

INHIBITION OF GERMINATION AND SEEDLING DEVELOPMENT OF *ATRIPLEX CANESCENS*

F. M. R. AL-CHARCHAFCHI AND M. A. CLOR

Agriculture and Water Resources Research Centre, Scientific Research Council,
Jadiriya, P. O. Box 2441, Baghdad, Iraq

ABSTRACT

Germination of *Atriplex canescens* seeds without bracts was reduced from 100% to about 80-85% when removed bracts were placed in vicinity. Seeding growth was arrested and the root tips of very young seedlings damaged in the presence of dry bracts. Water extract of the bracts had similar effects.

INTRODUCTION

The importance of the fourwing saltbush, *Atriplex canescens* (Pursh) Nutt, and some other atriplex shrubs as forage crops in many arid and semi-arid regions, has been emphasized (Clark, 1980; Clor and Al-Charchafchi, 1985; Franolet and Le Houerou, 1971; Malcolm and Clark, 1971, and Trumble, 1932). It was indicated that the bracts surrounding the seed prevented germination in the laboratory tests even when the seeds were washed in water for 24 h. However, when bracts were removed, full germination was obtained. When, on the other hand, naked seeds were mixed with their removed bracts in the same petri dish, germination was decreased by about 20%. Nord and Von Atta (1960) indicated that seed dormancy in *Atriplex canescens* was due to the presence of saponin. Beadle (1952), on the other hand, believed that germination inhibition was caused by chloride contained in the bracts, while Koller (1957) indicated that germination was inhibited by an unidentified water soluble substance in the bracts. The present work was an attempt to pursue further the study of the inhibitory effects of the seed bracts of the fourwing saltbush.

MATERIAL AND METHODS

The one year old seeds were germinated in 9 cm petri dishes, each lined with a layer of filter-paper and moistened with 10 ml of distilled water. In each treatment 25 seeds per dish were replicated four times and kept at 20°C in an incubator under continuous illumination. The average seedling length was calculated from a measure of randomly selected 10 seedlings.

Naked seeds were germinated regularly and three groups of ten seedlings each were selected to represent the following stages of development :

- (1) Radicle length 1-2 mm (about one day old),
- (2) Radicle length 2.5-3.5 mm (about two days old),
- (3) Radicle length 4-5 mm (about three days old).

Each group was placed in a petri dish containing 10 ml of distilled water and the dry bracts removed from 25 fruits, were added to each dish and effect on seedling growth was studied for six days.

Total water extraction for the chemical inhibitors was done as described by Rice (1964). Briefly, 150 g of dry bracts, removed from the fruits of fourwing saltbush, were boiled with one of DW for five minutes, then homogenized in a waring blender for 15 minutes. After filtration under reduced pressure, the filterate was centrifuged for 30 minutes. The volume of the filterate was then made to one litre representing the highest concentration from which the gradient concentrations representing 40, 60, 80, 100, 120 and 150 g/l were prepared.

RESULTS AND DISCUSSION

Naked seeds togetherwith bracts removed away, were placed in the same petri dishes. Germination and seedling lengths were noted on the 12th day (Table 1). Effects of inhibitor present in the bracts was noticeable on germination and seedling length of seeds placed in their vicinity.

Table 1. Effect of the inhibitor from the bracts on germination and seedling development (\pm SEM)

Parameter	Intact seeds	Naked seeds	Seeds in vicinity of the bracts removed
Germination(%)	0	100	82 \pm 0.35
Total seedling Length (mm)	0	56.7 \pm 0.32	7.4 \pm 0.10

It is considered that the inhibitor in the bracts of intact seeds was solubilized and entered the seeds to inhibit germination and drastically retard the seedling growth.

Results of the effect of dry bracts on growth of very young seedlings of *A. canescens* are given in Table 2.

Table 2. Effect of inhibitor diffused from seed bracts on the av seedling length (mm) of 1, 2 and 3-day radicles of *Atriplex canescens*

Day(s) after treatment	Control (1-day old radicle)	1-day old radicle (1-2mm)	2-day old radicle (2.5-3.5 mm)	3-day old radicle (4-5 mm)
1	8 \pm 0.35	4 \pm 0.32	5 \pm 0.32	8 \pm 0.36
2	15 \pm 0.45	7 \pm 0.30	5 \pm 0.32	8 \pm 0.36
3	20 \pm 0.39	8 \pm 0.31	5 \pm 0.32	8 \pm 0.36
4	28 \pm 0.46	8 \pm 0.31	5 \pm 0.32	8 \pm 0.36
5	33 \pm 0.49	8 \pm 0.31	5 \pm 0.32	8 \pm 0.36
6	39 \pm 0.47	10 \pm 0.45	5 \pm 0.32	8 \pm 0.36

It is evident that the inhibitor, which diffused out of the bracts, almost completely arrested seedling development at all stages.

Effect of water extract of bracts on germination and seedling development

Germination of naked seeds was tested by adding 5 ml of the water extract of the bracts from each concentration (material and methods) to each of four dishes per treatment. Each dish, as usual, contained 25 naked seeds and 10 ml of distilled water, except the control which contained 15 ml of distilled water per dish. The results are shown in Table 3.

Table 3. Effect of different concentrations of water extract of the bracts (g/l) on germination (%) and seedling length on 12th day of *Atriplex canescens*

Day after start of germination	Concentration of bracts (g/l)						
	0	40	60	80	100	120	150
	Germination % (\pm SE)						
2	68 \pm 0.79	52 \pm 0.79	40 \pm 0.79	24 \pm 0.71	22 \pm 0.80	20 \pm 0.80	10 \pm 0.70
4	98 \pm 0.35	80 \pm 0.71	74 \pm 0.80	50 \pm 1.10	50 \pm 0.70	48 \pm 0.70	38 \pm 0.80
6	100	84 \pm 0.80	74	56 \pm 0.35	60 \pm 0.71	52 \pm 0.41	40 \pm 0.80
8	100	84	76 \pm 0.80	66 \pm 0.61	64 \pm 0.50	62 \pm 0.61	40
10	100	84	76	66	64	62	40
12	100	84	76	66	64	62	40
	Total seedling length (mm)						
	68 \pm 0.87	12.4 \pm 0.56	11.5 \pm 0.30	8.0 \pm 0.40	4.6 \pm 0.13	4.0 \pm 0.30	1.0 \pm 0.13

It is seen that the inhibitory effect on germination of the water extract increases with increased concentration, but there occurred a drastic inhibition of the seedling development at all concentrations. The apical growth specially at the root tips is evidently very sensitive to the inhibitor (s) contained in the seed bracts.

The bracts surrounding the seeds of *Atriplex canescens* contain a water soluble inhibitor which diffused out upon the availability of enough moisture. The widespread presence of germination inhibitors in the seeds of many desert plants has adaptive significance. It is assumed, therefore, that in nature certain amount of sufficient rain is essential for successful germination and that sufficient rain leaches down the inhibitors. However, if the moisture is not enough, the solubilized inhibitor enters the seed and germination is inhibited. Thus such inhibitors act in a way as biological rain-gauges ensuring their successful survival in xeric climates.

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