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Research article

INFLUENCE OF ENVIRONMENTAL FACTORS ON GERMINATION ECOLOGY OF *CALLIGONUM COMOSUM*A MEDICAL PLANT FROM ARID REGION OF SAUDI ARABIA

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ABSTRACT: Environmental conditions may positively or negatively influence production, reproduction, and restoration of desert extinct vegetation. As desert plant populations decline, it is important to understand the potential impacts of the environment on the natural processes of plant reproduction. The objectives of this study are to provide fundamental information on sexual reproduction in a dominant species of *Calligonum comosum*. This plant species is one of the famous plants characterizing the habitat of Saudi Arabia environment, commonly used in traditional medicine. We investigated the effects of temperature, soil depth, soil moisture and salinity on the germination of *C. comosum*. As a results of these syude, the *C. comosum* seeds give the higher germination percentage at 10/20°C, followed at a temperature of 18/28°C, the best germination percentage was at a depth of 0.5 cm. And we found that the regular irrigation every 48 hours by 50 ml gave the best results, the germination rates decreased when concentrations of sodium chloride increased. From results we can conclude that the *C. comosum* plant has numerous adaptive qualities that enable it to withstand environmental pressures. It is also considered one of the plants adapted to the lack of water, grow in low salinity soil. And the best conditions for seed germination is a moderate degree of temperature 10/20 °C at a depth of no more than 0.5 cm from soil surface, and the rate of irrigation regulatory every 48 hours.It was also noted that the high temperatures may inhibit the germination process and this may be one of the direct causes of decrease the germination of the seeds of the *C. comosum* plant in the summer.

Key words: Germination ecology, *Calligonum comosum*, Saudi Arabia

INTRODUCTION

Calligonum comosum is a plant of tropical and subtropical regions. *C. comosum* locally known as (Alarta) belongs to the botanical family Polygonaceae (Fig. 1). It is a plant of tropical and subtropical regions and is wide spread in Saudi Arabia and Arabian Peninsula. Several studies have confirmed the anti-bacterial activity and benefits of C. comosum leaves in the treatment of certain skin diseases [1, 2]. In addition, ithas economic and pastoral value, and it has a major role in stabilizing the sand. Moreover, tar resulting from stem combustion is used to cure dromedary scabies. Stem bark and leaf serves as leather tanning and milk wineskin disinfectant. Forresearch onseed germination of wild plants have the share of *C. Comosum* slight due to the ease of cutting reproduction of this plant and growth through seed be slow, but when the plant began to decay and extinction seemed urgent need to find the best environmental conditions for seed germination. Ren *et al.* [3] has studied the impact of dumpings and on germination of ten different types of plant *C. comosum* in China and found that the increase of soil depth reduced the seed germination and the maximum depth was12 cm, while optimal depths ranging between 2-4 cm. Ren and Tao [4] conducted laboratory experiments to determine the effect of cycle of water saturation reciprocal with drought on the germination of seven species of *C. comosum* and found minimum time for seed germination in the seven species are not affected by a number of water saturation reciprocal sessions with drought.

Seed study and reproduction of plants is important because it means that the alternate plant generations. Planting seeds in the soil requires the creation of appropriate conditions and the exploitation of both the seed and the soil and surrounding environment. As it should try a lot of planting bushes C. comosum to confront the problems facing the deterioration of this plant in Saudi Arabia. Therefore, it became necessary to try and find out the conditions for the cultivation of seeds C. comosum plant to propagation and maintain it.

The objectives of this study was to investigate the effect of temperature, soil depth, soil moisture and salinity on the germination of *Calligonum comosum*.

Figure 1. *Calligonumcomosum* (Alarta)

MATERIALS AND METHODS

The study site was located in the north-east of Riyadh city, in "Dahna" area. Fruits (Achene) were selected from mature plant *C. comosum*, and then divided into groups of fruits (seeds) for following tests:

1. Effect of temperature on seed germination

100 seed of *C. comosum* were used for germination test at different temperatures, which have been selected after several preliminary experiments. Where 5 groups of Petri dishes in each group with 5 replicates and put in each dish a piece of cotton soaked with water and 20 seed, then has the germination process in incubators at temperatures fluctuating temperature regimes (every 12 hours), and in the following manner, 4/14 ; 7/17; 10/20 ; 18/28; 22/34°C in light/ dark. The seed consideredgerminate when the radicle appears. Germinated seeds are counted and recorded until end of germination, the registration continues for a 25 days, and calculate the percentage of germination.

2- Effects of soil depth on seed germination

Seeds were planted in pots (diameter 8 cm and depth of 10 cm), 5 replicates were used and 10 seeds were planted in each pot at different depths as follows: seeds are sown on the soil surface, seeds are sown at a depth of (0.5, 1, 2 cm) of the soil surface. Pots are watered regularly inside the nursery at the temperature 10/20°C, which have been selected from the previous experiment.The number of seedlings germinated per day were recorded until 25 days [5]. Seedling emergence considered an indicator of the success of the germination process.

3. Effect of soil moisture content of seed germination

The seeds were planted in sandy soil in pots (diameter 8 cm and 10 cm depth). Seeds are sown at a depth of 0.5 cm of the soil surface at 10/20°C and the seed subjected to different irrigation treatments. The soil irrigated with distilled water by 25 ml or 05 ml as following: irrigated once every (24, 48, 96 hours), four replicates per treatment and ten seeds were transplants in each pot, and the registration was regularly every day until 25 day.Then the percentage of seedlings were calculated .

4. Effect of *salinity on seed germination:*

Various concentrations of NaCl solution (50, 100, 150, and 200 mM) and distilled water for the control treatment. The 20 seed were germination in Petri dishes with 5 replicates).

Statistical analysis

First the percentage of the final germination and seedling were calculated, then the differences between the treatments using tests (t-test), (Levene, test) by SPSS. Also a multi-regression analysis (Multiple Regression Analysis) of the various treatments that have been carried out for seed germination using statistical program NCSS2000.

RESULTS AND DISCUSSIONS

The following is the results of a study ecologically seeds, which aims to determine the effect of environmental factors on the germination of the seeds of the *C. Comosum* plant.

Effect of temperature on the seed germination

The appropriate temperature degree of seed germination vary depending on the plant species.Indicated that the seeds of any plant species grow in a particular area of temperatures vary from one type to another, but they do not germinate at temperatures more or less than this area.Also, most of the plant seeds species germinate at a temperature between 15 - 30°C. The best range for germination and the maximum temperature for germination is between 35-40°C.

We studied the effect of different degrees of temperaturefluctuating (4/14, 7/17, 10/ 20, 18/28, 22/34 °C) on the seed germination. Figure 2 shows that the germination rates of *C. comosum*. We found that the germination rate was highest at temperature of 18/28°C and 22/34°C. While the highest percentage of germination recorded at temperature 10/20°C (47.5%). The germination of seeds at10/20, 18/28, 22/34°C corresponds to the temperature regimes that prevail in environmental habitat in the rainy season in the spring. The seeds of *C. comosum* pant do not have the phenomenon of dormancy that regulates germination, but the seeds germinate at optimum environment conditions [6,7,8].

Effect of soil depth on seed germination

The depth of the seeds in the soil has a clear impact on the ability of these seeds to germinate, as it directly affects all external environmental conditions affecting germination, such as humidity and exposure to air and light intensity.*C.comosum* was planted in this study in four depths (0, 0.5, 1, 2 cm) in sandy soil at fluctuating temperature (10/20°C). Figure 3 show that the germination rate at a depth of 0.5 cm was 37%. While the lowest percentage of germination of the seeds that were planted on the soil surface. This result means that the seeds of *C. comosum* need special intensity of light and gas exchange and water content, which makes the germination rate, is highest at a depth of 0.5 cm. And when planting seeds on the soil surface exposure to heat and direct light, which increases the probability of dry seeds and therefore may have a negative effect on the germination. It is noted that the families of the *C. comosum* existent in sandy land that is under permanent movement between cliff and deposition by water rain and wind which affects the depth of seeds. The germination will be successful unless the seeds found in the right depth [5, 9, 10]. The perfect depth for the *C. comosum* germination was at 0.5 cm from the soil surface. The low percentage of germination of seeds a into the soil surface due to the unsuitable conditions for germination, which reduces the chances of the seed absorption of water, as explained by [11].

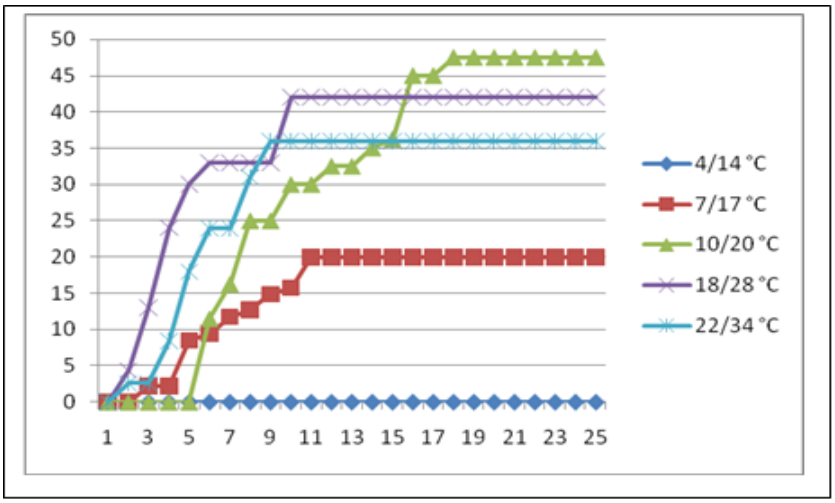

Fig. (2). Effect of temperature on percentage of seed germination of *Calligonum comosum*.

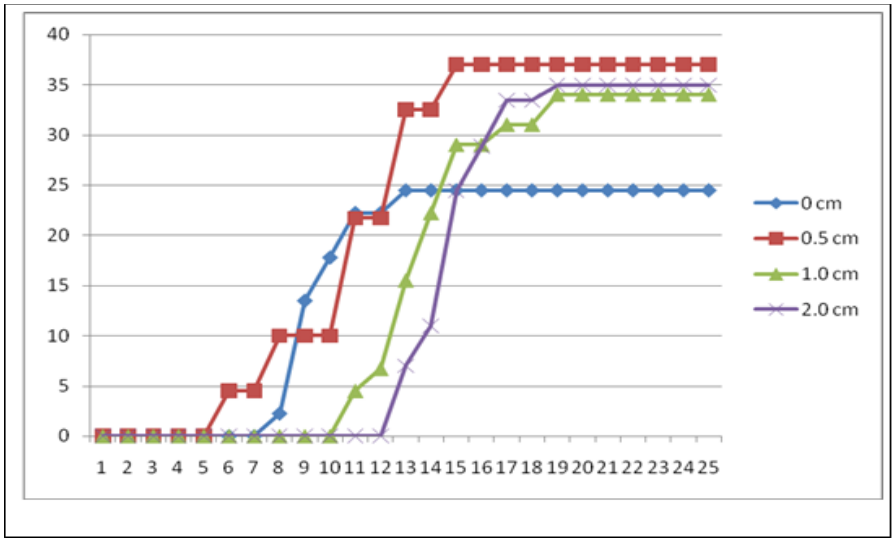

Fig. (3). The percentage of seed germination of *Calligonum comosum* as affected by soil depth.

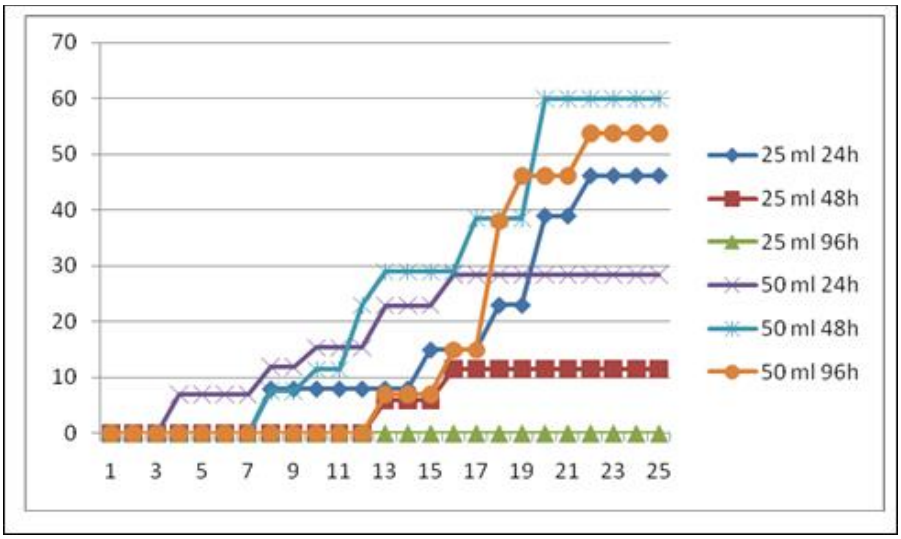

Fig. (4). The percentage of seed germination of *Calligonum comosum* in responses to soil moisture.

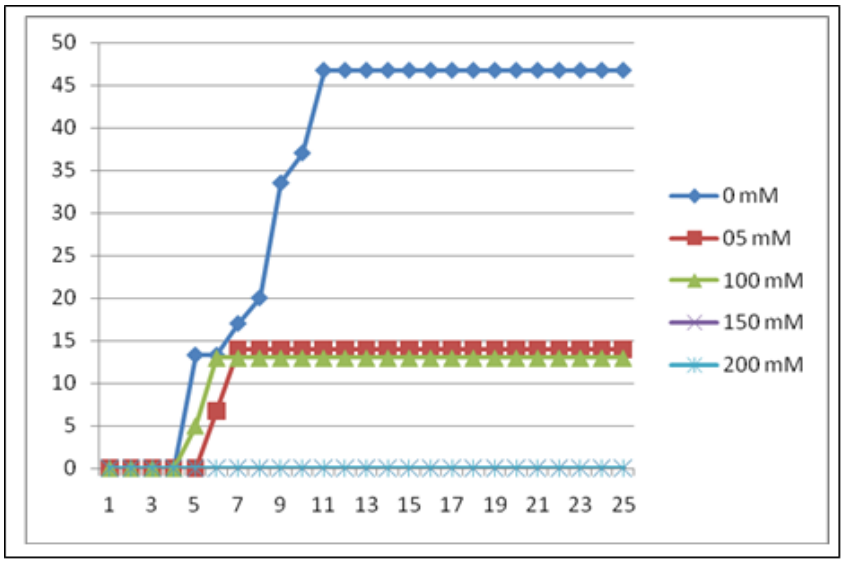

Fig. (5). The percentage of seed germination of *Calligonum comosum* in responses to soil salinity.

Effect of soil moisture on seed germination

Water is one of the important factors for germination, the amount of water absorb by seed is one of the most important environmental factors affecting germination. The difference in the water permeability of seed coat in addition to the pressure of absorption resulting from the melting of colloidal substances in water has impact on the ability of seeds germination. The pressure is responsible for the absorption strength of seed conservation of water, and therefore determines the amount of water sufficient to moisten the seed tissues during germination.We studied the effect of different treatments of irrigation onthe seeds germination of *C. comosum*, were grown at a depth of 0.5 cm in the sandy soil and at 10/20°C. Figure (4) shows that the germination was higher when irrigated by 50 ml of water, where the germination began on the third day when irrigation every 24 hours. While the germination delayed when irrigation every 24 hours with 25 ml by seven to nine days.The highest percentage of germination observed with 50 ml water every 48 hours it was 60%.Also observed that the irrigation with 25 ml of water gave best result at the daily irrigation regular (every 24 hours). While the seeds that were treated regularly irrigation system every 48 hours with 50 ml of water gave the best results, followed by 96 hours with 50 ml of distilled water.

The seed imbibing water to melt colloid material in the cotyledons and until reach the pressure sufficient absorption. This pressure is responsible for the cracking of the seed coat and appearance of seedling. After the arrival of the seed for this stage will be in need of the plant regulator of water and this is clear from our findings, where irrigation with 50 mL of distilled water every 48 hours is the transaction that gave the highest percentage of germination of seeds of each of the areas of study.The seeds of *C. comosum* plant response to different irrigation systems that mimic the pattern of rain in the desert environment irregular in terms of the amount and timing of rain.

Effect of salinity on seed germination

Salinity one environmental factors with significant impact on seed germination process, many studies showed the negative effects of stress salt on germination of many desert plants seeds [11] note that the extent of this effect varies depending on the type of plant. Figure (5) shows the percentages of germination percentage of the *C. comosum* seeds that has been germination in different concentrations of NaCl solution, we find that *C. comosum* seeds gave a high percentage of germination with water distilled, amounting to 46.7%, while the ratio reached 40% at germination in NaCl solution with 150 Mellmul and stop germination completely at a concentration of 100 and 200Mellmul of NaCl. The sodium chloride salt is more common in the dry lands [12], Khan and Weber [13] reported that the germination of halophytes seed scan be in all concentrations ranging from 200 to 1,700 mM, however Unger [14] found that the germination of many halophyte scan happen at concentrations of sodium chloride solution of 600Mellmul. In contrast the *C. comosum* seed germination with concentrations of sodium chloride solution low compared with halophytes plants.

C. comosum plant is one of non-saline plant and the environments which they settled is not considered saline environments but dry desert, however the seeds of the plant to the exposure of relatively high concentrations of salt is possible as a result of transmission of the soil solution to the top and subsequent evaporation of water in the soil surface because of high temperature prevailing in the environment. The germination of seeds in concentrations of sodium chloride solution up from 50 to 100 mM.

CONCLUSIONS

It was clear from the results that the *C. comosum* seeds give the higher germination percentage at10/20°C, followed at a temperature of 18/28°C, and this corresponds to the environmental conditions in which the *C. comosum* plant grows. When examining the different depths of seed planting in the soil, the best germination percentage was at a depth of 0.5 cm and there is a close relationship between the seed depth in the soil and speed of germination this is consistent with the results [3]. When examining the effect of different irrigation systems, we found that the regular irrigation every 48 hours by 50ml gave the best results. This may be due to plant seeds that need to a high amount of seed imbibing water for start the physiological processes necessary for the growth. The decrease in soil moisture for field capacity leads to a decrease in the course of germination process. So *C. comosum* plant in need of a high amount of water on regular intervals to complete the germination process. This may explain the germination *C. comosum* plant in the winter and spring due to the abundance of water in that period.When examining the effect of different concentrations of sodium chloride on germination *C. comosum* plant we found that the germination rates were best at the lack of salinity. The germination ratesdecreased when concentrations of sodium chloride increased, then the germination began to rise at a concentration of salinity 150 Mellmul. This may be caused by the *C. comosum* plant may exposed to landfill salt marshes, making the plant hardens and salt-tolerant. Zoghet and Al-Alsheikh [15] mentioned that the *C. comosum* plant is very tolerant for environmental conditions and can withstand salinity. Shaltout *et al*. [16] found that the vegetation in low-lying coastal areas of the eastern region of Saudi Arabia which the *C. comosum* plant spreads has high soil salinity.

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