Variation of Essential Oil Yield in Albanian *Vitex Agnus Castus L.* Fruits Relating Geographic Position

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ABSTRACT

This study investigates variation of Albanian *Vitex Agnus Castus L.* essential oil yield relating geographic position. Twelve samples were taken for this study. Sampling was done on different locations, from north to south Albania, during October, 2017 the main harvesting period, when the seed is fully matured. At each location fruits were collected randomly, from a large number of plants, representing the population of the sampling station. Samples were comminuted before extraction, and essential oils were obtained by hydro-distillation method, using a Clevenger-type apparatus. The mean oil yield obtained from all samples was 0.49 %. For different locations, it varies from 0.74% Gjader/V5 & Vau i Dejes/V3 to 0.15% Seman/V7. A considerable variation is seen between different locations of Albanian *Vitex Agnus Castus L.* High yielding populations are located mostly in north and north-west of Albania, mostly in the same environment such as near the sea or near a river bed. Samples taken in west and south - west, show a moderate yield percentage, Seman/V7 station show the lowest yield percentage 0.15%, due to a more inland location comparing to other stations.

Key words: extraction; hydro-distillation; Lamiaceae; seeds; vitex

1. Introduction

Vitex agnus-castus L. (VAC) is an aromatic, deciduous, and very decorative shrub, which formerly was classified in the family of Verbenaceae, but now the phylogenetic classification assorts it in the Lamiaceae (Aissaoui, 2010, Meena et al., 2010). Albanian local names for this plant are konopica, kopër mace, lule shingjergjit, lule e qenit, maraqe. VAC flowers during June – July and grows in areas where the Mediterranean climate is dominant, rather rocky places, wetlands such as stream banks and valleys (Cossuta et al., 2008), t is found in saturated soils, with a preference for basic to slightly acid pH. Soil structure is of various types of aluviones, more frequently the fine one (clay) and soils with good water reserves, sites with a

favourable water balance (GIZ, 2013), Leaves are characterized by aromatic flavour, which repels mosquitoes, while spikes are generally close to or at the ends of branches and they are weakly aromatic, varying in colour from purple to light purple and seed is oval to almost globular, with a diameter of up to 5 mm, (Cossuta et al., 2008, Sorensen & Katsiotis, 1999), VAC, is an important natural source of food and medicine products used all around the world (Meena et al., 2010), such as in Italy, Iran, Greece, and Egypt for over 2500 years, mainly to treat the gynecologic disorder (Roemheld-Hamm, 2005). The word "cactus" has been used for centuries to remark the meaning or purity associated with this plant (Eliana, 2020). Medicinal wild plants have been considered worldwide and for centuries valuable in the treatment of different diseases, due to their ease of use and improved cost-effectiveness compared to chemical remedies obtained from synthesis (Yeung et al., 2020). Fruits of VAC tree have been traditionally used in the treatment of women complaints, including menstrual disorders (amenorrhea and dysmenorrhea), premenstrual dysphoric disorder, corpus luteum insufficiency, hyperprolactinemia, infertility, acne, menopause, disrupted lactation, cyclic breast pain, cyclical mastalgia, and inflammatory conditions, diarrhea, and flatulence (Ono et al., 2008, Costa et al., 2007, Dugoua et al., 2008). Hydro-distillation of VAC fruits yields a pale-yellow to yellow essential oil with agreeable, interesting, somewhat peculiar top-note, reminding one of cannabis and eucalyptus. After a few minutes, it revealed an aromatic floral, warm but fresh, somewhat peppery, sweet, spicy fragrance with lemon-like, woody undertones (Sorensen & Katsiotis, 1999). The fruits, as well as leaves and flowers, contain essential oil, which varies in content and composition relating to geographical position (Sorensen & Katsiotis, 1999), Zwaving & Bos, 1996). In this study, we will be reporting the results of an investigation of Vitex agnus castus L. fruits oil content, collected in different sampling stations along the Albanian coast and not only.

2. Materials and methods

2.1 Plant material

Twelve samples were taken for this study. Sampling was done on different locations, from north to south Albania. Sampling points were located in different geographic locations such as, Shiroke/V1, Ura e Bunes/V2, Vau I Dejes/V3, Torovic/V4), Gjader/V5, Ura e Milotit/V6, Seman/V7, Pishpore/V8, Novosel/V9, Radhime/V10, Himare/V11, Qeparo/V12. Samples were taken in two consecutive days, during October, 2017 the main harvesting period, when the seed is fully matured. Sampling site is presented in Figure 1. Part of the plant chosen to be analyzed were aerial parts (fruit). One representative sample per location were picked. At each location fruits were collected randomly, from a large number of plants, representing the population of the sampling station. Samples were collected by hand, taking into account "Good collection practice of medical and aromatic plants in nature" and were placed in airy places, in shade to get fully dried at room temperature.

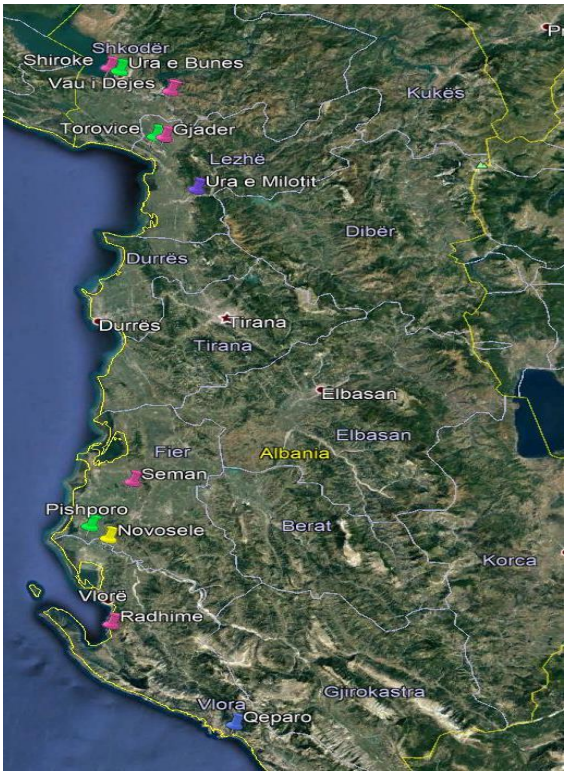


Figure 1. Sampling site and the sampling point

2.2 Oil extraction

Dry mature fruits were cleaned from impurities and dust. Samples were comminuted before extraction, until all particles pass through a 0.8 mm sieve. Immediately after the comminution, hydro distillation process commenced. Hydro distillation, were carried out for all samples, using a Clevenger-type apparatus. The quantity of sample used is 30 g immersed in 510 ml water and boiled using distillation flask heater for 3 hours, at boiling point temperature. The plant/liquid ratio used for this study was 1:17 (g:ml). The obtained essential oils were dried over anhydrous sodium sulphate and stored at 4-5 °C for further analysis.

3. Results and discussion

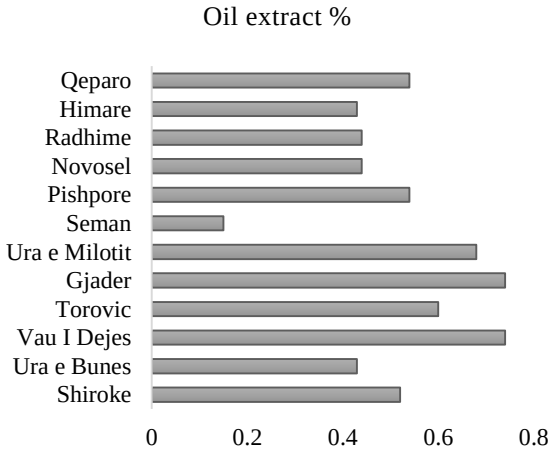
3.1 Yield percentage of Essential Oils

Essential oil content evaluation, in this study is done relating on one factor: geographic position and, the results for each sample are shown in Table 1. The mean oil yield obtained was 0.49 %. In different locations varies from 0.15 % to 0.74%, which is a considerable variation. According to Janina. M.S et al., 1999, who studied Cretan (Greek) VAC fruits, yield percentage range, for this population was from 0.15% to 1%.

Table 1: Oil extract percentage for Vitex agnus castus L. fruit in different geographic locations

Place of sampling	Sample code	Oil extract %
Shiroke	V1	0.52
Ura e Bunes	V2	0.43
Vau I Dejes	V3	0.74
Torovic	V4	0.60
Gjader	V5	0.74
Ura e Milotit	V6	0.68
Seman	V7	0.15
Pishpore	V8	0.54
Novosel	V9	0.44
Radhime	V10	0.44
Himare	V11	0.43
Qeparo	V12	0.54

Figure 2. Oil extract percentage for Vitex agnus castus L. fruit in different geographic locations



It is stated that in composition, qualitative terms, Cretan essential oil is similar to the Mediterranean region. Results of our study in terms of yield percentage seems quite close to the Janina. M.S et al., 1999 study, taking into account the geographical proximity and, the Mediterranean climate that characterizes both regions. In this study, yield percentage referring to geographic position, the same year, and same harvesting period, varies from 0.74% Gjader/V5 / Vau i Dejes/V3 > 0.68% Ura e Milotit/V6 > 0.60% Torovic/V4>0.54%Pishpore/V8/Qeparo/V1> 0.52% Shiroke/V1 > 0.44% Radhime/V10/ Novosel/V9 > 0.43% Ura e Bunes/V2/ Himare/V11 > 0.39% > 0.15% Seman/V7. Essential oil yield shows interesting differences for plants cropped in different location (Table 1). In this study high yielding populations are located mostly in north and north-west of Albania, mostly in the same environment like near the sea or near a river bed such as Gjader/V5, Vau I Dejes/V3, Ura e Milotit/V6 or Torovic/V4 (Figure 3). But there are populations cropped in north such as Shiroke/V1 or Ura e Bunes/V2, that shows a moderate yield percentage referring to the range 0.15 % to 0.74% and lower, comparing to the one obtained in samples such as Gjader/V5. Samples taken in west and south - west (Figure 4), show a moderate yield percentage, Samples taken in west and south - west, show a moderate yield percentage probably due to the fact that is more inland comparing to other stations.

Figure 3. Oil extract percentage for Vitex agnus castus L. fruit in north and north-west Albania

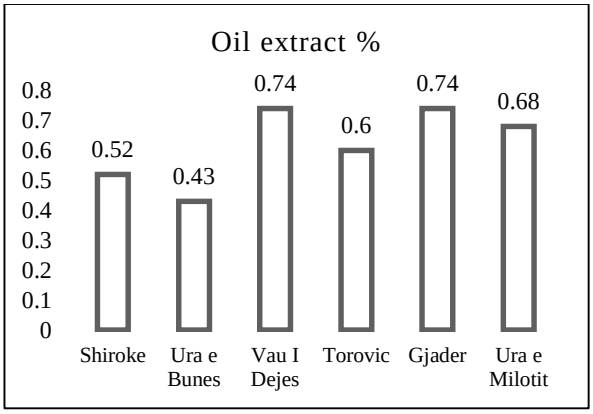
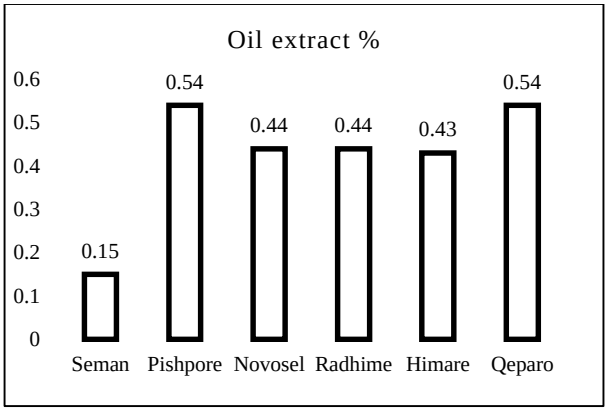


Figure 4. Oil extract percentage for Vitex Agnus Castus L. fruit in west and south-west Albania



4. Conclusions

From the above results it can be concluded:

- ✓ there are significant variations in essential oil yields percentage, referring geographic position, same year, and same harvesting period
- ✓ Vitex agnus castus L. samples essential oil varies, from 0.15 %, Seman/V7 to 0.74%, Gjader/V5 and Vau I Dejes/V3.
- ✓ The biggest difference was found between Gjader/V5/Vau I Dejes/V3 and Seman/V7 locations. Gjader is in north-west and Seman in west of Albania.
- ✓ Results show that this pattern is the same for mostly of the samples.
- ✓ It was interesting to find that yield percentage of essential oil, obtained in samples located in south Albania, such as Radhime/V10 or Himare/V11, was in moderate percentage compared to north or north-west.

Different factors can contribute to these results because the fulfillment of certain basis conditions for medicinal and aromatic plants growth and normal development are required. Among the most important factors are: climate, soil, their cultivation, age etc (Florina, 2014). Soil composition changes the nature and amount of plant active substances, which it is also associated with the growth and spread of plant species. Permeability, moisture, capillary as well as porosity affect soil fertility and aromatic plants yield, productivity (Akademia e Shkencës, 1988, 1992, 1996, 2000).

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