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Comparison of The Morphological Properties And Biochemical Contents of Some Cultured Lavender Specimens In The Aegean Region and

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Abstract: *Lavender plant has an important place among medicinal and aromatic plants. It has been used for centuries in many fields such as health, cosmetics, industry, etc. and is still used. The phenolic components contained in the lavender plant differ according to lavender species, morphological structure, growing conditions. These differences have shaped the intended use of the lavender plant. In this study, samples of cultivated lavender species from the provinces of Aydın, Izmir, Manisa, Uşak and Denizli belonging to the Aegean Region were collected. The morphological characteristics of these samples were measured and chemical content analyzes were performed. These two findings were compared and it was examined whether there was a correlation between them. After certain correlations are found, the types of these correlations are determined. In the graphed results, the type of correlations was determined and the common conditions of some deviations among all the obtained data were analyzed.*

Keywords: Lavandula, correlation, chemical content, morphological measurements

1 INTRODUCTION

Lavender (Lavandula spp.) is a genus, medicinal and aromatic plant belonging to the Lamiaceae (Ballıbabagiller) family, with its former name Labiatae, containing 236-238 genera/6500-7170 species. Lavender has 39 species, most of which are of Mediterranean origin. Wild species are common in Yugoslavia, Spain, Greece, Southern France, Central Italy. Only Lavandula stoechas and Lavandula angustifolia are grown as wild species in Turkey.

Due to the essential oils (the most basic ones are linalool, linalyl acetate and camphor) found in lavender, it is used in many fields such as medicine, cosmetics, perfumery, aromatherapy, food. The effect of environmental conditions and genetic differences in these essential oils can provide diversity in lavender. The most basic type of lavender is Lavandula angustifolia (English Lavender). However, nowadays, L. latifolia, L. pinnata, L. lanata, L. dentata and L. stoechas are also commonly used species.

1.1 Spread in Turkey

Only Lavandula stoechas and Lavandula angustifolia grow as wild species in Turkey. Since it is a plant of Mediterranean origin, it can grow in every province of Turkey where the Mediterranean climate is seen. Since lavender can be traded in terms of aromatic oil content, agricultural production is more common.

Lavender cultivation is carried out in Bulgaria, England, USA states, North African countries, France and Turkey. These cultivated species are cultured species.

Three types of lavender are used in agriculture: (Baydar, 2009)

- Lavander (*Lavandula angustifolia = Lavandula vera = Lavandula officinalis*)
- Lavandin (*Lavandula x intermedia = Lavandula hybrida*)
- Spike lavander (*Lavandula spica = Lavandula latifolia*)

Essential oil is usually obtained from lavender through water and steam distillation. This oil is the most important active ingredient of lavender (Aetheroleum lavandulae) with a slight yellow color or colorless. Lavender oil is one of the 15 most produced essential oils in the world (Aslancan and Sarıbaş 2011).

Lavender contains at least 1% essential oil component (Baydar, 2009). Although the essential oil yield varies according to lavender species, it is between 3-9% on average.

Every year, 200 tons of lavander oil, 1000 tons of lavandin oil, 150 tons of spike lavander oil are produced in the world (McGimbsey and Porter, 1999). 90% of 1000 tons of lavandin oil is produced in France (Karapandzova et al., 2012; Kıvrak, 2018).

Lavender known contains 150 volatile ingredients. Volatile components can be in different proportions according to the type, variety, place where it grows and organs. At the beginning of these components are terpenoids that cause the characteristic odor (they have the property of essential oil). These are linalool, linalyl acetate, sineol, borneol and camphor. In particular, linalyl acetate determines the quality of lavender oil. It is desirable to have at least 30% linalyl acetate

in lavender oil to be used in the cosmetic industry (Hui et al., 2010). According to ISO 3515: 2002 standard, linalool ratios should be between 25-38% and linalyl acetate should be between 25-45%.

Even if camphor is not a toxic substance, according to the European Pharmacopoeia, if the rate of camphor in a lavender exceeds 1.2%, it is considered a harmful chemical and Turkey has adopted this rate. Therefore, it is not used much in the pharmaceutical industry (Kara, 2011).

Pure lavender oil obtained from lavander variety is widely used in the cosmetic and food industry because it contains high linalool, linalyl acetate and low camphor.

1.2 Uses

- Since ancient times, lavender has been used in alternative medicine methods.
- Since it has sedative, anticonvulsive, spasmolytic effects, it has been used in ayurvedic, psychological treatments and pharmacologically mixed with other plants. (In the treatment of areas such as Parkinson's, panic attacks, migraines, stomach pain, epilepsy, regulating the menstrual cycle) (Balchin, 2002)
- It is used a lot in aromatherapy (Buchbauer, 1992).
- It is widely used in the food industry and in the field of cosmetics, especially as a perfume essence (Balchin, 2002).
- Perilly alcohol has positive effects on the treatment of cancer patients. Lavender is also thought to have an effect in the treatment of cancer because it contains a small amount of perilyl alcohol (Belanger, 1998).
- It has antifungal effect against fungals such as *Aspergillus niger, Aspergillus ochraceus, Fusarium culmorum, Aspergilli* (Canlı, 2018).

2 It has antimicrobial effect against Escherichia coli, *Klebsiella pneumoniae, Proteus miralibis, Proteus aeruginosa bacteria* (Canlı, 2018).

3 Matherials and Methods

In this study, cultured lavender samples were collected from 9 locations from 5 provinces of the Aegean Region of Turkey (Aydın, İzmir, Manisa, Uşak, Denizli). These lavender samples are coded and numbered according to locations.

A1, A2, A3, A4, A5, A6, A7, A8 Uşak/Ulubey

B1, B2 Uşak/Ulubey Lavanta Denizi

C1, C2 Manisa/Kula

D1, D2 Manisa/Alaşehir

E1, E2, E3, E4 İzmir/Turgut Köyü Lavanta Bahçem

G1, G2, G3, G4 İzmir/Turgut Köyü

H1, H2 Aydın/Kuyucak

J1, J2, J3, J4 Denizli/Teleferik

K1, K2, K3, K4, K5, K6, K7, K8, K9, K1O Denizli/Acıpayam Gündoğar Lavanta

Each specimen of lavender has been species-identified. 3 species were found: *Lavandula angustifolia, Lavandula latifolia, Lavandula intermedia*.

The 18 morphological characteristics of these lavender specimens, which were species-diagnosed, were measured. These morphological scales are: spike plant height, spike height, number of flower clusters in spike (whorl number), total number of flowers, intercluster spacing, number of leaves, leaf width (max.), leaf length (max.), pedicel number, pedicel length (max.), pedicel spike length (max.), pedicel flower cluster number, pedicel flowers number, calyx length (max.), calyx color, calyx hairiness, corolla color, petal number in a flower.

In addition to morphological properties, temperature and altitude are also added. And the lavender samples then went through certain stages to determine the chemical content analysis.

The first stage: the lavender samples are crushed with the mixer. They were separated according to their code, transferred to the glass and 50 ml of 99% pure ethyl alcohol solvent was added to them. And their mouths are covered with parafilm. In the orbital shaker, it is left to shake for 48 hours at 160 rpm.

Second stage (extraction process): after shaking, the samples were filtered through Whatman no 1 filter paper and filtered into glass balloons.

The samples filtered into glass balloons were attached to a rotary evaporator and separated at a pressure of 45 degrees and -0.8.

The solute substance remaining in the balloon was weighed at least 3 times with the sensitive weighing until the correct result. After weighing, the extract was obtained by adding 5ml of 99% pure ethyl alcohol with the help of a pipette of the solute.

These extracts obtained were put into the encoded centrifuge tubes. After the extract, the empty extract balloons were passed through the rotary evaporator again and weighed,

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and the difference was calculated and the amount of substance in each sample was calculated.

Third stage: samples were made in gc/ms for chemical content analysis. The GC/MS method is as follows [8].

4 RESULTS AND DISCUSSION

Correlates were established between the morphological features measured and the gc/ms results. Results from these correlations:

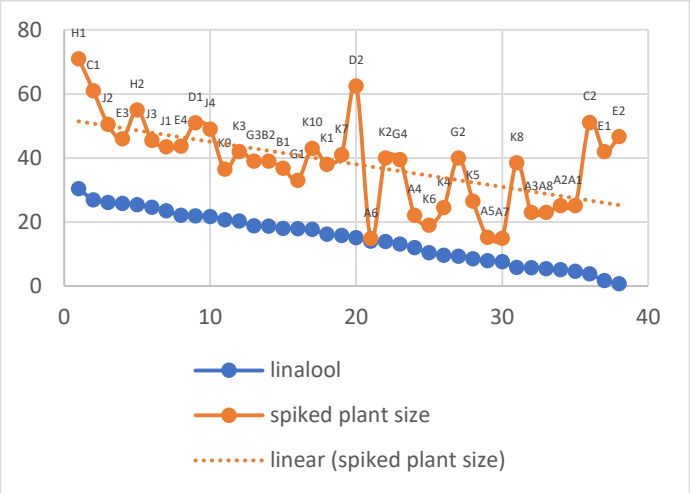
1) Among the plant specimens, it is the H1 plant with the highest linalool ratio and spiked plant size.

2) In plant samples at location A, the caryophyllene oxide ratio is the A6 plant with the lowest spike plant size and spike size.

3) Among the Lavandula latifolia species, Ethyl 2-(5-methyl-5-vinyltetrahydrofuran-2-yl)propane-2-yl carbonate, caryophyllene oxide is the lowest, eicosane is the highest, and spiked plant size is the highest K5; linalool is the K6 plant with the highest number of linalyl acetate, eicosane with the lowest and total number of flowers, spiked plant size at the lowest.

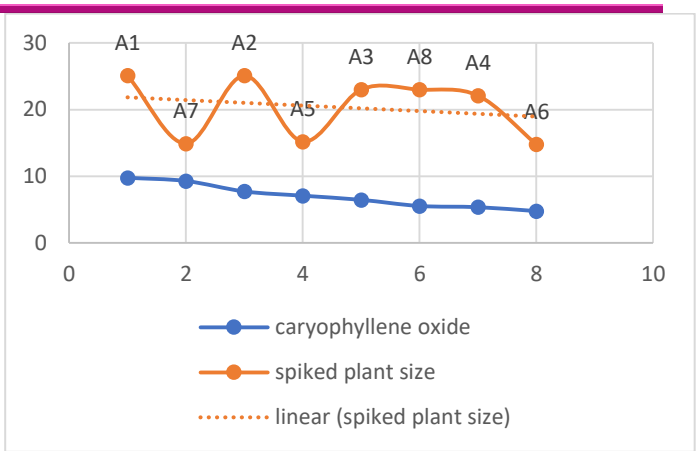
Below we see these correlations converted into graphs:

Chart 1: Chart of the 1st premise



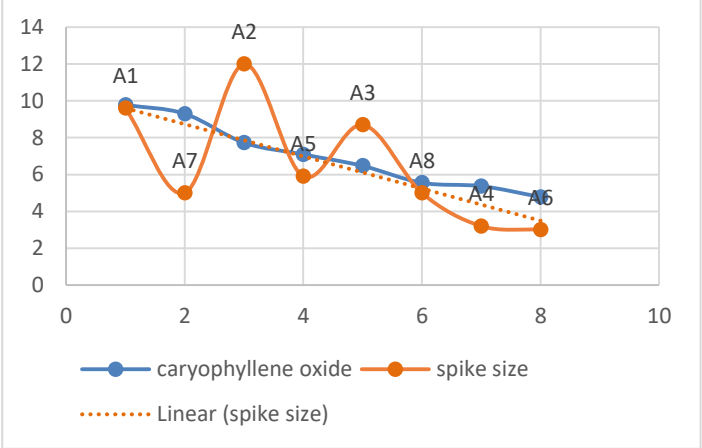
Here we see a linear correlation, where while linalool decreases, so does the height of the spiked plant size.

Chart 2: a) Chart of the 2nd premise



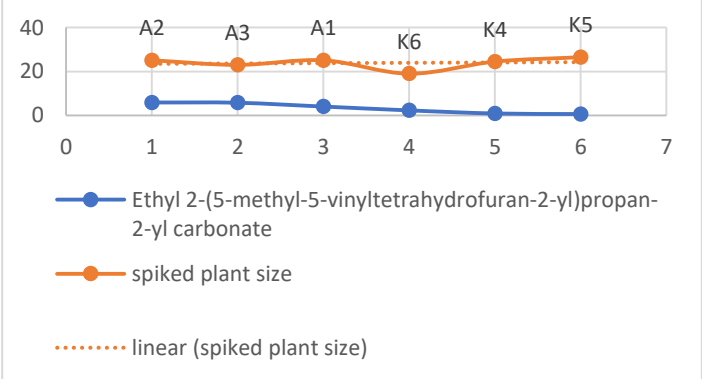
Here we see a linear correlation, where while caryophyllene oxide decreases, so does the height of the spiked plant size.

Chart 2: b) Chart of the 2nd premise



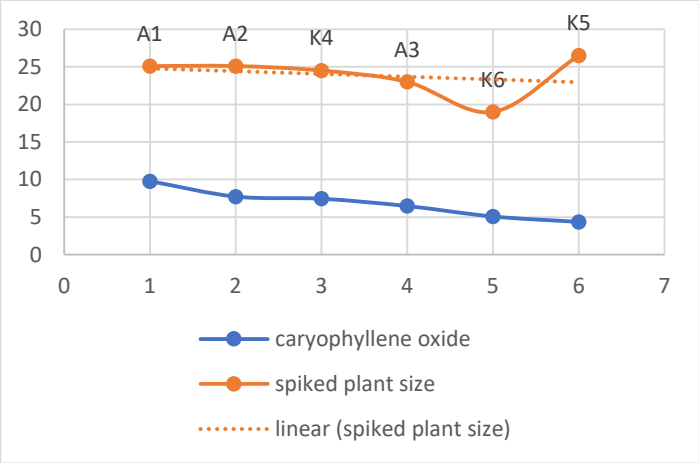
Here we see a linear correlation, where caryophyllene oxide decreases while spike length decreases.

Chart 3: a) Chart of the 3th premise



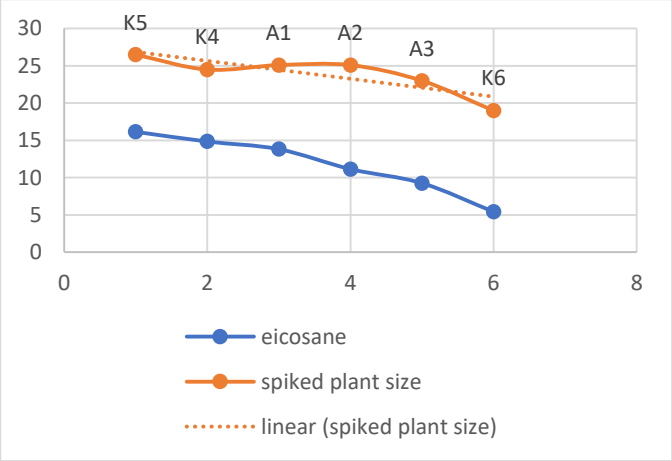
Here we see the inverse correlation that Ethyl 2-(5-methyl-5-vinyltetrahydrofuran-2-yl)propan-2-yl carbonate decreased while spiked plant size increased.

Chart 3: b) Chart of the 3th premise



Here we see a linear correlation, where caryophyllene oxide decreases while spike length decreases.

Chart 3: c) Chart of the 3th premise



Here we see a linear correlation, where eicosane decreases while spike length decreases.

When we look at the graphs above, we see some deviations in common:

For A7: In premise 1, linalool decreased, while spiked plant size also decreased. In the 2nd premise, caryophyllene oxide decreased, while the spiked plant size decreased. In other words, the change of the spiked plant size of A7 was affected by these two chemicals.

For K6: In premise 1, linalool decreased, while spiked plant size decreased. In the 3rd premise, Ethyl 2-(5-methyl-5-vinyltetrahydrofuran-2-yl)propane-2-yl carbonate and caryophyllene oxide decreased, while spiked plant size decreased. So the change in the spiked plant size of K6 was affected by these three chemicals.

As given above, a direct correlation was found between many morphological characteristics and the gc/ms biochemical content ratio.

In further studies, it is thought that the correlational relationships with samples from different countries and samples collected from nature can be revealed more clearly.

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