Effects of Seed Source and Soil Texture on Germination and Survival of *Nepeta asterotricha* as a Medicinal Plant

Mohammad Ali Hakimzadeh Ardakani\textsuperscript{A}, Mohammad Hossein Hakimi\textsuperscript{B}, Hamid Sodaeizadeh\textsuperscript{C}

\textsuperscript{A}Assistant Professor, Faculty of Natural Resources, Yazd University, Yazd, Iran (Corresponding Author), Email: hakim@yazd.ac.ir
\textsuperscript{B, C}Assistant Professor, Faculty of Natural Resources, Yazd University, Yazd, Iran

Received on: 21/11/2015
Accepted on: 15/04/2016

**Abstract.** *Nepeta* species are widely used as medicine plants because of their anti-spasmodic, diuretic, anti-septic, anti-asthmatic anti spasmodic, and tonic effects. *Nepeta* species also have anti-bacterial, anti-fungal, anti-viral and anti-inflammatory activities. Germination and seedling growth are two important stages of the plant development and plant survival. Soil texture is one of the environmental factors, which affects the germination mechanism. In order to evaluate the effects of seed source and soil texture on the germination of *N. asterotricha* as a medicinal plant, an experiment was conducted in a factorial arrangement based on a completely randomized block design with four replications in 2014. The studied factors included different sources of seed collection (Sanij, Dehbala, Dareshir, Tezerjan) and three types of soil texture (Sand, Sandy loam and Silty clay). Results indicated that *N. asterotricha* germination was affected by the origin of seed source (altitude, direction, and slope). Seeds collected from Sanij and Tezerjan had the highest and lowest germination percent, respectively. Among different soil textures, soils with sand and sandy loam texture had the best performance. Results showed significant effects of seed sources and soil texture interaction affects the seed germination percent and germination rate (p≤0.01). Seed sources had different responses to soil textures indicating that seed collected from different areas may be compatible with specific soil texture. In general, the light soil textures had better effects on seed germination traits of *N. asterotricha*.

**Key words:** *N. asterotricha*, Seed source, Soil texture, Survival
Introduction
The genus Nepeta (Lamiaceae) comprises 280 species that are distributed over a large part of central and southern Europe, West, central, and Southern Asia. About half of the existing species have been recorded in Iran. Topographic factors and diverse edaphic conditions in Iran are responsible for the diversity of microclimate that favors more than 8000 plant species (Haghighi and Mozafarian, 2011).

There are 75 species from Nepeta spp. genus. Nepeta species are widely used in folk medicine because of the antispasmodic, diuretic, antiseptic, antitussive, antiasthmatic, ethnobotanical, diaphoretic, vulnerary, antispasmodic, and tonic effects (Micelia et al., 2005). Surveying the essential oil of 38 Nepeta species (including native and endemic species) has been reported in Iran (Asgarpanah et al., 2013). Nepeta species has the anti-bacterial, anti-fungal, anti-viral and anti-inflammatory activities (Dinesh et al., 2010) and can be used as an analgesic, antitussive, carminative, digestive, laxative and sedative one (Formisano and Senatore, 2011). Pardure (2004) investigated chorological and ecological aspects of N. nuda. He stated that this species grows in the fields, meadows and glades.

Nadjafi et al. (2009) investigated N. binaludensis autecology. The results indicated that this plant grows in north-facing slopes with more than 50% and 2300-2700 m elevations. They also found that it prefers the mean annual rainfall ranging from 350 to 370 mm and annual mean temperature of 6 to 7°C and grows in light soils with a neutral pH and low mineral content. However, this plant still undergoes the domestication and one limitation in the large-scale cultivation is the scarcity of scientific research on the germination of Nepeta species. Significant factors for seed germination and good seedling establishment in the field are source of seed and soil type. Devagiri et al. (2007) in the assessment of 20 seed sources of Nepeta revealed that the seed source had a significant impact on the seedling length, number of shoots on each seedling and seedling biomass. Asgari et al. (2015) investigated the chilling effects on characteristics of seed germination, vigor and seedling growth of Nepeta spp. species. Their results showed that one-month chilling had positive effects on seed vigor index and two-month chilling had positive effects on seedling fresh weight of Nepeta spp. as compared to that of control treatment.

Mamo et al. (2006) evaluated the variations in seed and germination characteristics among nine Juniperus procera populations in Ethiopia. In the laboratory, the effect of light conditions on seed germination has been tested by incubating the seeds under continuous light or darkness. The results showed that there was a significant difference between the germination rates of nine Juniperus procera populations under different light conditions.

Ginwal et al. (2005) in the evaluation of Jatropha curcas reported that the seed source has a significant impact on the germination characteristics (germination percent, germination rate and germination ability) and seedling growth characteristics such as seedling height and dry weight.

Singh et al. (2004) had collected seeds of Celtis australis from 13 different sources ranging from 550 to 1980 m above sea level in Central Himalaya, India and concluded that there was a significant difference between different sources in the case of germination rate, average time of germination rate, germination and germination index.

Cecil and Fare (2002) studied the growth and quality of Quercus phellos and Q. shumardii in Mississippi and concluded that seedlings originating from southern regions (warmer regions)
survived and grew more than seedlings from northern regions (colder regions). Studying the effects of seed age and soil texture on the germination of some Ludwigia species (Onagraceae) in Nigeria showed that some soil types could significantly reduce the germination (Oziegbé et al., 2010). Ebrahimi (2012) reported that germination, growth and uptake of heavy metals by Hordeum bulbosum L. in the contaminated soils were affected by dose, dependent responses to the contaminated soils such as reduction in germination rate, height of root and shoot and biomass. Studying the effect of soil texture on Jatropha curcas seed germination and survival indicated that the highest rate of germination, germination index and seedling establishment had been found in sandy and sandy loam soils (Ofelia Andrea et al., 2013).

Mohajeri et al. (2014) evaluated the seed germination of Lilium ledebourii after cryopreservation. They concluded that the cryopreservation technique was an important approach for the long-term preservation of seeds of this endangered species.

Gulshan and Dasti (2012) examined the role of soil texture and depth in the germination of six types of weed seed species of legumes, two grass species, Fumaria species and the other one from Rubiaceae species. They stated that the maximum germination rate has occurred in the depth of 2 cm of sandy loam soil. Their results showed a significant positive correlation between the germination and soil texture and soil texture had a key role in the maximum germination rate. Darier et al. (2014) investigated the effect of soil type on the allelopathic activity of Medicago sativa L. and showed that the soil type was an important factor in the allelopathic effects of alfalfa on broad beans. Pahla et al. (2014) evaluated the effects of soil particle (clay, sand) and various treatments before planting on the germination and vigor of Acacia sieberana plant and concluded that the seeds treated with sulfuric acid in 60 minutes and planted in sandy soil had the highest germination percent and the shortest time (6 days) of germination.

According to the investigations, the role of soil texture and seed source in the germination of N. asterotricha seeds has not been investigated in Yazd province, Iran. The aim of this study was to evaluate the effects of soil texture and seed source on the germination of N. asterotricha species.

Materials and Methods

Study area

N. asterotricha is an endemic plant, which grows only in Yazd province of Iran. Therefore, seeds have been collected from four habitats in the eastern longitudes of 54° 1' 29" to 54° 9' 39" and northern latitudes of 31° 34' 31" to 31° 38' 20". The mean annual precipitation of study area in the past thirty years was 61.7 mm. The mean annual temperature was 18.1°C and maximum and minimum temperatures were +46.5°C and -15.5°C, respectively. This area has a cold and dry climate according to Emberger climate classification and according to the Demarton classification, its climate is ultra-dry cold (Dashtakian and Abolghasemi, 2003). In terms of natural vegetation, the study area is considered as an area without vegetation although some spaced and single plants of Salsola tomentosa, Anabasis setifera, Artemisia sieberi, Stipagrostis plumosa and Launaea acanthodes are observed on the path of channels (Baghestani Maybodi et al., 2015). The habitats slope of this species ranges from 5 to 80% in the northern, northeastern, western, and eastern slopes (Table 1).

The study of phenology stages of N. asterotricha in Dehbala with the elevation about 2779 m above sea level showed that the plant growth begins in
late March and continue until late May. Flowering begins in early June but it has been completed gradually during July. Seed formation occurs in late June and seed maturity date is mid-July. Due to weather conditions, dormancy period begins in November and will continue until mid March.

Table 1. Topography characteristics and location of *N. asterotricha* (Seed collection)

<table>
<thead>
<tr>
<th>Source</th>
<th>Altitude (m)</th>
<th>North latitudes</th>
<th>East longitudes</th>
<th>Slope (%)</th>
<th>Geographical directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanij</td>
<td>2503</td>
<td>31° 38' 20&quot;N</td>
<td>54° 01'29&quot;E</td>
<td>10-30</td>
<td>Northeast</td>
</tr>
<tr>
<td>Deh bala</td>
<td>2779</td>
<td>31° 34' 58&quot;N</td>
<td>54° 05'25&quot;E</td>
<td>10-30</td>
<td>Northwest</td>
</tr>
<tr>
<td>Dareh shir</td>
<td>2485</td>
<td>31° 37' 27&quot;N</td>
<td>54° 01'52&quot;E</td>
<td>5-30</td>
<td>Northeast</td>
</tr>
<tr>
<td>Tezerjan</td>
<td>2475</td>
<td>31° 34' 31&quot;N</td>
<td>54° 09'39&quot;E</td>
<td>10-80</td>
<td>East- northeast</td>
</tr>
</tbody>
</table>

**Soil selection and Characterization**

Three soils were selected with different textures: sand, sandy loam and silt clay. Soil organic carbon (OC) was determined by Walkey-Black method (1934). Soil pH and electrical conductivity (EC) were determined in the saturated paste. Soil CaCO$_3$ was measured by titration method with acid, AFNOR (1987) (Table 2).

Table 2. Some physical and chemical properties of soils

<table>
<thead>
<tr>
<th>Texture</th>
<th>Sand%</th>
<th>Silt%</th>
<th>Clay%</th>
<th>CaCO$_3$%</th>
<th>OC %</th>
<th>pH</th>
<th>EC dSm$^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>82</td>
<td>10</td>
<td>8</td>
<td>12</td>
<td>0.26</td>
<td>7.40</td>
<td>0.90</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>65</td>
<td>23</td>
<td>12</td>
<td>24.90</td>
<td>0.45</td>
<td>7.51</td>
<td>1.10</td>
</tr>
<tr>
<td>Silty Clay</td>
<td>20</td>
<td>39</td>
<td>41</td>
<td>37.50</td>
<td>0.81</td>
<td>7.76</td>
<td>1.80</td>
</tr>
</tbody>
</table>

**Experimental site and seed sowing**

The survey was conducted in the greenhouse of Natural Resources College in Yazd University, Iran in 2014. The experiment was performed in the pots in a factorial experiment based on the completely randomized design with four replications. The first factor was the seed source collected from four habitats (Sanij, Dehbala, Darehshir, Tezerjan) and the second factor was soil texture (sand, sandy loam, silt clay). The soil in each pot was watered daily up to the field capacity of each soil type in order to maintain the constant soil moisture levels in each container.

**Data collection**

The germinated seeds were accounted daily from the fourth day until 18th day when no further germination was observed. The survival rate was calculated from the number of seedlings surviving for a period of 14 days by the following formula (Equations 1&2&3).

\[ GP\% = \frac{\sum G_n}{n} \times 100 \quad (1) \]

Throneberry and Smith (1955)

Where:

- **GP%**= Germination Percentage
- **G**= the number of germinated seeds
- **n**= the total number of seeds

\[ \text{GR} = \sum \frac{Si}{Di} \quad (2) \]

Agrwal (2003)

Where:

- **GR**= Germination rate
- **Si**= number of germinated seeds in each count
- **Di**= number of days to the nth counting

\[ VI = \frac{\% GP \times MSH}{100} \quad (3) \]

Vashisth and Nagarajan (2010)

Where:

- **VI**= seed vigor index
- **%GP**= germination percent
- **MSH**= Mean seedling length (root+shoot) Allometric coefficient might be used as the drought tolerance. It was estimated using Agrwal (2005) formula (4).

\[ A\ C = \frac{\text{shoot dry weight}}{\text{root dry weight}} \quad (4) \]

Uniformity of germination (GU) is the amount of time it takes to germinate from 10 to 90% of maximum germination so that the less time indicates more uniform
germination of seeds. It has been estimated as follows (Soltani and Maddah, 2010):

\[ GU = D90 - D10 \]  

Where:

GU=Uniformity of germination

D10 and D90, day times that take seed germinate from 10% to 90%.

**Statistical analysis**

Data analysis was carried out using SPSS16 software and graphs were drawn using excel software. A two-way analysis of variance was performed and means comparisons were made using Duncan method. Normality and homogeneity of variance were tested using Kolmogorov-Smirnov test. Uniformity of germination has been calculated by Germin software.

**Results**

The results of analysis of variance are presented in Table 3. Results showed that there were significant differences between sources of seeds for germination percent, germination rate, seed vigor index, and allometric coefficient \( (p \leq 0.01) \). The effects of soil texture were also significant for germination percent, germination rate, seed vigor index, allometric and uniformity of germination \( (p \leq 0.01) \). Interaction effects of seed source and soil texture were significant for germination percent and germination rate \( (p \leq 0.01) \) (Table 3).

Means comparison between different germination traits for three soil textures of *N. asterotricha* has been presented in Table 4. The germination percent in the sandy and sandy loam soils was 72.50 and 71.80%, respectively and decreased to 44.40% in the silt clay soil \( (p \leq 0.01) \). Germination rate in the sand and sandy loam soils was 12.40 and 12.80, respectively and reached to 5.90 in the silt clay soil \( (p \leq 0.01) \). The seed vigor indices in the sand, sandy loam and silt clay soils were 31.50, 28.0 and 20.90, respectively. The sand soil texture had been assigned in the first class \( (p \leq 0.01) \). There was no significant difference between other traits in different soil textures.

Means comparison between seed origin (Table 5) showed the seeds collected from Tezerjan had the lowest values for germination percent, germination rate, vigor index and uniformity of germination \( (p \leq 0.01) \). Higher and lower germination percent of 73.3 and 45.8% has been obtained from Sanich and Tezerjan, respectively. Similarly, the germination rate of Sanij seeds was significantly faster than the rate of other regions. The germination rate decreased from 13.5% in Sanij to 9.7% in Dehbala and 9.5% in Dareshir and 8.7% in Tezerjan, respectively \( (p \leq 0.01) \). In Dehbala, the seeds had more vigor index than the seeds of other regions \( (p \leq 0.01) \). The results of Uniformity of germination (GU) showed the significant effect of soil texture \( (p \leq 0.05) \) (Table 3). Higher values of both D10 and D90 have been obtained in sandy loam soils (Table 4). However, the difference of D90 - D10 was lower for both sandy and sandy loam soils. The obtained values were of the same trends as other seed characteristics \( (p \leq 0.05) \). Interaction effects of soil texture and source of seeds were significant for germination percent and germination rate \( (p \leq 0.01) \) (Table 6) indicating that seed collected from different regions or altitudes had different responses of germination in soil texture. The seeds collected from Sanij and Dehbala had more performance in sandy loam whereas the seeds collected from Dareh shir and Tezerjan had better germination in sand soils (Table 6 and Fig. 1). In contrast for the other traits, the soil texture had the same response for all the regions (Table 6 and Fig. 1). These results showed that the assessment of both soil texture and sources of seed is necessary for the prediction of *N. asterotricha* responses.
### Table 3. Analysis of variance and the level of MS significant of four seed sources and three soil textures and their interactions of N. asterotricha grown in glasshouse condition

<table>
<thead>
<tr>
<th>Sources of variation</th>
<th>DF</th>
<th>Germination Source</th>
<th>Germination Rate</th>
<th>Source</th>
<th>Seed Vigor Index</th>
<th>Allometric Coefficient</th>
<th>D10</th>
<th>D90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>3</td>
<td>1507.63**</td>
<td>51.283**</td>
<td>Sand</td>
<td>340.07**</td>
<td>1063.56**</td>
<td>1.48s</td>
<td>2.75s</td>
</tr>
<tr>
<td>Texture</td>
<td>2</td>
<td>4375.00**</td>
<td>245.84**</td>
<td>Dehbala</td>
<td>576.29**</td>
<td>874.44</td>
<td>27.58s</td>
<td>41.10s</td>
</tr>
<tr>
<td>Source x Texture</td>
<td>6</td>
<td>222.22**</td>
<td>41.79**</td>
<td>Sanij</td>
<td>97.43</td>
<td>299.57</td>
<td>3.55s</td>
<td>3.47s</td>
</tr>
<tr>
<td>Error</td>
<td>36</td>
<td>9.02</td>
<td>1.27</td>
<td></td>
<td>61.6</td>
<td>166.8</td>
<td>1.69</td>
<td>1.94</td>
</tr>
</tbody>
</table>

** Significant at the 1% level, * significant at 5%

### Table 4. Comparison between different germination traits for three soil textures of N. asterotricha in glasshouse condition

<table>
<thead>
<tr>
<th>Soil Texture</th>
<th>Germination Source</th>
<th>Germination Rate</th>
<th>Seed Vigor Index</th>
<th>Allometric Coefficient</th>
<th>D10</th>
<th>D90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>72.50</td>
<td>12.35</td>
<td>31.51</td>
<td>23.16</td>
<td>0.88b</td>
<td>4.02c</td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>71.87</td>
<td>12.82</td>
<td>28.02</td>
<td>21.10</td>
<td>3.17a</td>
<td>7.16a</td>
</tr>
<tr>
<td>Silty clay</td>
<td>44.37</td>
<td>5.92</td>
<td>20.94</td>
<td>20.73</td>
<td>0.56a</td>
<td>6.25ab</td>
</tr>
</tbody>
</table>

Means with the same letter are not significantly different (p≤0.05)

### Table 5. Comparison between different germination traits of four seed sources of N. asterotricha in glasshouse condition

<table>
<thead>
<tr>
<th>Seed Source</th>
<th>Germination Source</th>
<th>Germination Rate</th>
<th>Seed Vigor Index</th>
<th>Allometric Coefficient</th>
<th>D10</th>
<th>D90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanij</td>
<td>73.33</td>
<td>13.51</td>
<td>25.87</td>
<td>27.66</td>
<td>1.96a</td>
<td>5.75a</td>
</tr>
<tr>
<td>Deh bala</td>
<td>66.66</td>
<td>9.73</td>
<td>32.57</td>
<td>24.27</td>
<td>1.73a</td>
<td>6.13a</td>
</tr>
<tr>
<td>Dareh shir</td>
<td>65.83</td>
<td>9.50</td>
<td>28.39</td>
<td>20.22</td>
<td>1.96a</td>
<td>6.00a</td>
</tr>
<tr>
<td>Tezerjan</td>
<td>45.83</td>
<td>8.70</td>
<td>20.47</td>
<td>27.66</td>
<td>1.16b</td>
<td>6.04b</td>
</tr>
</tbody>
</table>

Means with the same letter are not significantly different (p≤0.05)

### Table 6. Comparison between soil textures by seed source interaction effects for different germination traits of N. asterotricha in glasshouse condition

<table>
<thead>
<tr>
<th>Source</th>
<th>Texture</th>
<th>Germination Source</th>
<th>Germination Rate</th>
<th>Seed Vigor Index</th>
<th>Allometric Coefficient</th>
<th>D10</th>
<th>D90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanij</td>
<td>Sand</td>
<td>82.50</td>
<td>14.07b</td>
<td>25.94</td>
<td>13.87d</td>
<td>0.20c</td>
<td>2.65d</td>
</tr>
<tr>
<td></td>
<td>Sandy loam</td>
<td>95.00</td>
<td>16.17</td>
<td>32.09</td>
<td>9.36d</td>
<td>3.15ba</td>
<td>6.26ab</td>
</tr>
<tr>
<td></td>
<td>Silty clay</td>
<td>42.50</td>
<td>10.30</td>
<td>19.58</td>
<td>20.27bc</td>
<td>1.60bc</td>
<td>5.57b</td>
</tr>
<tr>
<td>Dehbala</td>
<td>Sand</td>
<td>72.50</td>
<td>10.21</td>
<td>40.92</td>
<td>26.73ab</td>
<td>0.40c</td>
<td>4.21c</td>
</tr>
<tr>
<td></td>
<td>Sandy loam</td>
<td>82.50</td>
<td>15.77</td>
<td>34.92</td>
<td>32.68a</td>
<td>3.87a</td>
<td>7.47a</td>
</tr>
<tr>
<td></td>
<td>Silty clay</td>
<td>45.00</td>
<td>3.21</td>
<td>21.86</td>
<td>23.58abc</td>
<td>1.92c</td>
<td>5.28b</td>
</tr>
<tr>
<td>Dareh shir</td>
<td>Sand</td>
<td>80.00</td>
<td>10.96</td>
<td>29.30</td>
<td>27.75ab</td>
<td>1.47c</td>
<td>5.51b</td>
</tr>
<tr>
<td></td>
<td>Sandy loam</td>
<td>72.50</td>
<td>12.35</td>
<td>28.44</td>
<td>20.50c</td>
<td>1.80c</td>
<td>7.58a</td>
</tr>
<tr>
<td></td>
<td>Silty clay</td>
<td>52.50</td>
<td>5.20</td>
<td>27.44</td>
<td>24.58abc</td>
<td>0.58c</td>
<td>7.06a</td>
</tr>
<tr>
<td>Tezerjan</td>
<td>Sand</td>
<td>55.00</td>
<td>14.15</td>
<td>29.88</td>
<td>24.31abc</td>
<td>1.44c</td>
<td>3.62cd</td>
</tr>
<tr>
<td></td>
<td>Sandy Loam</td>
<td>45.00</td>
<td>6.98</td>
<td>16.62</td>
<td>21.87abc</td>
<td>3.86a</td>
<td>7.32a</td>
</tr>
<tr>
<td></td>
<td>Silty clay</td>
<td>37.50</td>
<td>4.97</td>
<td>14.90</td>
<td>14.50d</td>
<td>1.96c</td>
<td>5.75a</td>
</tr>
</tbody>
</table>

Means with the same letter are not significantly different (p≤0.05)
Discussion
The obtained results showed that among different soil textures, soils with sand and sandy loam textures had the best performance for *N. asterotricha* germination rate; Ofelia Andrea *et al.* (2013) found similar results in a study of *Jatropha* germination. Larger pores and better aeration in sand soil can be two factors of increased germination percent and rate in sandy soils. The results obtained about the seed source indicated that *N. asterotricha* germination was affected by the seed source (altitude, direction and slope) so that Sanij and Tezerjan seeds had the highest and lowest

---

**Fig. 1.** Trends of soil texture in four seed sources for germination percent, germination rate, seed vigor index, allometric Coefficient, D10 and D90 of *N. asterotricha* in glasshouse condition
germination percent, respectively. In most references, it was reported that the seeds of a species collected from different sources or altitudes are different in germination, growth and production efficiency (Isik, 1986; Todaria and Negi, 1995). Ginwal et al. (2005) found that the seed source had a significant impact on the germination characteristics. Singh et al. (2004) had collected seeds of Celtis australis from 13 different sources ranging from 550 to 1980 m above sea level in central Himalaya, India and concluded that there was a significant difference between different sources in the case of germination rate, average time of germination and germination index.

In General, germination characteristics such as germination percent, germination rate, seed vigor index, allometric coefficient and uniformity of germination have been considered as the indicators of seedling growth and development. In addition, the germination percent and seedling length were considered as the criteria for evaluating the vigor index in the early stages of plant growth and in many plant species, the correlation between these characteristics and seed vigor has been proved (Hampton and Tekrony, 1995). In their research, it was found that the amount of these characteristics has been influenced by the seed source (elevation above the sea level, direction and slope) so that with the increased slope percent and geographical direction, the amount of these characteristics decreased steadily. In this regard, Cecil and Fare (2002) had studied the growth and quality of Quercus phellos and Q. shumardii in Mississippi and concluded that seedlings originating from southern regions (warmer regions) would survive and grow more than seedlings from northern regions (colder regions). Isik (1986) in the study of Pinus brutia, and Tabari et al. (2006) in the study of Acer velutinum showed that the seeds in high elevation (colder regions) germinated more slowly had lower germination percent and smaller seedlings as compared to the seeds from low and middle elevations (warmer regions). Such differences may be seen in the seed source due to different conditions and environmental resources (nutrition, light or water) which are available for native plants during the growing season (Todaria and Negi, 1995). However, outside the greenhouse, the ability of seed germination is also depended on environmental factors such as length of day, temperature and light quality. The temperature is important so that sometimes, even a slight increase in temperature (during development stage or seed ripening) will significantly affect the ability of seed germination.

Conclusion
Nepeta species has anti-bacterial, anti-fungal, anti-viral and anti-inflammatory activities and can be used as an analgesic, anti tussive, carminative, digestive, laxative and sedative one. Therefore, the conditions of growth and reproduction of this species are important. Seed source and soil type have been found to affect the germination of N. asterotricha.

In this research, we found that the amounts of these characteristics have been influenced by the seed source (elevation above the sea level, direction and slope) so that with the increased slope percent and geographical direction, the amount of these characteristics decreased steadily. The results obtained about the seed source indicated that N. asterotricha germination has been affected by the seed source (altitude, direction and gradient) so that Sanij and Tezerjan seeds had the highest and lowest germination percent, respectively. Moreover, soil texture significantly affects the germination activity so that among different soil textures, soils with sand and sandy loam textures had the best performance.
Acknowledgements
We are grateful to the Research Council of Natural Resources Faculty of Yazd University, Iran for their support.

Literature Cited


تأثیر منبع بذر و بافت خاک بر سبز شدن گیاه دارویی پونه‌سای چرک ستاره‌ای (Nepeta asterotricha)

Mohammad Hossein Hakimzadeh Ardakani, Mohammad Reza Hakimzadeh Ardakani, Amir-Hossein Amini, Reza Mohammadi, Mohammad Reza Pakshir, Mohsen Hosseini, and Reza Mohammadi.  

چکیده. گونه‌های مختلف جنس گیاه Nepeta در طب سنتی در سطح وسیعی به دلیل داشتن خواص مفیدی مانند تقویت کننده سیستم ایمنی، ضد عفونی، ضد اسپاسم، ضد اردنگی و ضد التهابی، در درمان بیماری‌های مختلف ویژه گیاه‌داری، مورد استفاده قرار می‌گیرند. همچنین این گیاه دارویی فعالیت‌های مهمی در گیاه‌شناسی در برگزاری برای نمونه گیاه بوده و نمونه گیاه واکنش به آنها است. از طریق بافت خاک یکی از عوامل محیطی موثر بر گیاه‌شناسی می‌باشد. به منظور بررسی تأثیر مبدأ بذر و بافت خاک بر سبز شدن بذر گیاه دارویی پونه‌سای چرک ستاره‌ای، آزمایشی بطور تکرار طرح فاکتوریل در قالب طرح کاملاً تصادفی با چهار تکرار در سال 1394 اجرا شد. فاکتورهای مورد بررسی شامل منبع بذر و بافت خاک بودند. در این آزمایش بافت‌های لوام شنی، لوام برنجی و رسی سیلتی بهترین عملکرد را نشان دادند. نتایج نشان داد که نسبت به منابع بذر، منابع بذر گیاه‌های مختلف و بافت خاک می‌توانند نقش مهمی در سبز شدن و کاهش بوده و در نهایت به بهره‌وری در گیاه‌شناسی و بهبود کیفیت محصولات طبیعی کلیكی گذاشته سبز شدن گیاه دارویی پونه‌سای چرک ستاره‌ای بهترین تاثیر را دارند.

کلمات کلیدی: پونه‌سای چرک ستاره‌ای، منبع بذر، بافت خاک، سبزی‌سازی