Survey some physiological characteristics of medicinal plant *Scrophularia striata* Boiss in Ilam province

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### A B S T R A C T

The scrophularia plant (*Scrophularia striata*) is a perennial plant of the Scrophulariaceae, which has five species in Iran. In order to study the physiological characteristics of Scrophularia striata Boiss., its habitat was collected in Ilam province in 2016. A sampling of 8 populations was carried out in which 10 samples were collected from each population and dried in shadows. Then, the traits were evaluated for each plant including dry weight of fruit, stem dry weight, shoot dry weight and essential oil content. Data were analyzed by Excel and MSTAT-C software. The findings of this study showed that in the scrophularia plant, the effect of the studied populations on shoot dry weight was statistically significant. The results of this study showed that in the scrophularia plant, the effect of the populations studied on the essential oils was statistically significant. The results of this study showed that the highest amount of essential oil in the population of Saleh Abad was 1.06%. Also, the lowest essential oil content was obtained in the population of Abdanan at 90%. In general, the results showed that other essential traits of other traits were significantly affected by scrophularia populations. Populations of hemp and helminth showed the highest dry weight of different organs and chlorophyll content. The population of Saleh Abad, which had a low abundance in most traits, showed the highest amount of essential oil. The results of this study can be used to plant a scrophularia medicinal herb and determine the best population in terms of essential oil content.

### Key words: Ilam, Scrophularia striata, Physiologic, Dry weight

### Introduction

Scrophularia plant *Scrophularia striata* is one of the most important herbs in the family of mummies, with three subfamilies and 222 genera and 4480 species in the world. In Iran, scrophularia has 60 species and subspecies of one year, two years old and several years old, 28 of which are exclusively Iranian. In Iran, a scrophularia plant grows more in the cold and mountainous populations of Zagros. Antimicrobial properties (Xue et al., 2004), treatment and repair of wound healing and common bacterial infections have been reported (Giner et al., 2000). Scrophularia is used in traditional medicine for the treatment of stomach, respiratory and liver disorders, and is used as an anti-inflammatory drug. In India, the plant is used to treat diabetes, and the people of Nepal use the *S. unpoensis* to treat colds, fever, headaches, eye diseases, illnesses, and digestive and anticancer disorders (Miazava et al., 2003). Since this plant is known in the province of Ilam as the scrophularia local name, traditionally used to boil and simmer this plant to treat superficial, deep, cold and high blood pressure treatments, the same An investigation has been carried out on the antimicrobial effects of various herbs on some of the microorganisms and has shown that some of the extracts of this plant have antimicrobial activity against selected microorganisms (Amiri et al., 2011).

Considering the importance and role of medicinal plants in different industries, increasing the production of biomass and their effective substances without the use of chemical inputs is one of the essential requirements for their sustainable production. Regarding the investigation of the secretion structures of the genus Scrophularia, significant studies have been done, and in most of them, the presence of idioblast in the species of this genus has been confirmed, as the research has shown that out of 89 species Sixty-six species of Scrophularia have an idioptic secretion structure found on the upper and lower surfaces of leaves and stems and contain substances such as resins and volatile compounds such as essential oils (Bahamin et al, 2013; Monsef esfahani et al, 2010).
Tasdemir et al (2008) in a study on the physiological and phytochemical evaluation of Iranian Rhana massifs in order to identify and select the best plant populations, the mean square of the studied traits showed that the factor of year only affects the morphological traits of the plant, that is, the limb Air and root have a meaningful effect (at 1% level). The highest amount of active ingredient of alizarin belonged to Torbat Jam (0.38%) and Zanjan (0.39%) and the least amount was in Saveh mass (0.17%). A simple survey among the evaluated traits showed that no correlation was significant. Cluster analysis and decomposition to the main coordinates were also used to assess geographical distribution compliance with other characteristics.

Considering the importance of different species of dark mimosa and the necessity of preserving and preserving its medicinal species, no study has ever been conducted on the evaluation of biodiversity on phytochemical and morphological characteristics of Scrophularia striata Boiss is in Ilam province. In the distribution area of Ilam province as one of its important distribution centers for the purpose of domestication and production of suitable populations in order to supply sustainable plant material based on the needs of affiliated industries, therefore, the study of phytochemical and morphological comparisons in separation The populations of this plant can be a suitable line for improvement and improvement of the mentioned cases. The purpose of this study was to identify the essential oil content and to study the secretion of the plant (Scrophularia striata Boiss), which has so far been investigating this issue. The present study can not be considered as the first report in this field to be In general, the aim of this study was to identify the phytochemical and physiological characteristics of the scrophularia medicinal plants (Scrophularia striata Boiss) in Ilam province.

Materials and methods

This research was conducted field experiment (in the most important habitats and natural areas in Ilam province). Phytochemical and morphophysiological study of aerial parts of Scrophularia striata Boiss. The natural habitat was collected in Ilam province in 2016. The aforementioned plant was collected from 8 populations and from each population of 10 plant specimens and dried under shade conditions. The traits were evaluated for each plant including dry weight of fruit, dry weight of shoot, dry weight of shoot and essential oil of measured plant. The population of the sample includes 8 major populations in the whole of Ilam province, the largest number of which is available (Table 1).

Since the essential oil of the plant is adhesive and is attached to the internal surfaces of the Klevenger apparatus, the essential oil was isolated from these surfaces by using the hexane solvent, and then the essential oil was isolated from the essential oil by the use of a rotary device, and the hexane was isolated from the essential oil was determined. The weighing method was used to determine the percentage of essential oil, so that a 50 ml clean balloon weighing in the oven at a constant weight was first weighed, then the sample containing essential oil and n-hexane separated from the Clevenger device It was moved. The balloons containing essential oil and hexane were attached to the rotary vaporator to evaporate the n-hexane. The essential oil was then weighed again and weight difference (weight of balloon) and secondary (weight of balloons and essential oils) were calculated. (Omidi Beigi, 2005). Due to lack of facilities and high cost, the components of the essential oil are measured Did not happen.

Table 1: Characteristics of the populations studied in Ilam province

<table>
<thead>
<tr>
<th>Latitude</th>
<th>Longitude</th>
<th>Populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>66° 18' 48&quot;</td>
<td>36° 80' 13&quot;</td>
<td>Abchomahgein</td>
</tr>
<tr>
<td>64° 33' 39&quot;</td>
<td>36° 50' 12&quot;</td>
<td>Pirmohammad</td>
</tr>
<tr>
<td>65° 70' 42&quot;</td>
<td>36° 29' 29&quot;</td>
<td>Halesem</td>
</tr>
<tr>
<td>59° 41' 22&quot;</td>
<td>37° 60' 50&quot;</td>
<td>Koshk</td>
</tr>
<tr>
<td>73° 06' 14&quot;</td>
<td>36° 48' 82&quot;</td>
<td>Abdanan</td>
</tr>
<tr>
<td>60° 98' 49&quot;</td>
<td>37° 07' 32&quot;</td>
<td>Zanjan</td>
</tr>
<tr>
<td>61° 12' 50&quot;</td>
<td>37° 09' 92&quot;</td>
<td>Saleh Abad</td>
</tr>
<tr>
<td>59° 72' 50&quot;</td>
<td>37° 27' 67&quot;</td>
<td>Mirmakan</td>
</tr>
</tbody>
</table>

Also, to dry the samples, weighing the dry weight of the oven at a temperature of 72 °C for 48 hours and drying in order to obtain the effective ingredient by drying in the shade used. Chlorophyllometer (SPAD) was used to measure the cost. In this study, Excel and MSTAT-C software were used to analyze the variance of data. Comparison of meanings was done by LSD test at 5% level.

Results and discussion

Root dry weight

The results of this study showed that in the scrophularia plant, the effect of the studied populations on the dry weight of fruit was statistically significant (Table 2). The results of this study indicated that the highest dry weight of fruit in the population of Abochomagheinwas 6.68 g, which was significant with the majority of other populations. Also, in the Saleh Abad population, the lowest dry weight of the fruit was 42.5 g. Mirmakan population was also in the second place in terms of dry weight of fruit and population of old mohammad in the third place in terms of fruit dry weight, which did not have a significant difference with the population of Abochomaghein (Fig. 1). Health and et al. (2011) in a research study on the genetic diversity of different populations of cumin (Camumium cyminum L.) using morphological traits indicated that root dry matter was significant in different genotypes. The range of yield variation among the studied populations varied from 0.98 g/plant in Sirjan population to 1.33 g/plant in Birjand population.
Table 2: Analysis of variance of studied traits of scrophularia plant

<table>
<thead>
<tr>
<th>Essential oil yield</th>
<th>Essential oil yield</th>
<th>Chlorophyll leaf</th>
<th>Aerial organ in plant</th>
<th>Dry shoot in plant (g)</th>
<th>Dry leaf in plant</th>
<th>Dry fruit in plant</th>
<th>Root dry weight in plant</th>
<th>df</th>
<th>S.O.V</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001ns</td>
<td>0.003ns</td>
<td>2.35ns</td>
<td>0.57ns</td>
<td>0.78ns</td>
<td>0.55ns</td>
<td>0.107ns</td>
<td>2.51ns</td>
<td>4</td>
<td>Rep</td>
</tr>
<tr>
<td>0.002ns</td>
<td>0.097*</td>
<td>35.03**</td>
<td>19.87**</td>
<td>43.71**</td>
<td>19.9**</td>
<td>1.45*</td>
<td>6.79**</td>
<td>7</td>
<td>Population error</td>
</tr>
<tr>
<td>0.009</td>
<td>0.064</td>
<td>185.60</td>
<td>34.12</td>
<td>42.71</td>
<td>34.12</td>
<td>1.098</td>
<td>5.76</td>
<td>28</td>
<td>CV(%)</td>
</tr>
<tr>
<td>10.2</td>
<td>9.3</td>
<td>14.3</td>
<td>9.3</td>
<td>8.5</td>
<td>11.4</td>
<td>9.33</td>
<td>7.22</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**, *, and ns: respectively, at a probability level of 1%, 5% and no significant difference

Dry fruit weight

The results of this study showed that in the scrophularia plant, the effect of the studied populations on the dry weight of fruit was statistically significant (Table 2). The results of this study showed that the highest dry weight of fruit in the population of Abochomaghein was 3.23 grams, which was significant with all other populations. Also, in the Saleh Abad population, the lowest dry weight of fruit was 2.71 g. Mirmakan population was also in second place in terms of dry weight (Fig. 2).

Ajir et al. (2010) stated in a study on Agropyron cristatum that in comparison with ecotypes by Duncan test, the 208p8, 208s, 4056p4 and 619p13 ecotypes in irrigated conditions in irrigated conditions were 1336 to 1138 kg / ha other ecotypes had more performance. In a study comparing morphological and phytochemical characteristics of various (Thymus kotschyanus Boiss. & Hohen) populations with Thymus vulgaris L. specimens, Bebri et al. (2012) stated that the highest production in species Garden thymus was obtained and the genotype of Thymus vulgaris in Isfahan province with the highest production rate was 2200 kg / ha.

Leaf dry weight

The findings of this study showed that the effect of the studied populations on the leaf dry weight was statistically significant in the thymus plant (Table 2). The results of this study showed that the highest leaf dry weight was obtained in Pirmohammad population (3.36 gr), which was significantly different from most other populations. Also, in the Salehabad
population, the lowest leaf dry weight was obtained 3.64 g. Mirmakan population was also placed in the second place in terms of leaf dry weight (Fig. 3).

In a study comparing morphological and phytochemical characteristics of various populations of (Thymus kotschyanus Boiss. & Hohen) with Thymus vulgaris L. specimens, Berry et al. (2012) stated that the highest leaf weight of Thymus vulgaris also belonged to the population of West Azarbaijan. Cluster analysis classified the genotypes into four distinct groups. The first group, which had a longer period of growth, had more stem weight, so it could be argued that increasing the growth period due to the effect on photosynthesis and nutrient uptake could lead to an increase in dry matter. In the present study, hypoglycemic populations in different locations may have a different growth period, which leads to changes in stem dry weight. The leaf dry weight showed a high correlation with the amount of water (Table 5), which can be due to the difference in the amount of photosynthesis, and since increasing photosynthesis leads to an increase in herbicide, it can be expected that this relationship between the population Different types of scrophularia logic.

Figure 3. Comparison of the average leaf dry weight of the plant in different scrophularia populations

**Stem dry weight**

The results of this study showed that in the scrophularia plant, the effect of the studied populations on stem dry weight was statistically significant (Table 2). The results of this study showed that the highest dry weight of the stem was obtained in Mirmakan population of 11 grams, which was significant with the majority of other populations. Also in Zangian population, the minimum dry weight of the stem was 9.8 grams (Fig. 4). High correlation was observed between leaf dry weight and stem dry weight (Table 3).

In a study comparing the morphological and phytochemical characteristics of (Thymus kotschyanus Boiss. & Hohen) with Thymus vulgaris L. specimens, Berry et al. (2012) stated that the highest weed density of Thymus vulgaris also belonged to the population of West Azarbaijan with a production of 1640 kg per hectare. Cluster analysis classified the genotypes into four distinct groups. The first group, which had a longer period of growth, had more stem weight, so it could be argued that increasing the growth period due to the effect on photosynthesis and nutrient uptake could lead to an increase in dry matter. In the present study, hypoglycemic populations in different locations may have a different growth period, which leads to changes in stem dry weight. Derikvandi et al. (2014) in a study titled "Evaluation of phenological traits of some populations and medicinal plants of Borago officinalis L. in Ahwaz climatic conditions, said that due to genetic differences between the mass and cultivars, cultivar Germany, later than the other masses and earlier cultivars, and the Isfahan masses, went through the phonological stages. Differences in the phonological stages can lead to changes in the dry weight of various organs, including stems. In a survey of the morphological structure of six species of mimosa (scrophularia), called S.ilwensis, S.nodosa, S.capillaris S.libanotica, S. lucida and S.cinerascens, collected in the northeastern part of Turkey , It was found that the dry weight of the different organs of these populations was different (Bass et al., 2007).

Figure 4. Comparison of the average dry weight of the stem in the plant in different scrophularia populations
Dry Aerial organ

The results of this study showed that in the scrophularia plant, the effect of the studied populations on the dry weight of the aerial is statistically significant (Table 2). The results of this study showed that the highest dry weight of the aerial in the Mirmakan population was 4.18 g. Also, in the Saleh Abad population, the lowest dry weight was obtained with an air of 2.15 grams. The population of Saleh Abad was also in the second place in terms of dry weight (Fig. 5). High correlation was observed between leaf dry weight, root and stem with dry weight of shoot (Table 4).

Chlorophyll index

The findings of this study showed that the effect of the studied populations on leafy lizard was statistically significant in the thymus plant (Table 2). The results of this study showed that the highest leaf berry was found to be 34 in the Kooshk population. Also, in the worm population, the least leafy leaves were found to be 30.2. (Figure 6).

Sufi Abadi et al. (2012) in a study entitled "The study of some of the agrofiscic characteristics of Allium altissimum Regal, a plant and pharmaceutical plant, said that the study of changes in photosynthetic pigments, some reconstituted and antioxidant compounds in the beetle plant showed that the percentage reduction of a, B in the sensitive ecotype of Shirvan was more than the Tandoreh and Kalat resistant ecotypes. In this study, populations with a higher cost added more dry matter due to the increase in the amount of photosynthesis, which confirms the results of the correlation of traits (Table 4).

Essential oil content

The results of this study showed that the effect of the populations studied on essential oil was statistically significant (p. 2). The results of this research showed that the highest amount of essential oil in the population of Saleh Abad was obtained in the amount of 1.06%, which was significant in most other populations. Also, the lowest essential oil content was obtained in the population of Abdanan at 90%. (Fig. 7).

Lersten et al (1998) reported that of 89 species of Scrophularia, 62 species with an idiopathic secretion structure were observed on the upper and lower surfaces of leaves and stems, and contained substances such as resins and compounds. Volatile oils are like essential oils. The same study showed that 14 species of Scrophularia, found in North America, have 14 idioblast species. The presence of this physiological difference may possibly lead to a change in the amount of essential oil. In a study titled "Comparison of morphological and phytochemical characteristics of different populations of Thymus vulgaris", Bebri et al. (2012) stated that the percentage of essential oil of T. albicans ranged from
42.0% to 17.2% and in Soddy thyme from 42.0% to 75.7% 1% of variables were obtained. The percentage of combination of thymol in mountain mulberry from 63.64% to 74.52% and carvacrol percentage was from 3% to 78.24%, and in Thymus vulgaris, thymol percentage ranged from 32.53% to 79.75% and carvacrol percentage was 5.74% % To 53.16% varied. 

Lersten et al (2000) reported a total of 34 compounds in the essential oil of Scrophularia striata Boiss. It was identified that 90.3% of the total essential oil was included. Linalol (18.3%) 6,10,14-Trimethylpentadecane-2-one (8.4%) Dibutyl phthalate (9.9%) and β-Damascone (5.9%) were the most important formulation compounds. The ingredient is an essential oil. The researchers also stated that the difference between the different ecotypes was significant in terms of essential oil content and attributed it to the difference in weather conditions, since temperature or humidity variation was effective on the amount of essential oil. For example, according to researchers, high temperatures and low humidity are two factors that change the amount of essential oil and increase it. The reason for this phenomenon is probably that, under stress conditions, the amount of secondary compounds increases (Omid Beigi, 2009).

Essential oil yield

The results of this study showed that the effect of the studied populations on the essential oil yield was not statistically significant in the thymus plant (Table 2). The results of this study showed that the highest amount of essential oil in the population of Saleh Abad was 0.15 grams.

Table 3: Simple correlation coefficient between traits

<table>
<thead>
<tr>
<th>Essential oil content</th>
<th>Chlorophyll index</th>
<th>Dry organ weight</th>
<th>Aerial stem weight</th>
<th>Dry fruit weight</th>
<th>Dry leaf weight</th>
<th>Dry stem weight</th>
<th>Root weight</th>
<th>dry yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root dry weight</td>
<td>0.94**</td>
<td>0.54**</td>
<td>0.60**</td>
<td>0.42*</td>
<td>0.43*</td>
<td>0.63**</td>
<td>Chlorophyll index</td>
<td></td>
</tr>
<tr>
<td>Leaf dry weight</td>
<td>0.55**</td>
<td>0.42*</td>
<td>0.62**</td>
<td>0.33ns</td>
<td>0.43*</td>
<td>0.63**</td>
<td>Dry Aerial organ</td>
<td></td>
</tr>
<tr>
<td>Fruit dry weight</td>
<td>0.04ns</td>
<td>0.03ns</td>
<td>0.19ns</td>
<td>-0.30ns</td>
<td>-0.39*</td>
<td>-0.40*</td>
<td>Essential oil content</td>
<td></td>
</tr>
<tr>
<td>Stem dry weight</td>
<td>0.24ns</td>
<td>0.26ns</td>
<td>0.19ns</td>
<td>0.30ns</td>
<td>0.31ns</td>
<td>0.31ns</td>
<td>Essential oil yield</td>
<td></td>
</tr>
<tr>
<td>Dry weight</td>
<td>0.76**</td>
<td>0.73**</td>
<td>0.76**</td>
<td>0.46*</td>
<td>0.30ns</td>
<td>0.31ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Root weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>dry yield</td>
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*, **, and ns indicate a significant difference in the level of 5%, 1% and no significant difference.

In general, the results showed that other essential traits of other traits were significantly affected by scrophularia populations. Populations of hemp and helmith showed the highest dry weight of different organs and chlorophyll content. The population of Saleh Abad, which had a low abundance in most traits, showed the highest amount of essential oil. The results of this study can be used to grow a scrophularia medicinal plant and determine the best population for essential oil.

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