Environmental Research Journal 7 (2): 20-24, 2013
ISSN: 1994-5396

Contribution to the Study of *Lygeum spartum* L. Germinative Properties in the South Region of Tlemcen (Western Algeria)

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Abstract: The spart steppes occupy large areas of the West algerian territory inspite of their obvious regression since the beginning of the last century, particularly in the Southern region of Tlemcen. This study highlights *Lygeum spartum* germinative capacities. Germination tests in the laboratory enabled us to determine optimal conditions for germination. Temperature is the most important factor in germination, the germination rate is high at 25°C, spart caryopses are sensitive to cold (5°C) and also to strong heats (35°C). The middles of cultivation used (nutrient agar and Muller Hinton) play a limitant role in the experimentation, spart seeds germinate better in distilled water than in these two middles of cultivation.

Key words: *Lygeum spartum*, South of Tlemcen, germination, seeds, temperature, middles of cultivation

INTRODUCTION

In the arid and desert areas of Algeria, researchers notice a fast decline of the natural vegetative cover associated to the biological diversity erosion (Le Houerou, 1959, 1969; Floret and Pontanier, 1982). This vegetative cover degradation, principally due to stressful environmental conditions, clearing and overgazing, leads to incresingly damaging effects on both the economical and ecological side (desertification) (Jaouadi *et al.*, 2010). To fight more effectively against this phenomenon, researchers have to search solutions that can improve the vegetative cover and resolve some species problems of regeneration in arid regions, especially the alfa and the spart which know a worrying decrease and decline.

This disequilibrium is due to natural regeneration problems (low density and duration of seeds viability in the soil, seeds predation by the insects and herbivorous) as well as to human activities and drought (Ernst *et al.*, 1989; Skoglund, 1992; Hauser, 1994; Ward and Rohner, 1997; Wiegand *et al.*, 1999; Barnes, 2001). In cases where the vegetative cover degradation reached the threshold of irreversibility and where the natural regeneration can not lead in the medium term to the restoration of this cover (Floret, 1981; Novikoff, 1983), the use of socalled rehabilitation techniques becomes an imperious necessity. In arid areas where the germination characteristics are deeply involved in the selection for vegetables adaptation to the medium conditions (Jordan and Haferkamp, 1989; Koller, 1995), researchers can admit that the first critical phase of rehabilitation is the one relative to the germination of species to be reintroduced. For these reasons, this research is dedicated to the study of germinative properties of steppic poaceous seeds *Lygeum spartum* which object if is to determine the principal environmental constraints that affect the seeds germination (Come, 1970; Ungar, 1995) in particular because the temperature is considered as a limiting factor. It intervenes in the oxygen solubility, its disponibility and its use compared to the embrayo, it also acts in a direct way on the speed of biochimical reactions implemented during the germination (Mazliak, 1982), the enzymatic activity which increases with the temperature influences the fluids characteristics.

From a physiological point of vue, germination is the process that marks the seed transition from slow to active life in optimum conditions of germination (Come, 1970; Mazliak, 1982; Heller *et al.*, 1990; Suzka *et al.*, 1994). These researchers explain the germination process into two phases: the first phase of floodwater inside the seed (imbibition) which is accompanied by an intense resumption of the metabolic activity, the second phase of seed turgescence that induces radicular elongation and necessarily the germination. However, these steps do not occur if some intrinsic factors (preservation of

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germination capacity, absence of imbibition) and extrinsic ones (temperature, humidity, ventilation and sometimes lighting) are not present.

Lygeum spartum L. or spart is a monocotyledone of endemic poaceous family that the outbreaks spread on the highlands of Algeria and Morocco. In algeria, this species is abundant on the province of Oran where it spreads from the littoral to the Ksour Mounts.

Spart root system is very developped, it permits the soil fixation and the dune stability then it is a precious vegetable to fight against desertification. Lemee indicates (points out) the big hygroscopicity of *Lygeum spartum* roots that can absorb atmospheric moisture, even dead on the basis on 100% from their initial weight. Since, the threat of population regression at *Lygeum spartum* in Algeria, researchers have analyzed the species germinative behavior in order to establish later a program of preservation and rehabilitation. Within this context, researchers will determine optimal conditions of germination then exploit these results in order to evaluate the species ability of germination under different abiotic constraints. Within this context, researchers will determine the principal environmental constraints that affect spart seeds germination in particular the temperature (5, 25 and 35°C), the classical middle (distilled water) and middles of cultivation (nutrient agar and Muller Hinton).

MATERIALS AND METHODS

The study focused on trials of *Lygeum spartum* seeds germination, carypsoses are taken from clumps ears which grew in natural conditions on May 2012 and which come from two stations in the South of Tlemcen (Sebdou and El Aouedj). Rising up 920 m of altitude with latitude 34°38'North and longitude 1°19'West, Sebdou area belongs to an arid bioclimatic floor of a temperate Winter. Average annual rainfall is 267.5 mm with 36.7°C as the average temperature of the highest ones in the warmest Month (M) and 4.8°C as the average temperature of the lowest ones in the coldest month.

The area of El Aouedj stands on 1120 m of altitude with latitude 34°29'North and longitude 1°23'West, it belongs to an arid bioclimatic floor of a temperate Winter. Average annual rainfall is 180.37 mm with 36.01°C as the average temperature of the highest ones in the warmest Month (M) and 5.3°C as the average temperature of the lowest ones in the coldest month. In natural conditions, poaceous fruition occurs in spring, caryopses maturation and scattering occur in the beginning of summer. Caryopses are sorted and onlyn healthy ones (with no apparent anomaly) are tested. The brown-red colour indicates the seeds morphlogical and physiolocial maturity (Hasnaoui *et al*., 2006). The method of desinfecting plant material consists in washing seeds with running water, immersing them in a bleach solution (80% sodium hypochlorite) for 4 min, rinsing them with distilled water for 30 sec then dipping them in ethyl alcohol at 95° for 10 sec and finally washing them three times with sterile distilled water. Culture media used (Nutrient agar and Muller Hinton) have been liquefied in a double boiler then they have been poured (in supercooling) in Petri dishes between two benzene nibs. The boxes were kept open to avoid the formation of water droplets on the lid. After disinfection, ten seeds have been placed per Petri dish using sterillized pliers. The boxes have been closed to avoid contamination. For the control, researchers sowed the seeds in cotton wool wetted with distilled water. For each middle, researchers did three repetitions. Then, boxes were placed in three different temperatures: 5°C (refrigerator), 25 and 35°C (sweating room) in order to test temperature action on germination.

RESULTS

Sprouted seeds are counted each week, germination criterion chosen is the integument slot, its uprising and the appearance of cleoptiles or coleorhize (Come, 1970; Harche, 1979; Corbineau *et al*., 1987). Bonnet-Masimbert (1975), Lamond (1978) and Youmbi *et al*. (1994) think that the release of the elongated radicule of about 1mm is a sprouted seed criterion.

Distilled water: The germination rate is small at 5°C, it is at 30% for Sebdou station and 40% for El Aouedj station. At 25°C, seeds showed a very high percentage of germination: 90% for Sebdou station and 100% for El Aouedj station (Fig. 1-3).

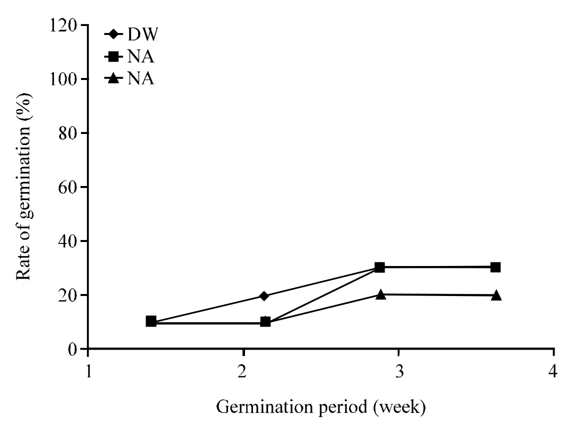

Fig. 1: Evolution of seeds germination rate at *Lygeum spartum* at 5°C (Sebdou)

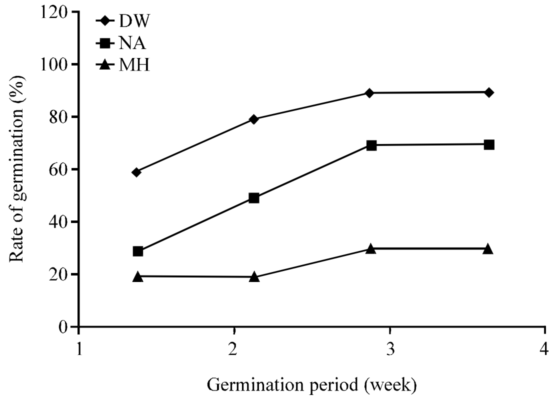

Fig. 2: Evolution of seeds germination rate at *Lygeum spartum* at 25°C (Sebdou)

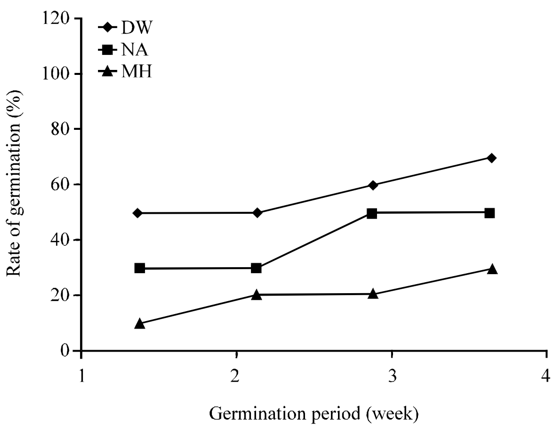

Fig. 3: Evolution of seeds germination rate at *Lygeum spartum* at 35°C (Sebdou)

Nutrient agar: At 5°C, germination percentage is small, it is at 30% for the two stations (Sebdou and Al Aouedj). On the contrary, at 25°C, germination is still high, it is at 70% for Sebdou station and 80% for El Aouedj station. Finally, at 35°C, the germination rate is appreciable of about 50% for Sebdou station and 70% for El Aouedj station (Fig. 4-6).

Muller Hinton: Germination rate is less important, it is at 20% for the two stations (Sebdou and El Aouedj), at 25°C the germination rate is the most important, it is at 30% for the station of Sebdou and 50% for the station of El Aouedj. Finally, at 35° seeds showed a germination percentage of 30% for the two stations (Sebdou and El Aouedj) (Table 1 and 2). Researchers notice that the germination is more important in distilled water comparing to the other two cultivation middles, regardless of the used temperature. Germination of a batch/lot of seeds depends on the conditions in which it was placed and on

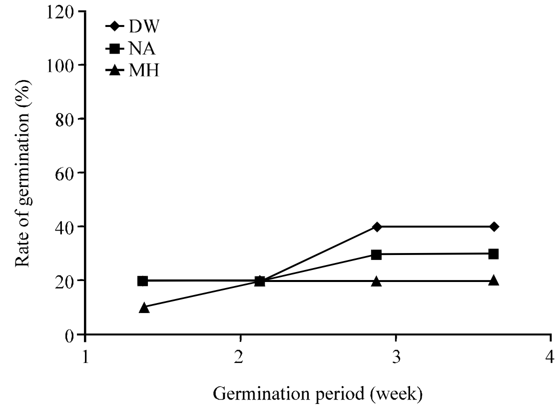

Fig. 4: Evolution of seeds germination rate at *Lygeum spartum* at 5°C (El Aouedj)

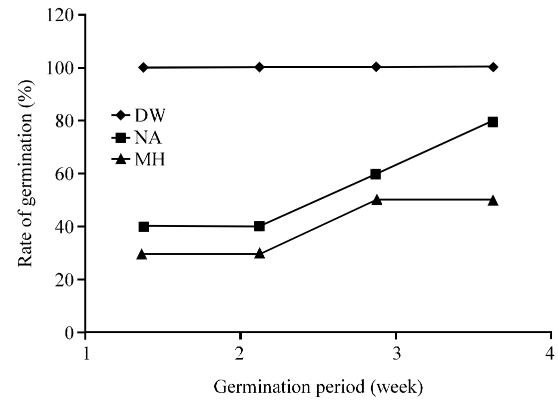

Fig. 5: Evolution of seeds germination rate at *Lygeum spartum* at 25°C (El Aouedj)

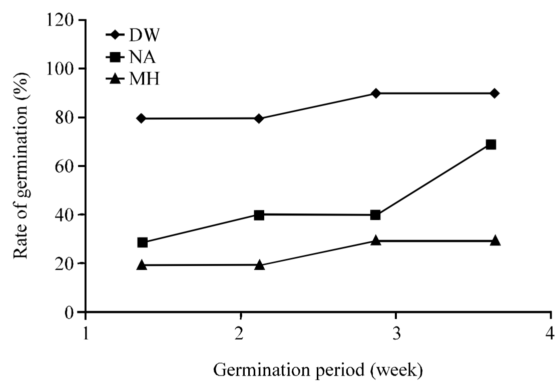

Fig. 6: Evolution of seeds germination rate at *Lygeum spartum* at 35°C (El Aouedj)

the vital dispositions used (Mazliak, 1982). Temperature has a significant influence on this phenomenon at the spart since germination is performed in a considerable way at 25 and 35°C. The cold makes germination less important.

Table 1: Germination of seeds at *Lygeum spartum* in different middles and at different temperatures in station 1: Sebdou station

	Weeks and rates of germination							
	1st		2nd		3rd		4th	
Middle	Nbre	%	Nbre	%	Nbre	%	Nbre	%
Germination with 5°C								
Distilled water	1	10	2	20	3	30	3	30
Nutrient agar	1	10	1	10	3	30	3	30
Muller Hinton	1	10	1	10	2	20	2	20
Germination with 25°C								
Distilled water	6	60	8	80	9	90	9	90
Nutrient agar	3	30	5	50	7	70	7	70
Muller Hinton	2	20	2	20	3	30	3	30
Germination with 35°C								
Distilled water	5	50	5	50	6	60	7	70
Nutrient agar	3	30	3	30	5	50	5	50
Muller Hinton	1	10	2	20	2	20	3	30

Table 2: Germination of seeds at *Lygeum spartum* in different middles and at different temperatures in station 2: El Aouedj station

	Weeks and rates of germination							
	1st		2nd		3rd		4th	
Middle	Nbre	%	Nbre	%	Nbre	%	Nbre	%
Germination with 5°C								
Distilled water	2	20	2	20	4	40	4	40
Nutrient agar	2	20	2	20	3	30	3	30
Muller Hinton	1	10	2	20	2	20	2	20
Germination with 25°C								
Distilled water	10	100	10	100	10	100	10	100
Nutrient agar	4	40	4	40	6	60	8	80
Muller Hinton	3	30	3	30	5	50	5	50
Germination with 35°C								
Distilled water	8	80	80	80	9	90	9	90
Nutrient agar	3	30	4	40	4	40	7	70
Muller Hinton	2	20	2	20	3	30	3	30

In the two middles of cultivation, researchers had a contamination from a fungal origin as to boxes preserved at 25 and 35°C. On the other hand as to petri dishes preserved at 5°C, contamination rate is small, it is of a bacterial origin. Auge *et al.* (1989) think that explants are the source of the infection which seems due to an incomplete sterilisation of explants.

The end of germination is characterised by the integument opening due to coleorhize and coleoptile. Morphologically, the beginning of the seedling growth is similar to that of alfa (Harche, 1979) and Oyat. The achieved results within this study, conducted in laboratory show the high germinability of seeds at *Lygeum spartum* in different middles and at different temperatures.

The temperature is the most important element of germination, it intervenes directly by acting on the speed of biochemical reactions and indirectly on the oxygen stability in the embryo (Binet and Brunel, 1968). Spart caryopses are thermo-sleeping seeds, i.e., seeds that do not germinate at temperatures higher than 35°C. These results remind us those achieved at Oyat *Ammophila arenaria*, *Stipa tenacissima* (Harche, 1979), *Aristida pungens* except for *Stipa lagascae* of which the germination optimal temperature is situated between 5 and 15°C.

Spart caryopses are sensitive to cold and strong heats which nullify their ability to germinate by freezing protein synthesis, this could be explain by their ecotypic origin which is characterized by a good thermal environment in which the minimum of the coldest month does not fall down >4°C and the maximum of the warmest month doesn't exceed 37°C.

The middles of cultivation used (nutrient agar and Muller Hinton) play a restrictive role in the experimentation, spart seeds germinate better in distilled water than in these two cultivation middles. This is perhaps due to a strong presence of agar which causes a germination slowing. Finally, researchers note that the middles have known contminations from fungal and and bacterial origins.

Spart is a species which plays an important role in both the balance and maintenance of steppe and desert ecosystems, the success of this species germination and growth stages requires inevitably a good knowledge of these germinative characteristics and the development of its reaction towards the middle conditions.

CONCLUSION

The study shows that measures and techniques of restoration need to be developped through long term studies, taking into account the dynamic of the species development starting from prior stock of viable seeds in the soil by the introduction of new seeds and even seedlings in order to improve the process of the species regeneration.

ACKNOWLEDGEMENTS

Researcher thanks all the teachers who have achieved a modest level of knowledge in a field of science in general and ecology in particular proved large voluminous and complex.

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