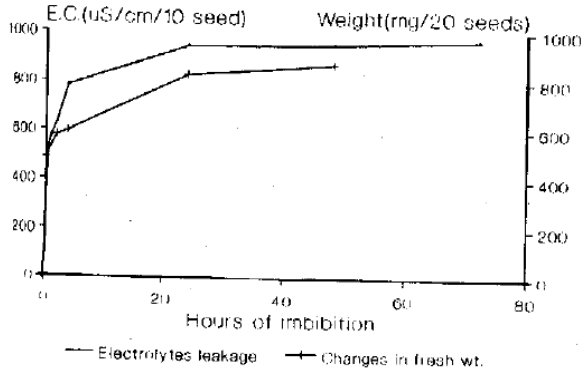

Fig. 3: Changes in fresh weight and E.C. during imbibition of *Salvadora oleiodes*.

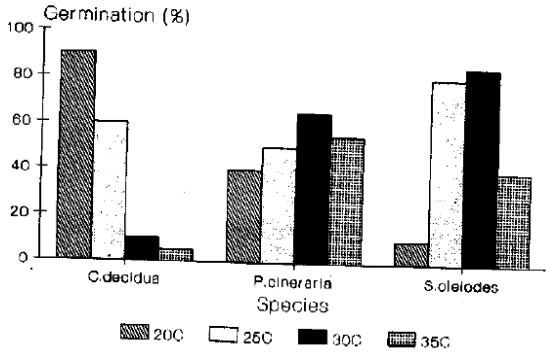

Fig. 4: Effect of temperature on the germination of *C. decidua*, *P. cineraria* & *S. oleiodes*

germination (Table 2, Figure 4). Maximum germination of 90 per cent has been obtained for *C. decidua* at 20°C; iaximal germination for *P. cineraria* and *S. oleiodes* has been seen at 30°C; seed germination of 65 percent was lotained for *P. cineraria* and 85 percent for *S. oleiodes*. Table 2 demonstrates the spread of germination of seeds at varing temperature regimes. Spread of germination for *C. fecidua* decreases from 8 days to 1 day as the germination temperature increases from 20-30°C, associated with increase in the total number of seeds germinated from 90°C 10 percent, respectively. Maximum germination of 80 percent for *P. cineraria* has been observed at 25°C in and. At 30°C, 65 percent seed germination has been een in 10 days. For *S. oleiodes*, 30°C seems optimal germination temperature. 80 percent germination occurs at 25°C on 3rd day of imbibition and 85 per cent on 5th ay of imbibition at 30°C. At 35°C, a reduction of 45 percent seed germination has been seen and 40 percent seeds have been germinated on the 4th day of germination.

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References

Chopra, G.R., A.C. Jain and T.R. Seshadri, 1971. Constitution of the new thiourea derivative from the seeds of *Salvadora oleoides*. Curr. Sci., 40: 267-267.

Gupta, M.L. and C.S. Mathur, 1974. Studies on the seasonal variation in the chemical composition of Khejri (*Prosopis spicigera* Linn.). Indian Forester, 100: 269-273.

Ifzal, S.M., R. Ali and Z.H. Zaidi, 1982. Protein and carbohydrate contents of *Salvadora oleoids*. J. Chem. Soc. Pak. 4: 211-214.

Kackar, N.L., K.R. Solanki and S.K. Jindai, 1983. Variation in food and seed characteristics of *P. cineraria* (L.) Macbride in Thar desert. Ind. J. Foret., 9: 113-115.

Kirtikar, K.R. and B.D. Basu, 1998. Indian Medicinal Plants. Vol. 2, International Book Distributors, Deradun, India, pp: 839-892.

Kokab, T., R. Yasmin, F.H. Nasim, M.L. Mirza, A. Majeed, M. Sharif and M. Ali, 1986. The amino acids, ascorbic acid, vitamin A, minerals and enzyme contents of *C. decidua*. J. Sci. Res., 15: 15-25.

Nandwani, D. and K.G. Ramawat, 1993. *In vitro* plantlets formation through juvenile and mature explants in *Prosopis cineraria*. Indian J. Exp. Biol., 31: 156-160.

Prasad, R.B.N. and R.S. Vankob, 1979. Phospholipid composition of *S. oleiodes* seeds. J. Oil Technol. Assoc. India, 11: 35-38.

Rao, A.R., M. Arshad and M. Shafiq, 1989. Perennial Grass Germplasm of Cholistan Desert and its Phytosociology. Cholistan Institute of Desert Studies, Islamia University, Bahawalpur, Pakistan, pp: 84.

Sharma, B.M., 1968. Chemical analysis of some desert trees. Proceedings of the Symposium on Recent Advances in Tropical Ecology, January 1968, Varanasi, India, pp: 1248-1251.

Shekhawat, N.S., T.S. Rathore, R.P. Singh, N.S. Deora and S.R. Rao, 1993. Factors affecting *in vitro* clonal propagation of *Prosopis cineraria*. Plant Growth Reg., 12: 273-280.

Simon, E.W. and R.M.R. Harun, 1972. Leakage during seed imbibition. J. Exp. Bot., 23: 1076-1085.

Singh, R.V., 1985. Fodder Trees of India. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.

Valenti, G.S., L. Melone, O. Orsi and F. Riveros, 1992. Anatomical changes in *Prosopis cineraria* (L.) Druce seedlings growing at different levels of NaCl salinity. Ann. Bot., 70: 399-404.