Annals of Arid Zone 25 (2) : 97-104, 1986

SEED CHARACTERISTICS AND GERMINATION OF ARTEMISIA SCOPARIA

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ABSTRACT

Seeds of *Artemisia scoparia* become enveloped by a transparent gelatinous substance on contact with water. This envolope evidently helps in supplying moisture to the germinating embryo when water becomes unavailable. Fresh seeds collected in winter exhibit a very low percentage of germination which, however, increases with time to a maximum of about 95% after one year. At room temperature seeds retain their high germinability for another year but the seeds stored in the refrigerator maintain such high germinability for at least five years. The germination is photophilic as very little germination occurs in the dark regardless of storage conditions or germination temperature. High germination percentage is obtained in continuous light and in complete darkness interrupted for about half an hour by normal laboratory light.

INTRODUCTION

Artemisia scoparia Waldstetkit (Compositae) is a native shrub widely distributed in the arid regions of Iraq either as a loose community or in association with *Ephedra alata, Zilla spinosa*, or *Artemisia herba alba.* In the western deserts it is usually found in open silty clay depressions or along the wadi beds. In the lower Jezira area, it is dominant in slightly moister places such as silty depressions (Al-Ani *et al.*, 1970; Guest, 1966; Thalen and Al-Mufti, 1973). *A. scoparia* is moderately grazed by sheep, especially when green and when the other more palatable species are not available. It has a relatively good nutritive value i.e., 13.79% crude protein and 19.38% crude fibre (Thalen and Al-Mufti, 1973). The medicinal value of this plant has also been recognized (Al-Jeboory and Al-Umary, 1983).

Eco-physiological studies of the important native range shrubs, especially on seed germination, assumes significance in the improvement and reseeding of the deteriorated desert rangelands. No studies on seed characteristics or on seed germination of *A. scoparia* have been reported except by Al-Ani *et al.* (1971, 1975), who showed that seeds of *A. scoparia* germinated best at 10-15°C and required post-harvest ripening. The present paper reports further studies on seed characteristics and germination requirements of *Artemisia scoparia.*

METERIAL AND METHODS

To study the effects of time lapse and storage conditions on germination, a sample of the seeds of *A. scoparia* collected from the western desert of Iraq in mid-December 1980 was stored at room temperature (15-40°C). Another sample was kept in a refrigerator at 6°C. Germination tests were done in glass petri dishes (9 cm dia), lined with a layer of Whatman No. 30 filter paper, and moistened with 5 ml of distilled water. Twenty five seeds per dish were used, and each experimental unit consisted of four dishes. All tests were done in an incubator (Precision Model 806) at the temperatures of 10, 15, and 20°C either under continuous fluorescent illumination or complete darkness or intermittent light (complete darkness interrupted for a period of about 30 minutes by normal laboratory light during germination counts every other day). To keep the germinating seeds in complete darkness, the petri dishes were covered by black polythene until the ninth day when final counts were made. Morphological characterization of seeds and germinating embryo was done under a binocular microscope. Respiration was measured as oxygen uptake determined with Warburg apparatus by the method of Dixon (1952).

RESULTS AND DISCUSSION

Morphology of seed and seedling

Seed:

The seed of *Artemisia* is an achene, a dry indehiscent single seeded fruit (Fig. 1A). The true seed coat is not well developed and the pericarp has the characteristics of the seed coat (Clor *et al.*, 1974). The achenes are light brown in colour and narrowly obovate, with average length 1 mm and width 0.5 mm at the centre. One of the distinctive features of the achene is that a transparent gelatinous envelope develops around it within a few minutes of contact with water as also in the case of *Artemisia herba alba* (Clor *et al.*, 1974; Al-Charchafchi and Jawad, 1982). This mucilaginous envelope persists for several days, it may help the germinating seed to adhere to the soil particles and offers some protection to the delicate embryo against desiccation by water retention.

Young seedling

The embryo axis consists of a short hypocotyl bearing a pair of tiny cotyledons at one pole and a small dome-shaped radicle at the other (Fig. 1B and 1C). In germination, usually the radicle protrudes first (Fig. 1D), but in some cases the cotyledons emerge before the radicle (Fig. 1E). As the radicle develops into a primary root, extensive root hairs develop (Fig. 1F).

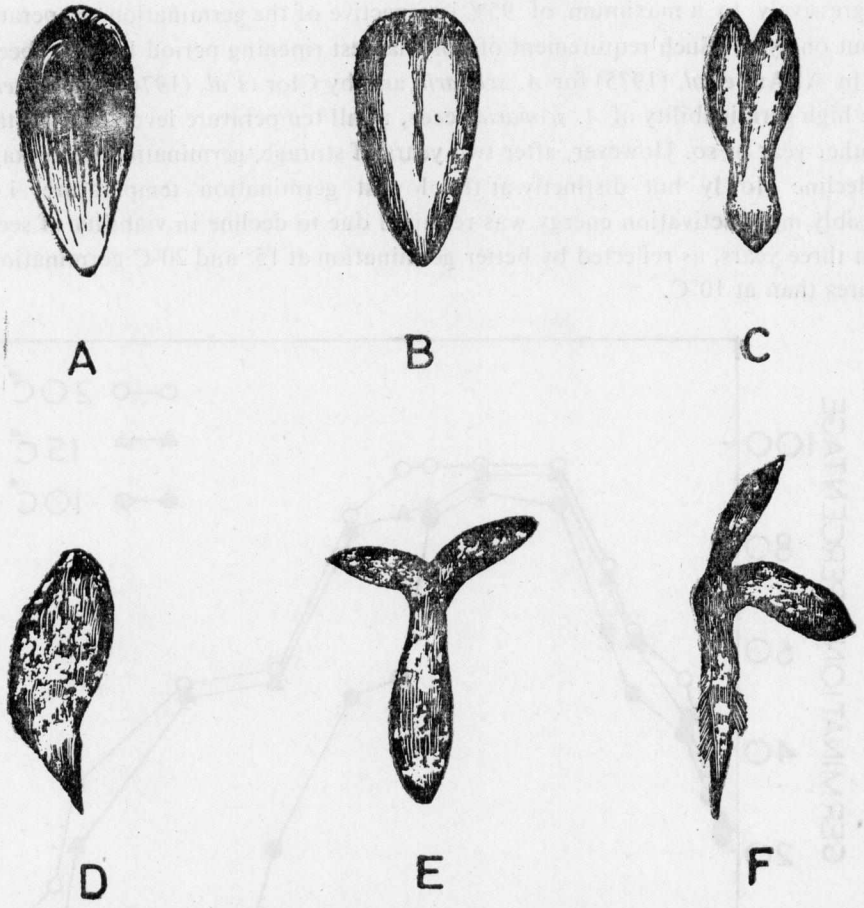

Fig. 1. Morphology of the germinating seed : A, the achene; B, longitudinal section through the achene; C, the embryo; D, the emerging radicle; E, the cotyledons emering first; F. the young seedling, note the dense root hairs.

Effects of temperature and seed age on germination

Seeds stored at room temperature were tested periodically for germination at the temperatures 10, 15, and 20°C, and under continuous illumination. The results are presented in Fig. 2. The fresh seeds collected in winter exhibited a low percentage of germination. However, in the following spring and summer, the germination improved progressively to a maximum of 95% irrespective of the germination temperature after about one year. Such requirement of post harvest ripening period has also been reported by Al-Ani *et al.* (1975) for *A. scoparia* and by Clor *et al.* (1974) for *A. herba alba.* The high germinability of *A. scoparia* seeds, at all temperature levels, is maintained for another year or so. However, after two years of storage, germination percentage began to decline slowly but distinctly at the lowest germination temperature, i.e., 10°C. Possibly more activation energy was required due to decline in viability of seeds older than three years, as reflected by better germination at 15° and 20°C germination temperatures than at 10°C.

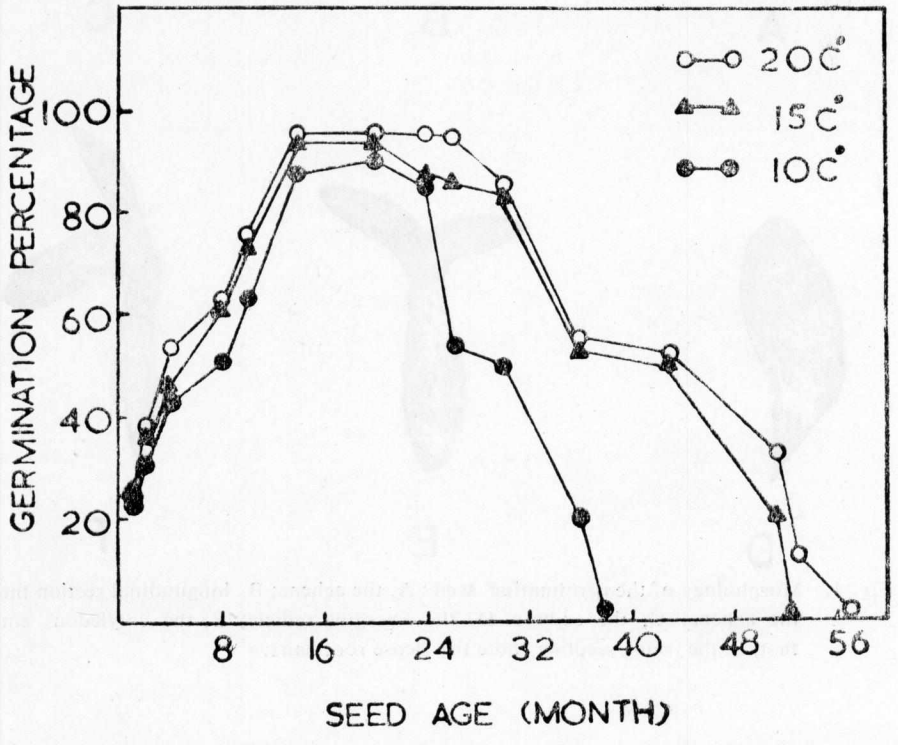

Fig. 2. Effect of seed age on germination of *Artemisia scoparia* at 3 different temperatures

Effects of light and seed age on germination

Germination of *A. scoparia* is highly responsive to light and very little germination takes place in complete darkness (Fig. 3), regardless of storage conditions. However, a remarkable increase in germination percentage occurred under continuous illumination and a distinct increase occurred also under intermittent light. The level of increase in germination percentage by the influenence of light began to decline after three years of storage at room temperature. On the other hand, seeds stored in the refrigerator retained high germinability for upto five years (end of the experiment).

The role of the mucilaginous cover

About one year old seeds of *A. scoparia* were enclosed within a fine piece of cheese cloth and suspended in distilled water for two days; a jelly-like mass of mucilaginous substance developed and remained enveloped around seeds. The cheese cloth, alongwith its contents, was then taken out of the water, suspended in an empty beaker and the beaker was covered with a watch glass. Within a day or two, a good many number of seeds germinated and developed into vigorous seedlings; healthy roots growing through the cheese cloth developed dense root hairs. These seedlings remained healthy and alive for about a week until the gelatinous material completely dried out. This is evidently an effective mechanism for absorption and retention of moisture which helps the germinating seeds under the conditions of limited moisture.

Effects of age and light on respiration

An attempt was made to measure respiration as oxygen uptake in fresh (one month old) and older seeds (14 months old), under both continuous light and complete darkness at 20°C. All seeds were kept under room temperature conditions. The results are given in Table 1.

Table 1. Oxygen uptake (µl/100 seeds) by germinating seeds of different age; CL = continuous light, CD = complete darkness

Hour	1 month old seeds		14 months old seeds	
	CL	CD	CL	CD
1.	8.10	5.31	10.99	8.36
2.	9.90	6.93	22.02	13.98
3.	21.10	14.64	30.24	20.90
4.	27.50	18.91	45.20	30.32
	Germination percentage			
	24.0	3.0	96.0	14.0

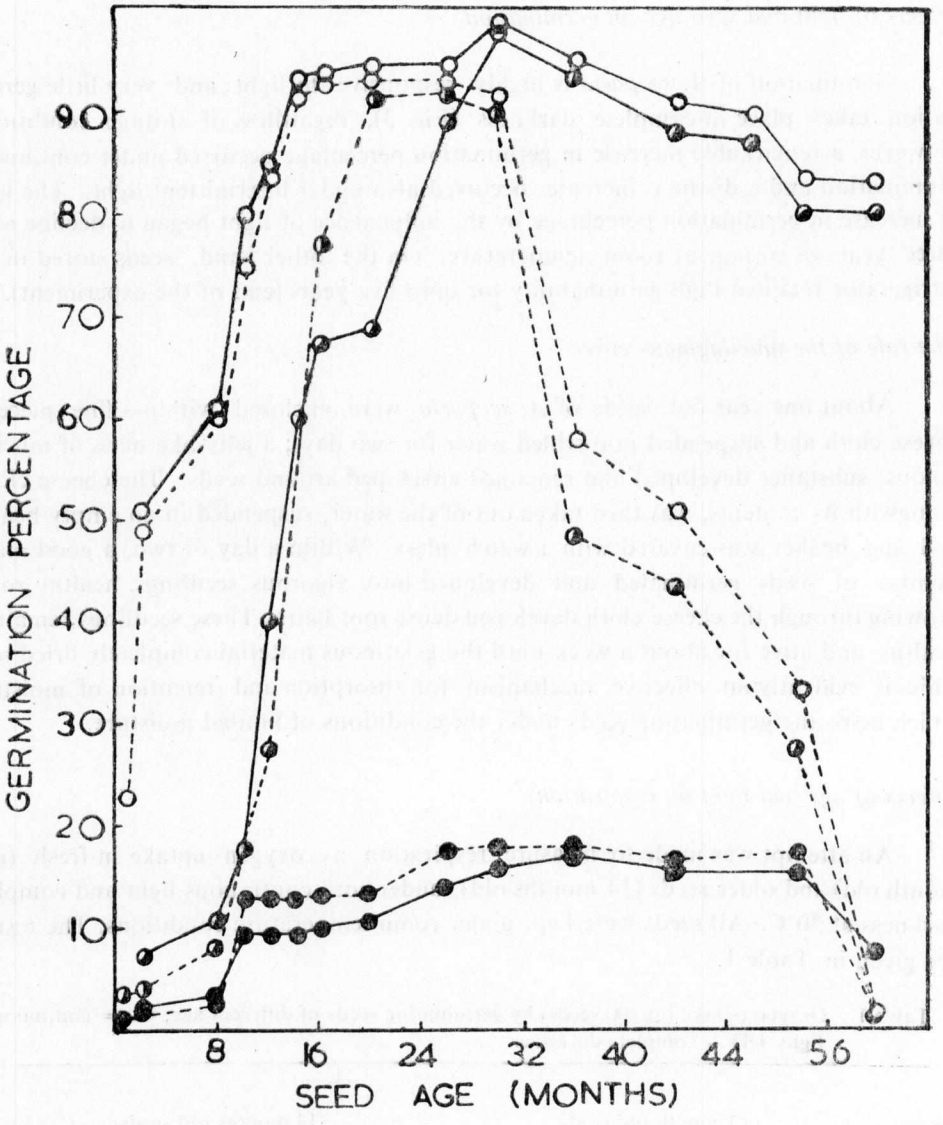

Fig. 3. Germination of *Artemisia scoparia* seeds of different age under continuous illumination, intermittent light and complete darkness.

As the seeds become older, respiration is increased significantly under light as well as dark conditions. This suggests that certain changes (in the pericarp or the embryo) do take place to induce better germination. Seeds also possibly become more responsive to light. Pecket and Al-Charchafchi (1979) have also pointed out increased respiration under conditions of light in lettuce seeds.

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