Germination of *Kochia americana* in Relation to Salinity[1]

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Highlight

***Kochia americana*, desert molly, is a forage species of the western U.S.A. which grows on highly saline soils. This study, which shows that desert molly can germinate at much higher salinities than other halophytic forage plants, encourages further work on the species in hope that it can be used in revegetation of depleted salt desert sites.**

Kochia americana S. Wats., desert or gray molly, is a perennial half-shrub occupying saline-alkali areas of the deserts and semi-deserts in the western United States. Several studies have indicated that it grows on saline soils unsuitable for most other forage species. These soils are characterized by very high salinity below the first foot of the profile (Kearney et al., 1914; Cook, 1961). The value of *K. americana* as a forage plant has been disputed, but Kearney et al. (1960), Hutchings (1954) and Sampson and Jesperson (1963) class it as fair forage for sheep. Considering the apparent great losses in abundance of this plant, and its high salinity tolerance, it is surprising that no known attempts have been made to propagate it.

Materials and Methods

The study employed a randomized block design with two replications, six sodium chloride levels (0.0, 1.0, 2.0, 4.0, 6.0 and 8.0% solutions in 1.5% agar), two seed sources (pure and mixed stands) and three dates of collection (9/29/67, 11/1/67, and 11/25/67). Each replication consisted of 60 seeds from each of 10 plants from each seed source.

The two seed sources were about 20 miles southwest of Snowville in Curlew Valley, Utah. The "pure" stand is a remnant population of *Kochia* preserved in a livestock-, rodent-, and rabbit-proof exclosure. This community occurs in a big sagebrush–gray molly mosaic, as described by Cook (1961). The "mixed" stand seed was taken from plants occurring on a former beach line of pluvial Lake Bonneville where the community dominants are *Atriplex confertifolia, Eurotia lanata, Artemisia spinescens, Poa nevadensis* and *Sitanion hystrix*. Both stands occur at an elevation of about 4,520 ft above mean sea level.

The seed was stored at room temperature until January, 1968 when germination tests commenced. Prior to germination, the seeds were separated from the plants and scarified by rubbing on a soil sieve. The seeds were germinated on 1.5% agar plates in darkness according to the method developed by Workman and West (1967) for *Eurotia lanata*. A temperature regime of 65 F for 10 hours alternating to 85 F for 14 hours was used.

Percentage germination was recorded after 7 days, and the germination percentages converted to arcsins for analysis of variance (Steel and Torrie, 1960). The data were also expressed in percentage of germination reduction per treatment compared with the control.

Results and Discussion

No significant[2] difference in germination percentage was found between seeds from the pure and mixed stands, but the date of collection was highly significant.[3] The seed source by date interaction was also highly significant. Table 1 shows that seeds from the pure stand germinated best when collected on September 29 and that percentage germination decreased progressively after that date. However, seeds from the mixed stand germinated least when collected on September 29, and best results were obtained with seeds collected on November 1.

Variation between salinity levels was highly significant for seeds from all sources and dates of collection. The percentage of germination decreased as the sodium chloride increased. The results show that *K. americana* is capable of germinating under high salinity. A few seeds germinated on 10% sodium chloride effected agar in an unreplicated test. Few halophytes are able to tolerate such high salinity during germination (Chapman, 1960).

The source by salinity interaction was also highly significant. The seeds from the pure stand germinated in greater numbers than those from the mixed stand on 0% agar, but the seeds from the mixed stand were more tolerant of salinity than those from the pure stand. There was no significant interaction between salinity and date of collection.

Expression of the germination percentages in the six salt treatments as a percentage of the control (Table 2) gave somewhat different results. In this case, there was a highly significant difference in percentage germination between the seeds from the pure and mixed stands. Collection date and salinity levels also influenced germina-

Table 1. Germination percentages of seed from two localities collected in 1967 at three dates in response to six levels of sodium chloride, Curlew Valley, Utah.

NaCl	Pure stand			Mixed stand		
(%)	9/29	11/1	11/25	9/29	11/1	11/25
0.0	61[a]	38	38	22	44	36
1.0	28	23	18	14	35	31
2.0	28	23	17	9	20	21
4.0	13	14	8	2	21	9
6.0	9	6	6	4	10	9
8.0	3	4	1	5	6	8
10.0	4[b]	0	0	0	4	2

[a] Each value represents the mean of two tests of 50 seeds each.
[b] One sample of 50 seeds only.

Table 2. Germination percentages of seeds from two localities at Curlew Valley, Utah, collected in 1967 at three dates in response to six levels of sodium chloride expressed as percentage of distilled water control.[a]

NaCl	Pure stand			Mixed stand		
(%)	9/29	11/1	11/25	9/29	11/1	11/25
1.0	55[b]	40	53	37	21	20
2.0	55	40	57	60	55	42
4.0	79	63	79	91	53	75
6.0	86	84	84	81	77	75
8.0	95	90	98	82	86	77

[a] $\text{Value} = \dfrac{\left(\begin{array}{c}\text{control germination} \\ - \text{ test germination}\end{array}\right)}{\text{control germination}} \cdot 100$

[b] Each value represents the mean of two tests of 50 seeds each.

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[2] Statistically significant at the 5% level.

[3] Statistically significant at the 1% level.

tion significantly, but no other measured variable had a significant effect.

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