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Determination of Mucilage Content of Mullein (*Verbascum songaricum*) Populations

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Abstract:

Mullein genus is the largest genus of Scrophulariaceae family that has wide natural habitat in Southwestern of Iran. In this study, 7 ecotypes of *Verbascum songaricum* were collected from southwest of Iran for determination of mucilage content. The amount of mucilage was measured using hot extraction method. Results revealed that the content of mucilage was different among *Verbascum songaricum* ecotypes. The highest and lowest content of mucilage was obtained from Shirmard ecotype (4.26 mg/g DW) and Kallar ecotype (0.16 mg/g DW). The correlation analysis showed that there was a significant negative correlation between mucilage and plant habitat elevation. In general, our findings revealed that there was a significant difference among ecotypes collected from different regions in the southwest of Iran in terms of mucilage content.

Keywords: Scrophulariaceae, *Verbascum songaricum*, Mucilage, Hot extraction

INTRODUCTION

The use of plants for treating the diseases dates back to the mankind birth on earth. Medicinal plants are frequently used in various medical, industrial, agricultural, nutritional environments and a great many of the other fields [1]. The recognition of the medicinal species is of a particular position in making use of the medicinal herbs. These species and their pharmaceutical values are introduced in pharmacopoeia. Although scientific research and investigation on the medicinal herbs is a particular position the precise recognition of the active ingredients usually contributes to the proposition of predictions regarding the medicinal value of certain species [2]. Mullein (*Verbascum* L) is one of the largest genera of Scrophulariaceae family [3] with almost 360 species [4-5]. This genus is medicinal source for various pharmaceutically active substances that have long been used as antimicrobial, antioxidant, anti-inflammatory and treatment of cough, asthma and headache [6-7-8-9]. Mullein flower had various phytochemical compounds such as mucilage, carotenoids, flavonoids, saponins, iridoid glycosides, ascorbic acid, and minerals [8]. Mucilage is a polysaccharide mixture commonly found in many plant species and probably affect many of physiological process in plants due to its high variability in terms of chemical compositions [10]. Mucilages also play a role in water transport [11] and responses to abiotic stresses [11-12].

Bodor et al (2007) reported the level of flavonoids and total tannins in *V. phlomoides* collected from nature as 0.97 and 4.12 g / 100 g, respectively [13]. In a study by Armatu et al (2011), the flavonoid and total phenol levels in *V. phlomoides* species reported as 1.10 rutin mg / g and 4.18 mg GA / g, respectively [7].

The compounds identified in medicinal plants are used as sources for the synthesis of new drugs with fewer complications. Environmental factors cause changes in the quantity and quality of the active substances of medicinal plants. Identification of habitats and their impact on the yield of herbs is effective as well as domestication and preservation of genetic diversity. The objective of this study was to determine the mucilage content in *V. songaricum* ecotypes.

Figure 1: *Verbascum songaricum* [15].

MATERIALS AND METHODS

Apparatus

In this study used of apparatus including, Buchner funnel (SCHOTT DURAN), centrifuge (DEPOSE HICOLL), heater (PIT) and Scales (KERN ALS).

Plant material

The samples were collected in full flowering stage from their natural habitats (Table 1). The botanical identification

was made by using the given information in Flora Iranica [14]. Herbarium specimen was kept at the Research Center of Agriculture and Natural Resources, Shahrekord, Iran (Figure 1.).

Sample preparation

The flowers were dried at room temperature away from direct sunlight.

Mucilage extracting and determination

Mucilage extraction was performed by hot extraction method. Briefly, 2 g of dry samples mixed with 10 mL of acidified distilled water (pH = 3.7). Then, 200 mL of distilled water (the same pH as above) was added and blended for 20 minutes. After separating the waste products using a Buchner funnel, the remaining solution was centrifuged and ethanol 96% was added (4 times the solution volume). The final solution kept at 4 °C for 24 hours to mucilage precipitation. The precipitate was separated by vacuum filtration using a Buchner funnel and then weighted after drying [16].

Data analysis

All statistical analysis was performed using Statistical Package for the Social Science (SPSS 16.0, SPSS Inc., USA) computer software. Analysis of variance (ANOVA), followed by LSD comparisons, was used to compare of mucilage levels among ecotypes. Pearson's correlation was used to test the studying of association between mucilage content and plant habitat elevation.

RESULTS AND DISCUSSION

Mucilage extraction

The results of analysis of variance revealed significant difference among ecotypes in terms of mucilage content in *V. songaricum* from studied regions. In this study, our finding showed the highest and lowest level of mucilage was found in the Shirmard (4.26 mg/g DW) and Kallar (0.16 mg/g DW) populations, respectively (Table 2). The Shirmard ecotype had significant different with other ecotypes. The mucilage content in other ecotypes including Tomanak, Sendegan, Farrokhshahr, Naghneh, Semirom 1 and Semirom 2 was 1.63, 1.35, 0.99, 0.56, 0.44 and 0.42 mg/g DW, respectively.

Table1: Geographical distribution of *V. songaricum* populations.

Population	Height (m)	Longitude	Latitude
Naghneh	2302	51 ˚19′	31˚ 55′
Farrokhshahr	2149	50 ˚59′	33 ˚14′
Semirom 1	2320	51˚ 32′	31˚ 22′
Semirom 2	2492	51˚ 38′	31˚ 34′
Sendegan	1988	51 ˚18′	31˚ 12′
Kallar	2344	51 ˚04′	31 ˚49′
Shirmard	2206	51 ˚12′	31 ˚24′

Table2: Mucilage compounds of *V. songaricum* ecotypes in southwest Iran.

Population	Mucilage (mg/g DW)
Naghneh	0.56±0.04^{d}
Farrokhshahr	0.99±0.05^{c}
Semirom 1	0.44±0.03^{d}
Semirom 2	0.42±0.01^{d}
Sendegan	1.35±0.1^{b}
Kallar	0.16±0.02^{e}
Shirmard	4.06±0.3^{a}

Means *within a* column *followed by the* same letter *are* not significantly different *at the 5%* level according *to* LSD test.

Mucilage and plant habitat elevation

The correlation analysis showed that there was a significant negative correlation between mucilage and plant habitat elevation.

The evaluation of climate and optimum growth conditions of plants is necessary for obtaining higher amount of active ingredients in medicinal and aromatic plants. The results of a study Bodor (2007) in two different climate zones in Hungary (Soroksar and Kisward regions) on *V. phlomoides* showed that the planting area was effective on flower active substances [13]. Karimian et al (2012) reported that chemical composition of mullein flowers such as ketones and alkaloids in different regions of Isfahan province were influenced by growing area [17]. Ecological factors such as soil clay percentage, evapotranspiration, temperature and duration of dryness have more effects on the flower compounds. Goldstein and Nobel (1991) reported that the amount of mucilage in opuntia. Ficus-indica increased during acclimation to low temperatures, as also occurs for it in response to drought [18]. Safi et al (2016) showed that some flower chemical compositions of *V. songaricum* in the different region were affected by environmental factors [19]. Gosztola and Nemeth (2016) reported that the higher temperature helps the accumulation of polysaccharide compounds in chamomile flowers; although it can be shown that chamomile samples with different origin were very diverse in terms of their mucilage content [20]. In a study by Ahiakpa et al (2014) showed that mucilage content of 21 Accessions of Okra (*Abelmoschus spp*) Influenced by genetic and environmental factors [21].

Many factors such as temperature, rainfall, light intensity and altitude, which determine the climate of an area, are the most important environmental factors affecting the generation and accumulation of secondary metabolites in plants [22].

CONCLUSIONS

The result of this study showed that ecological factors, like genetic factors, were effective on the amount of mucilage in *V. songaricum* and has a higher level of mucilage in Shirmard region than other regions and this ecotype can be used as a plant source of these compounds in pharmaceutical industries.

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