Environment and Ecology 37 (4A) : 1390—1397, October—December 2019
Website: environmentandecology.com ISSN 0970-0420

Study of the Effect of Livestock Grazing on Seeds' Properties of Four Rangeland Species

**Jamal Bakhshi, Seyed Akbar Javadi,
Ali Tavili, Hossein Arzani**

Received 17 July 2019 ; Accepted 2 September 2019 ; Published on 4 October 2019

ABSTRACT

The livestock grazing can directly or indirectly affect the structure and dynamics of the rangeland plants' seeds, which can be studied by livestock grazing management. For the mean comparison of seed germination percentage, rate and time of four rangeland species under exclosure and non-exclosure conditions in rangelands, after collecting baseline information and field visits of four areas, respectively, 11-year exclosure area, 8-year exclosure area, an area with mean grazing intensity and an area with high grazing intensity were selected for sampling. After determining each area stand, the rangeland plants' seeds of *Stipa barbata, Salvia officinalis, Poa bulbosa* and *Hordeum murinum* were randomly collected, then the seeds of each species' were combined and the mean number of each species seeds, seed germination percentage, time and rate of each species were studied *in vitro*. Data analysis was performed using software SPSS 24.0. The results showed that the mean seed germination percentage, rate and time were different in different areas.

Keywords Livestock, Grazing, Seeds' properties.

Jamal Bakhshi
Department of Range Management, Science and Research Branch, Islamic Azad University, Tehran, Iran
e-mail : mahalat20@yahoo.co.uk

Seyed Akbar Javadi*
Associate Professor,
Department of Range Management, Science and Research Branch, Islamic Azad University, Tehran , Iran
e-mail : a.javadi@srbiau.ac.ir

Ali Tavili
Associate Professor, College of Natural Resource, University of Tehran, Tehran, Iran

Hossein Arzani
Professor, College of Natural Resource, University of Tehran, Tehran, Iran
*Corresponding author

INTRODUCTION

The rangelands cover about 41% of the world's lands and most of urban and rural populations of the rangelands depend on the stability and improvement of these ecosystems accounted for nearly 2 million persons in the world. The rangelands' destruction can cause economic and social problems associated with it and environmental consequences. Reducing the biomass of the Earth's surface when destructing the rangelands affects the properties of the seeds by the return of nutrients to the soil and plant biomass.

In appropriate exploitation reduces vegetative capacity and regeneration and causes non-establishment of seedlings of valuable rangeland species (Moghadam 2000). Over time, following an increase in population and the increasing need for meat and dairy products to meet food needs, the human intervention has gradually increased in the rangelands and

has had more or less positive and negative effects and in areas where there is an unreasonable intervention it has caused livestock and rangelands' imbalance that the damage to vegetation is one of its complications (Ghaemi et al. 2012). The rangelands can be called ecosystems. Given that the rangeland ecosystem is composed of biotic and abiotic components and there is a complex relationship between them, creating a change in a component may have a negative or positive effect on other components. One of the properties of rangeland ecosystems is that vegetation changes in response to changes in environmental conditions and livestock grazing pressure. One of the most useful and indicative components that can alter and interpret the short-term and long-term effects of livestock grazing in rangelands is exclosure (Moradi and Mofidi 2012).

Since the factors affecting the vegetation of the different areas are not the same, as well as the continuous awareness of the process and status is necessary for planning and proper management of the exploitation, so recognition of the relationship between these factors and the distribution of the plants in the rangeland ecosystems will help us apply these findings to the management, modification and development of rangeland ecosystems (Zamora et al. 2007). The human intervention in natural ecosystems in the last century has caused disruption and changes in their structure and function (Harris and Diggelen 2006). Since the rangelands are dynamic ecosystems and undergo changes following environmental disturbance, their sustainable exploitation will be possible only when these changes are known (Holechek et al. 2003). Preventing further destruction of these natural ecosystems and regeneration of destructed rangelands is an important part of the activities of rangeland managers. This is done with performing vegetation regeneration operations by combining biological and-mechanical methods. In this regard, regeneration is one of the methods currently being used in rangelands and watersheds to protect water, soil and vegetation that exclosure is one of the most commonly used methods of doing so Mesdaghi (2007), Moghadam (2000). Exclosure is the easiest and least costly method of rangelands' regeneration, which increases the natural vegetation (Moghadam 2000). In other words, exclosure provides conditions for natural regeneration of the rangeland by creating opportunities for the plant species' seeding (Azarnivand and Zare Chahuki 2008). Such intervention in rangeland ecosystems can have effects on different components of the ecosystem. Evaluating such changes in the components of the regenerating ecosystem can show the success rate or positive effects of regeneration operations and the operational difficulties and efficiency of the treatments used (Jangjo 2009).

Shahbazi et al. (2016) when evaluating germination traits of *Hedysarum crinifrum* Boiss at periodic temperature and under drought stress concluded that, with increasing temperature and drought, the percentage of germination of this species reduced. Ganjali et al. (2017) by examining the effect of drought and salinity on germination of *Alyssum homalocarpum* concluded that different treatments of drought and salinity stress had a significant effect on seed germination properties ($p<0.05$). The mean comparison of data showed that germination percentage and germination rate reduced with increasing salinity and drought level. Shamsaei et al. (2016) by examining the effect of drought stress on the native plant and some germination indicators of *Satureja hortensisl* produced seeds concluded that drought stress applied on the native plant was significant on the germination rate at 1% level and germination percentage at 5% level. Jafarian and Ahmadi (2015) by examining the germination of two rangeland species of *Helichrysum globiferum, Helichrysum aucheri* under drought stress concluded that due to drought stress, germination percentage and rate reduced significantly. Shamsi et al. (2015) by examining the effect of different treatments on breaking seed dormancy and stimulation of seed germination of *Atriplex leacoclade* Boiss concluded that the highest germination percentage (73.4%), seed germination rate (1.35) and brown seed (35.1%) for brown seeds and the highest germination percentage was 63.3%, germination rate (0.74) of black seeds' were obtained from seeds double scratch treatment by sandpaper.

Akhavan et al. (2013) by examining the effect of drought stress on germination and growth indicators of the rangeland plant genotype seedling of *Agropyron trichophorum* concluded that with increasing drought stress, germination percentage and rate factors reduced significantly. Akhavan et

al. (2013) by examining the effects of drought stress on germination indicators of four rangeland species' genotypes of *Bromus tomentellus* concluded that with increasing drought stress, seed germination rate and percentage reduced significantly. Khoshkholghsima et al. (2013) by examining the effect of salinity on barley germination and tolerance threshold that the percentage of germination in all samples reduced significantly with the increasing sodium chloride concentration ($p<0.05$). Tabatabai et al. (2013) by evaluating salinity tolerance of barley cultivars under laboratory and field conditions concluded that with increasing salinity, germination percentage reduced due to salinity stress. Amiri et al. (2012) by examining and comparing the effect of NaCl salt Na_2SO_4 on early stages of germination and early growth of *Alhagi persarum* and *Salicornia herbacea*, concluded that a significant difference was found between different salinity concentrations in both species. Soltanipour et al. (2011) by examining the effect of pre-emergence treatments on seed germination traits of *Zygophyllum atriplicoides* concluded that pre-emergence treatments had a significant effect on germination percentage and rate, so that potassium nitrate treatment had the highest percentage and rate of germination.

Rasouli et al. (2011) by examining the effect of two salts of NaCl and Na_2SO_4 at the stages of germination and early growth of *Seidlitzia rosmarinus* concluded that increasing salinity in both salts caused a significant reduction in these traits. Khajeh et al. (2011) by examining germination and dormancy of several rangeland species of legumes and cereals in the rangelands of North Khorasan Province concluded that in non-treated case (distilled water) germination of all species of legumes was less than 5%, while desired germination was observed for cereals' seeds germination which on average was 66.77%. Mosleh et al. (2010) by examining the effect of salinity stress on germination of seed in three species of Salsola concluded that increasing the concentration of both salts (NaCl + Na_2SO_4, NaCl) reduced germination percentage and rate of seeds in all three species. Safaian and Azarinvand (2010) by examining the effect of some treatments on breaking seed dormancy and improvement of germination of *Prangos ferulacea* seed concluded that lighting, cooling and temperature of 10°C in comparison with other treatments had a significant effect on breaking seed dormancy of *Prangos ferulacea*. Ghasemi et al. (2008) by examining increased seed germination of *Porema ammoniacum* concluded that the best temperature for seed germination of *Porema ammoniacum* was 3°C and the higher the temperature, the less germination percentage, reaching 0 at 15°C.

Sabzi et al. (2014) by examining the effect of different levels of salinity on seed germination and retrieval of three rangeland species of *Kochia prostrata, Eurotia ceratoides, Salsola rigido* in Markazi Province concluded that a significant difference was found between the control treatment (0 mili Molar of chloride sodium salt) and other treatments (different concentrations of salinity). Kamonporn et al. (2018) by comparing the effects of reactive species on seed germination, growth and metabolism of vegetables concluded that RONS affected seed germination, growth, development and metabolism differently. Linjun et al. (2017) by examining the ecological role of seed germination of grass species concluded that germination percentage had a significant difference in the increase of at least one percent in production. Stefania et al. (2017) by examining the effect of environmental factors on seed germination of *Vaccinium myrtillusl* concluded that temperature had the greatest effect on seed germination. Ruiting et al. (2017) by examining the effects of temperatur and salinity on seed germination of *Ruppia sinensis* concluded that temperature is an important factor in seed germination.

In general we can say that percentage, rate and time of emergence of seedlings are important factors affecting the plant yield. Regarding the necessity of conducting this study, it should be said that the fact of the effect of exclosure management method (in order to increase awareness and extent of participation in the implementation of the relevant projects) and grazing on the percentage, rate and time of seed germination despite the wide range of rangeland few studies have been conducted in this regard and studies conducted on seed rate and germination percentage can be considered as one of the best ways of rangelands' desired development. Using seeds with higher germination percentage as well as quick germination

and establishment is desired in the development of the plant. Therefore, conducting this research is necessary. Also, in recent years several studies have been conducted on seed germination of the rangeland plants. These studies are mostly laboratory -related and affected by various treatments such as salinity, drought, fire. However, the present study examined different conditions of mean seed germination rate and percentage with different livestock grazing intensities and in the absence of livestock grazing on the rangeland species of different exclosure years.

MATERIALS AND METHODS

Study area

The studied area is one of the central rangelands of Iran with a cold dry climate using Amberger method with geographical coordinates between longitude of 0.4 to 30 and 50 to 59.7, 44 and 50 and latitude of 29.2, 37 and 33 to 47.7, 49 and 33.

Identification of the study area

First, we collected basic statistics and information including meteorology, topography (slope mapping) and pedology information of the area. Then, with regard to the records and documents related to the implementation of the managerial exclosure plan, we determined exclosure areas since 2005 with an area of about 300 hectares, since 2008 with an area of approximately 365 hectares, an area with mean grazing intensity of 200 an area with high grazing intensity of 730 hectares and their ranges were landed on the map. Then, in each area, homogeneous stands were determined that represent each area for sampling and these stands were identified for sampling.

Measuring the percentage and rate of seed germination

In order to study the effect of grazing management on the seed germination, from each stand, 10 bases were selected to represent other bases in the area. Then,the seeds of these bases were collected and after natural drying (4 days in front of the sun) the seeds' wings were removed to the required amount by hand and then the treatment of 24 h under running cold water and 48 h in shade was applied (Mohebbi et al. 2012). After applying the treatment, Petri dishes with dimensions of 9 ×10 cm were placed in an autoclave in order to prevent infection. Before starting the experiment, the fungicide was applied to the seeds and the seeds were washed 2-3 times with distilled water. Then, the seeds were placed on drying paper at 20^{o}C in Petri dish and between two filter paper. The germinated seeds were counted every day after the start of the experiment. The mean seed germination time, rate and percentage of seed germination were calculated by the following formula (Jefferson and Penachchio 2003) :

FGP = $\sum$ (number of seeds germinated until day I × 100)/Total number of seeds.
FGP : The final germination percentage.
I : The number of days after the start of the test.
GR =$\sum$ (number of seeds germinated until day I × 100)/I.
GR : Germination rate.

The percentage of seed germination was also calculated for each of study areas and each Petri dish was calculated using the formula of the number of germinated seeds in each Petri dish divided by the number of total Petri dishes in each area and the mean seed germination percentage for each area was calculated using the formula of the sum of the number of Petri dishes in each area divided by the number of total petri dishes in each area and recorded in the Table.

Data analysis

Before data analysis, first, normality should be considered. For this purpose, several methods have been proposed, one of which is Kolmogorov-Smirnov test. Using this test, the data normality were controlled. Then, statistical analysis was performed and analysis of variance was used given that the study groups were more than two groups. Since Duncan test and some other tests compared the mean of all treatments as pairs, hence after measuring the significance of variance analysis test, using Duncan test, the means were compared with each other to obtain the difference between different treatments (Basiri and Iravani 2009). Software SPSS was used to analyze the data.

RESULTS

The results of analysis of variance of seed germination

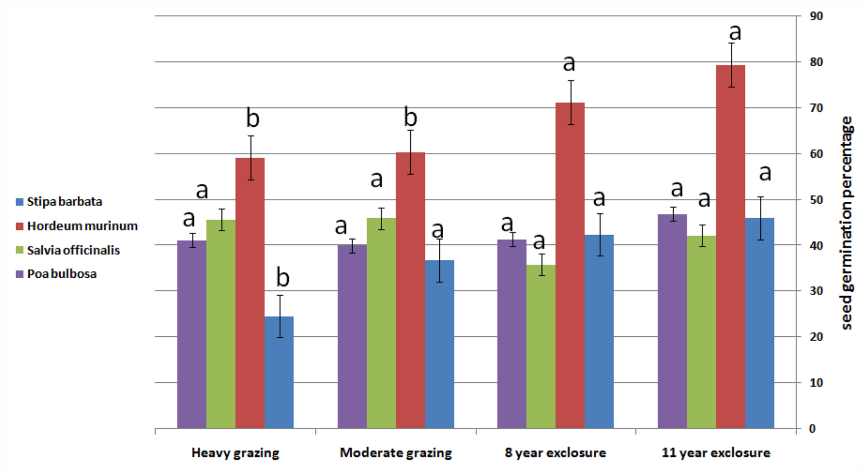

Fig. 1. Mean comparison of seed germination percentage in studied areas.

percentage of plant species showed that livestock grazing had no significant effect on seed germination percentage of *Salvia officinalis* and *Poa bulbosa*. However, livestock grazing on seed germination percentage of *Hordeum murinum* and *Stipa barbata* showed a significant difference a 1% level.

Different livestock grazing intensities had a different effect on seed germination percentage of the plant species of the area. So that livestock grazing increased the percentage of seed germination of *Salvia officinalis* and the percentage of seed germination of other plant species reduced due to livestock grazing. Also the rangeland exclosure increases seed germination percentage of other plant species. The highest percentage of seed germination among the key species of the area is related to *Hordeum murinum*, with the highest level in 11-year exclosure area (Fig.1).

The results of analysis of variance of germination rate of seeds showed that among the plant species of the study area, grazing of livestock had a significant effect on germination rate of *Stipa barbata* at 1% level, but the rate of germination of other species

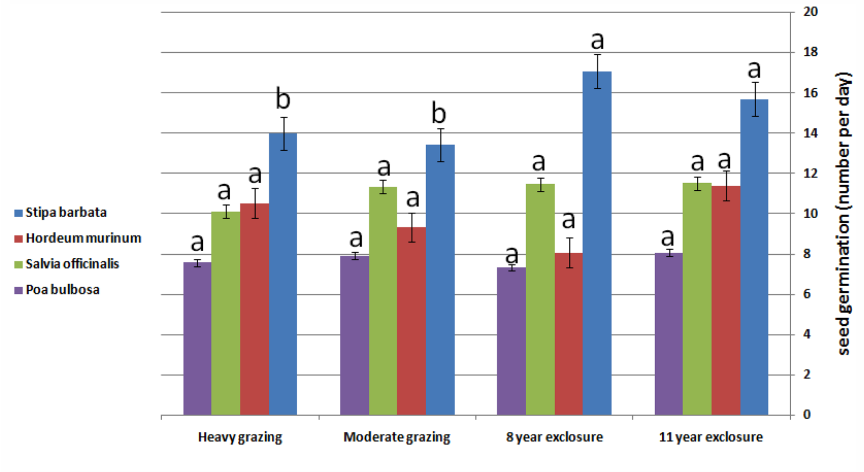

Fig. 2. Mean comparison of seed germination (number per day) in studied areas.

due to grazing of livestock showed no significant difference. According to (Fig. 2), livestock grazing intensity had a different effect on the germination rate of different species. So that livestock grazing on *Poa bulbosa* germination rate is not significant, but livestock grazing reduced the rate of seed germination of *Stipa barbata*. The highest rate of seed germination (number per day) among the plant species studied is related to *Stipa barbata.*

DISCUSSION

The results showed that plant species have different responses to livestock grazing. Taqipoor et al. (2014) examined the effect of fire (dark red) products on seed germination of the three predominant species in semi-steppe rangelands of the Central Zagros and concluded that these three species had different responses to fire products. Mohebbi (2012) the effect of exclosure and grazing conditions on the mean percentage, rate and time of seed germination of *Atriplex canescens* and concluded that the mean percentage, time and rate of seed germination was not significantly different in both sites. In other words, the seeds in exclosure and non-exclosure sites in terms of this feature were similar.

The results showed that seed germination rate and percentage of rangeland species did not follow one another, so that increasing the rate of germination would increase or reduce the percentage of germination of plant species, perhaps the reason is different resistance of plants to grazing. Sabzi and Naseri (2012) compared the percentage and rate of germination in halophyte *Salsola orientalis* and glycophyte *Alyssum sibiricum* and concluded that germination percentage and rate at 5% probability level were not significantly different.

The results showed that the mean rate and percentage of germination of plant species of *Poa bulbosa* and *Salvia officinalis* were not significantly different due to livestock grazing, which can be attributed to the resistance of these plants to livestock grazing. However, the percentage of germination showed a significant difference. Tavili et al. (2009) examined the inhibiting effect of *Artemisia sieberi* on the germination properties of *Salsole rigida* and concluded that a significant difference was found between the studied treatments in terms of germination percentage at 1% probability level and germination rate at 5% level. Mohebbi (2012) examined the effect of exclosure and grazing conditions on the mean percentage, rate and time of seed germination of *Atriplex canescens* and concluded that the mean percentage, rate and time of seed germination in both sites showed no significant difference. In other words, seeds in exclosure were the samesites in terms of these traits. Akhavan et al. (2013). In a study on *Bromus tectorum* concluded that seeds of *Bromus tectorum* have high adaptation to environmental conditions and high adaptation of this species made it an invasive plant and in each area can make ecotypes that are compatible with environmental conditions.

According to the results, livestock grazing affected germination percentage of plant species more than germination rate. In this regard, Gholami et al. (2014) by examining the effect of salinity and drought on germination traits of *Secale montanum* at early growth stages concluded that salinity and drought treatment had a significant effect on seed germination percentage and rate. In general, with increasing salinity and drought stress, germination percentage and rate reduced. Bianca et al. (2017) by examining the effect of priming on germination of *Ziziphora* seed concluded that priming does not increase the germination percentage of this species but reduces the germination time. The results showed that habitat conditions (exclosure and grazing) affected germination rate and percentage of some plant species and the rangeland exclosure increased the percentage and rate of germination of *Stipa barbata*, which can be due to the suitable conditions of habitat for this species, low grazing intensity and pressure of this plant, increased seed nutrient and vigor. In this regard, Jangjo and Tavakoli (2008) stated that a logical relationship was found between the successful germination treatment and studied habitat conditions. In this regard, several studies have also been conducted (the effects of salinity, potassium nitrate, gibberellic acid hormones, propylene glycol, sulfuric acid, soaking in water, placement in wet sand, low temperature (cooling) and high temperature (heating) on rangeland seed germination. However, it is predicted that a combination of

different levels of these treatments will increase the germination percentage of these plants.

REFERENCES

Akhavan Armaki M, Azarinvand H, Osareh M, Jafari A, Tavili A (2013) Investigation of effects of drought stress on germination indicators of four genotypes of *Bromus tomentellus* rangeland species. Rangeland and Watershed J, Iran J Natural Resour 66 (2) : 167—177.

Amiri B, Asareh MH, Jafari M, Rasooli B, Jafari A (2012) Investigation and comparison of the effects of NaCl and Na_2SO_4 on early germination and growth stages in *Salicornia herbacea* and *Alhagi persarum*. Iran Rangeland and Desert Res 19 (2) : 233—243.

Azarnivand H, Zare Chahuki MA (2008) Rangeland Modification. Tehran : Tehran University Press.

Basiri M, Iravani M (2009) Vegetation changes after 19 years of experimental exclosure in Central Zagros. Rangelands 3 (2) : 155—170.

Bianca A Santini, Mariana Rojas-Aréchiga, Erick Garcia Morales (2017) Priming effect on seed germination : Is it always positive for cacti species ? J Arid Environ 147 (2017) : 155—158.

Ganjali A, Ajurlou M, Khaksefid A (2017) The effect of drought and salinity stresses on seed germination of *Ayyusum homalocarpum*. J Pl Breed 9 (21) : 139—146.

Ghaemi MT, Akbarzadeh M, Abedi SH (2012) Study on the vegetation changes of natural rangelands in semi-steppe area of Bilehvar, Khoy, West Azerbaijan Province. Iran J Range and Desert Res 14 (1) : 88—96.

Ghasemi Arian A, Izadi J, Saeid Afkham al-Shoara M, Ejlali R (2008) Evaluation of seed germination of Dorema ammoniacum. Quart J Res on Rangeland and Desert Iran 15 (4) : 455—463.

Gholami P, Ghorbani J, Shokri M (2014) Investigation of changes in species diversity of Sorpa and Soil Seed Bank in Exclosure areas in Mahoor rangelands of Fars Province. Scient Res J Iran Rangeland and Desert Res 4 : 745—755.

Harris JA, Diggelen RV (2006) Ecological restoration as a project for global society. In : Andel JV, Arowson J (eds). Restoration Ecology. Black Well Publishing Company, pp : 3—28.

Holechek JL, Pieper RD, Herbel CH (2003) Range Management, Principle and Practices. 5th edn. Prentice Hall, USA, pp 607.

Jafarian Z, Ahmadi A (2015) Germination of two rangeland species *Helichrysum globiferum* and *Helichrysum aucheri* under drought stress. Quart J Natural Ecosyst Iran 6 (4) :1—10.

Jangjo M (2009) Rangeland improvement. Mashhad : Jahad University Press.

Jangjo Barzelabad M, Tavakoli M (2008) Study of seed germination in 10 rangeland and desert species. Scientific J Iran, Rangeland and Desert Researches 15 (2) : 215—226.

Jefferson LV, Penachechio M (2003) Allelopathic effects of foliage extracts from four chenopodiacea species on seed germination. J Arid Environ 55 : 275—285.

Kamonporn Panngoma, Thanyarat Chuesaard, Natchathorn Tamchan, Thitima, Jiwchan, Kantirat Srikongsritong, Gyung soon Park (2018) Comparative assessment for the effects of reactive species on seed germination, growth and metabolisms of vegetables. Scientia Horticulturae 227 (2018) : 85—91.

Khajeh Hosseini M, Jangjo M, Anvar Khah S, Sanjabi S (2012) Study of seed germination and dormacy of several rangeland species of legumes and grasses in rangelands of North Khorasan Province. Second Nat Conf on Seeds Sci and Technol, Mashhad.

Khoshkholghsima A, Ali Tabar R, Eghbalinejad M, Babazadeh P, Tale Ahmad S (2013) The effect of salinity on barly germination and tolerance to salinity. Iran J Agric Res 11 (1) : 107—120.

Linjun Yao, Anne Naeth M, Federico PO Mollard (2017) Ecological role of pyrolysis by-products in seed germination of grass species. Ecol Engg.108 (2017) : 78—82.

Mesdaghi M (2007) Range Management in Iran. Astane Ghodse Razavi Press, pp 334 (In Persian)

Moghadam MR (2000) Range and Range Management. Tehran University Press, pp 470 (In Persian).

Mohebbi Z, Tavili A, Zare Chahuki M, Jafari M (2012) Allelopathic effect of *Artemisia sieberi* on germination and early growth properties of *Stipa arabica*. J Rangeland Res 4 (2) : 298—307.

Moradi A, Mofidi M (2012) The effect of exclosure on vegetation properties in semi-strip rangelands of Semirom, Isfahan (Case study : Henna exclosure). Rangelands 6 (3) : 272—281.

Mosleh Arani A, Bakhshi Khanyaki GH, Nemati N, Soltani M (2010) Study the effect of salinity stress on seed germination and vigor in three species of *Salsola* (*Salsola abarghuensis, Salsola arbuscula, Salsola yazdiana*). Genet Res and Improv Iran Rangelands and For Pl 18 (2) : 267—279.

Rasouli B, Amiri B, Jafari M, Osareh M (2011) Study the effect of two NaCl and Na_2So_4 salts on germination and early growth stages of *Seidlitzia rosmarinus*. Quart J Res on Rangeland and Desert Iran 18 (4) : 505—514.

Ruiting Gu, Yi Zhou, Xiaoyue Song, Shaochun Xu, Xiaomei Zhang Haiying Lin, Shuai Xu, Shuyu Zhu (2017) Effects of temperature and salinity on Ruppia sinensis seed germination, seedling establishment and seedling growth. Mar Poll Bull. Available online 16 Aug 2017.

Sabzi M, Naseri H (2012) Comparison of percentage and rate of germination in *Salsola orientalis* halophyte species and *Alyssum sibiricum* glycophyte species. Third Nat Student Conf on Rangeland Watershed and Desert.

Sabzi M, Naseri H, Azarnivand H, Jafari M (2014) The effect of different levels of salinity on seed germination and retrieval of three rangeland species of Markazi Province (*Salsola rigida, Kochia prostrata, Eurotia ceratoides*). Seed Res (Seed Sci and Technol) 4 (1) : 66—75.

Safaian R, Azarinvand H (2010) Study the effect of some treatments on dormancy break and seed germination of *Prangos ferulacea*. Iran Rangeland and Desert Res 17 (2) : 331—339.

Shahbazi A, Matin Kah H, Bashari H, Tarkesh Isfahani M (2016) Evaluation of germination traits of *Hedysarum criniferum* Boiss in terms of periodic temperature and drought stress. Appl Ecol 5 (15) : 27—36.

Shamsaei M, Soodaye Zadeh H, Tajamolian M (2016) The effect of drought stress on maternal plant on some germination indicators of *Satureja hortensis* L. Seeds Desert Manag J (8) : 27—35.

Shamsi F, Roshandel P, Kharazian N (2015) The effect of different treatments on seed dormancy break and stimulation of germination of *Atriplex leucoclada* Boiss. J Pl Res (Iran J Biol) 28 (5) : 1043—1053.

Soltanipour M, Asadpour R, Bagheri R (2011) Study of the effect of pre-emergence treatments on seed germination traits of *Zygophyllum atriplicoides*. Environm Erosion Res (2) : In press.

Stefania Nin, Willian Antonio Petrucci, Massimo Del Bubba, Claudia Ancillotti, Edgardo Giordani (2017) Effects of environmental factors on seed germination and seedling establishment in bilberry (*Vaccinium myrtillus* L.). Scientia Horticulturae, Vol 226, 19 Dec 2017, pp 241—249.

Tabatabai A, Kochaki A, Mullasadghi J (2013) Evaluation of salinity tolerance of barley cultivars under laboratory and field conditions. J Pl Growth Physiol 5 (20) : 87—101.

Taqipoor A, Khaje-al-din S, Bashari H, Tahmasebi P, Iravani M (2014) The effect of fire products on seed germination of three prevailing species in semi-steppe rangelands of Central Zagros. Appl Ecol 3 (9) : 71—79.

Tavili A, Janat Rostami M, Ebrahami Dariche K (2009) Study the inhibiting effect of *Artemisia sieberi* inhibition on germinating properties of *Salsola rigida* . Rangeland and Desert Res Iran 16 (3) : 409—418.

Zamora J, Verdu JR, Galante E (2007) Species richness in Mediterranean agro ecosystems : Spatial and temporal analysis for biodiversity conservation. J Biol Conserv 134 : 113—121.