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STUDIES ON THE GERMINATION OF *ASPHODELUS AESTIVUS* BROT.

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ÖZTÜRK M. and PİRDAL M. *Studies on the germination of Asphodelus aestivus Brot.* BIOTRONICS **15**, 55–60, 1986. The seeds of *Asphodelus aestivus*; one of the economically important mediterranean elements; show a coat dormancy and do not germinate under normal conditions. They need a scarification treatment before left for germination. The pretreated seeds show maximum germination at 15°C and 6/18 h photoperiod. They are light sensitive and germinate best at the soil surface or 1 cm depth. The seeds are sensitive to higher salt concentrations too and germination decreases with an increase in the osmotic pressure.

Key words: *Asphodelus aestivus* BROT.; seed germination; light sensitive seed; photoperiod; temperature; soil depth; osmotic potential.

INTRODUCTION

Asphodelus aestivus Brot., a member of the Liliaceae, is a perennial herb distributed widely throughout the mediterranean region. It usually forms dense stands in the macuis after fire, growing from the sea level up to an altitude of 600 m. The seeds start sprouting in May and after dispersal are subjected to high summer and low winter temperatures. It is an economically important species containing starch, inulin, fatty acids and high percentage of sugars (*17*, *18*). The plant bulbs can form nutritions fodder for cattle and can be used for the biogas production (*7*, *17*).

In view of the economic importance of *A. aestivus*, it was thought worthwhile to work out its seed responses. As seed is one of the agents in this species to achieve its continuity and faces adverse external conditions before actual germination, the success of the propagules depends on the interaction of several factors. The present study deals with the responses to these factors of *A. aestivus* seeds, which are dormant when freshly harvested and show poor germinability under laboratory conditions.

MATERIAL AND METHODS

The mature seeds of *Asphodelus aestivus* Brot., collected at random from several pure stands in nature were used throughout the course of these investigations.

They were dispensed in batches of 50 in petri dishes (9 cm in diameter) containing two layers of filter paper (Whatman No. 1) and 5 ml of distilled water or test solution. In each treatment two replicates were used and radicle emergence selected as an index to germination. Unless otherwise stated, all tests were carried out in a "SHERER BIOTRON MODEL J" using 5, 10, 15, 20, 25 and 30°C temperatures, and 3, 6, 9, 12, 18 and 24 h light regimes under 40 W daylight fluorescent tubes of Tekfen.

The seeds possess a hard seed coat and contain mucilage too. As such, their coats were first pin pricked, these were then left in lukewarm water for 24 h, picked up and washed thoroughly with distilled water to remove the mucilaginous cover. The seeds were then left for germination under preset conditions.

RESULTS AND DISCUSSION

Germination in relation to different photoperiods

Although the influence of light on the seed germination was known to even the neolithic farmers (*24*), it was put forth clearly only in 1860 (*6*). Today we find a big list of light sensitive seed varieties. Light may be inhibitory to germination as in *Ranunculus* species (*1*, *2*) or promotive as in *Ranunculus laetus* (*3*). Some of the seeds germinate after a short exposure, whereas some need long- or short-day photoperiod, many however appear indifferent to light. The seeds of *A. aestivus* kept under 3, 6, 9, 12, 18 and 24 h light treatment, and 24 h darkness (at a tem-

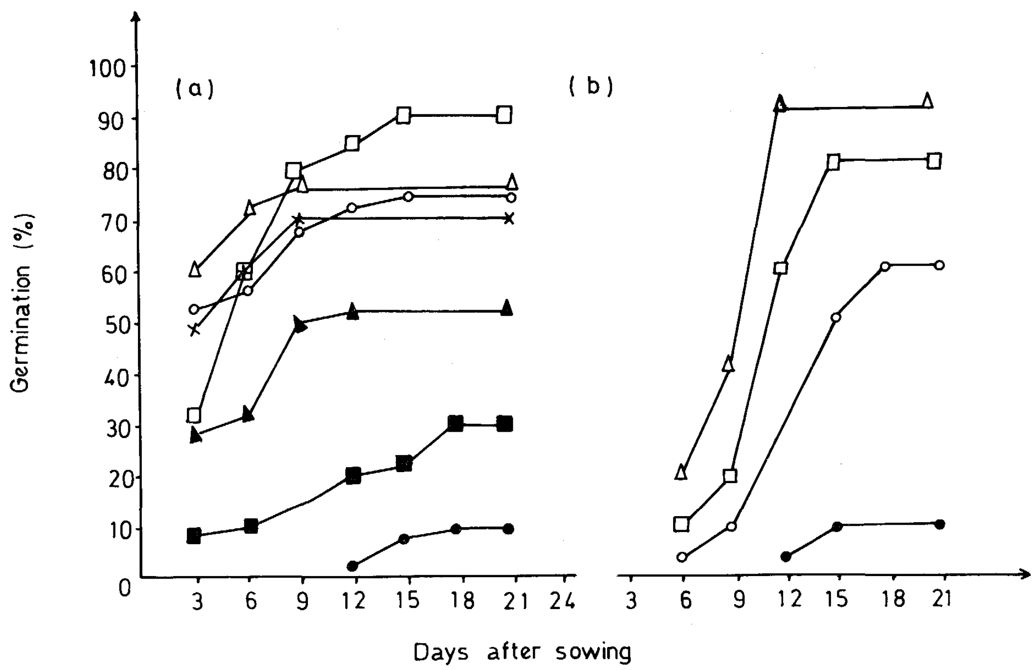

Fig. 1. The effect of light (a) and depth of sowing (b) on the percentage germination of *Asphodelus aestivus*. a) △ (3 h), □ (6 h), ○ (9 h), × (12 h), ▲ (18 h), ■ (continuous light), ● (continuous dark). b) □ (surface), △ (1 cm), ○ (3 cm), ● (5 cm).

perature of 20°C, light intensity of 10000 lux measured with Eel photoelectric photometer) showed that (Fig. 1 a), the germination in continuous dark starts on 12th day and reaches up to a maximum value of 10% after 21 days. An interruption of the dark period by 3 h light increases the germination rate and in 3 days percentage goes up to 60%. However, the maximum germination percentage (90%) is obtained by 6 h light treatment within a period of 15 days. As the light interval increases the percentage goes down, till it reaches up to 30% in continuous light. If pretreated seeds are left in 1 ppm GA in dark the germination reaches to a level of 68% (*17*). As a result of their germination behaviour, the seeds of *A. aestivus* can be included among the light sensitive group.

This is further supported by the findings concerning the effect of depth of sowing on germination of these seeds (Fig. 1b). The pretreated seeds of *A. aestivus* were sown in garden soil up to a depth of 5 cm, and seed germination was examined under natural light condition in the greenhouse at an air temperature of 18±2°C. The seeds germinate well at the surface and 1 cm depth. The germination decreases with increase in depth, which can be directly related to the light factor. Although 60% of the seeds germinate at 3 cm depth but the seedling emergence is poor due to the resistance offered by the soil particles. The behaviour of *A. aestivus* differs from other typical mediterranean elements like *Myrtus communis* (*11*), *Inula graveolens* (*12*), *I. viscosa* (*16*) and *Ceratonia siliqua* (*19*), all of which are indifferent to light.

Germination in relation to different temperatures

The complex changes that occur in seed germination involve different metabolic events. It is not thus surprising to find a close dependance of this phase on temperature. In the case of seeds which do not show dormancy, the effect is at least reflected in the rate and speed of germination. Generally germination rate increases steadily with an increase in temperature upto an optimum, however, in certain cases even a single shift in this factor proves to be highly beneficial. Although some of the seeds achieve and optimal state from 0–5°C, this range widens between 10–40°C in others (*11, 12, 21, 25*). The germination of pretreated seeds was examined with regard to temperature effect in a range from 5–30°C under 6/18 h photoperiod at a light intensity of 10000 lux. Results show that the seeds germinate from 10–25°C, with differences in the rate and its progress. At 15°C a maximum percentage of 80% is attained within 18 days. It goes down to (Fig. 2) 60% at 20°C, 10% at 25°C and remains at a level of 56% at 10°C. The optimal range is 10°C below that of other mediterranean elements where maximum percentage is obtained from 25–27°C (*11–13, 19*). There is no germination at 5 and 30°C, which can be attributed to the non-mobilisation of the materials. The seeds in fact show a secondary dormancy at these temperatures which is overcome by a shift of these seeds to 15 and 20°C temperatures. This range represents a specific thermal adaptation to the temperature conditions prevailing under the natural habitats of *A. aestivus*, as the species flourishes in nature during early spring months.

Germination in relation to different osmotic solutions

One of the stress types that effects the growth and development of non-halo-

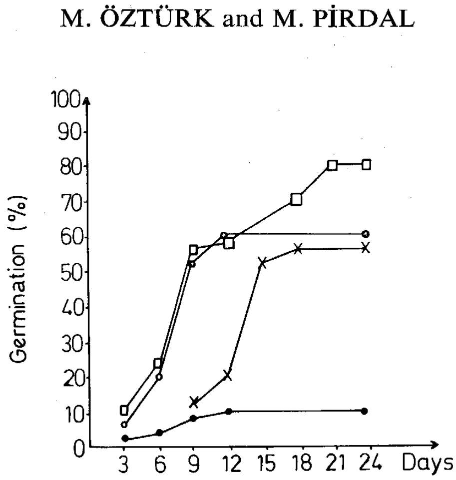

Fig. 2. The effect of temperature on the germination of *Asphodelus aestivus*. × (10°C), □ (15°C), ○ (20°C), ● (25°C).

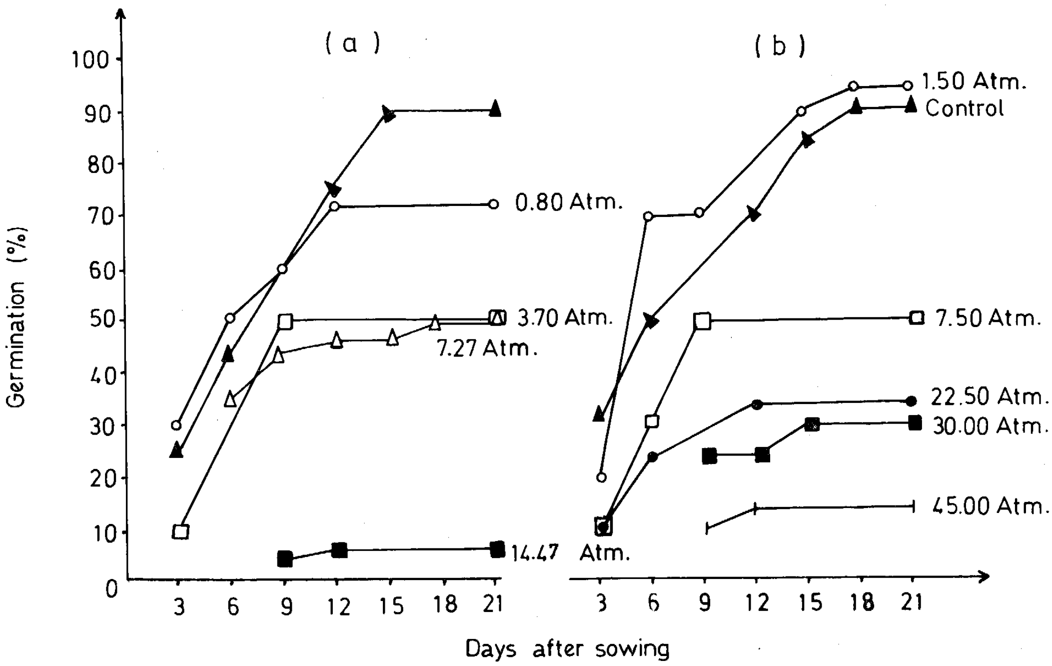

Fig. 3. The effect of the osmotic concentration of the medium on the germination of *Asphodelus aestivus*. a) NaCl, b) saccharose, ▲ (control), ○ (0.1 mol), □ (0.5 mol), △ (1 mol), ● (1.5 mol), ■ (2 mol), ⊢—⊣ (3 mol). Atm (osmotic pressure in atmospheres).

phytes in nature is the salts of sodium particularly NaCl. They either increase the osmotic pressure of the habitat or result in a decrease in the water potential, which in turn inhibits the imbibition and ultimately the germination (*8*, *22*). Several investigators have reported that the most salt sensitive phase in the plants is the germination and with an advance in the growth and development salt tolerance also increases (*5*, *9*, *15*, *20*). In the plants of *Trifolium fragiferum* and *Lotus corniculatus* (*10*) 100% germination occurs at lower salt concentrations but it is completely inhibited at 1 and 1.5% respectively, whereas in the seeds of *Myrtus communis* (*15*) an appreciably good germination occurs upto 1.5% which then reduces by about 50% at 2% salt.

The behaviour of *A. asetivus* seeds in 4 different treatments of NaCl and 5 different treatments of sugar solutions at 15°C, in diffused light followed for 25 days (Fig. 3a, b) showed that, in NaCl 72, 50, 50, 6% of the seeds germinate at 0.1, 0.5, 1.0, and 2.0 M (0.80, 3.70, 7.27, 14.47 atm), percentage decreasing with an increase in the salt concentration. At 2 M it goes down up to 6%, which is a quite negligible percentage. The differences between the control and 0.1 and 2% being as high as 18 and 84% respectively. This depicts the sensitiveness of *A. aestivus* to the higher salt concentrations. In fact, we hardly find this species in saline habitats (*17*). The toxic effect of the high Cl ion concentration seems to be the main factor for inhibition, as reported by Ayers too (*4*).

As regards the sugar solutions *A. aestivus* seeds germinate up to 3 M (45 atm). 0.1% sugar solution showed an additive effect by increasing the percentage of germination by a value of 4% as compared to the control (90%). However as the osmotic pressure of the solution increases the percentage germination also decreases. The difference between control and 0.5, 1.5, 2 and 3 M solutions is 40, 56, 60, and 66% respectively. In general these results show that *A. aestivus* seeds can still germinate under relatively higher moisture stress conditions (45 atm). This seems to be an adaptation to its xerophytic habitat conditions. Different species however, behave differently in this respect. Some being more tolerant like *A. aestivus* and its other mediterranean associate *Myrtus communis* (*23*, germinating up to 56.61 atm), others less tolerant such as *Inula graveolens* (*14*, germinating up to only 2.45 atm).

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