



## Comparison of different helichrysum species in terms of agro-morphological characteristics and essential oil content

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### Keywords:

*Helichrysum stoechas*,  
*Helichrysum italicum*,  
*Immortelle*,  
*Goldengrass*

**Abstract** — *Helichrysum* species belonging to the Asteraceae family are popularly known as goldengrass, mantuvar, guddeme flower and immortelle in our country. *Helichrysum* species, which are commonly found in nature in Anatolia, are consumed as herbal tea. *Helichrysum* essential oils are used in folk medicine to protect against colds, kidney stones, stomach ailments, coronary heart disease, stroke and some cancer derivatives, thanks to their antioxidant, antiviral, antifungal, antimicrobial, anti-inflammatory properties and phenolic compounds. This research was carried out to compare agro-morphological characteristics and essential oil ratio between cultured *Helichrysum italicum* (HI) and naturally distributed *Helichrysum stoechas* (HS) species. The experiment was established in Ege University Ödemiş Vocational School's land in April 2022 with HS and HI species according to the Random Blocks Trial Design with 3 replications. In the study, plant height, green herb yield, dry herb yield, fresh flower yield, dry flower yield and essential oil ratio parameters were investigated. The results of the analysis of variance with the data of the investigated characteristics, it was determined that the culture form HI may be a more suitable medicinal plant for the ecological conditions of İzmir-Ödemiş compared to HS, which spreads in the flora.

**Subject Classification (2020):** 62K10, 92F05.

## 1. Introduction

*Helichrysum*, a perennial herbaceous plant belonging to the Asteraceae family, is colloquially known as mantuvar, guddeme flower [1]. *Helichrysum* genus consists of more than 1000 species that are widely found in the world. There are 21 *Helichrysum* species and 27 taxa in the flora of Türkiye, and 14 of them are endemic species [2]. The flowers of the plant have been used in traditional medicine in Asia and Europe from past to present [3]. The biologically active and dominant compounds in the flowering parts of *Helichrysum* are flavonoids, flavanones, salipurposide, purine, and naringenin. Other highly present compounds are essential oils, carotenoids, and yellow pigments [4]. *Helichrysum* species are generally used to protect against colds, kidney stones, stomach ailments, stroke, and coronary heart disease thanks to their antioxidant, antiviral, antifungal, antimicrobial properties, and phenolic compounds [5]. It has been reported that *Helichrysum* genus generally shows anticarcinogen, carcinogen, and genotoxic effects and provides protection against cancer diseases [2]. *Helichrysum italicum* (HI) and *Helichrysum*

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*stoechas* (HS) are included as folk remedies due to their antiallergic and anti-inflammatory properties [6]. It is also known that HI has an anti-mutagenic effect [7]. Due to its anti-inflammatory properties, HI is preferred as a medicinal tea in traditional medicine for gallbladder disorders due to its bile regulating and diuretic properties. In many studies, antioxidant and inflammatory activity of aboveground of HI has been determined in various in vivo and in vitro experimental models [8,9]. In addition, the flowers of HI are traditionally used in the treatment of sunburns as well as their anti-inflammatory and anti-allergic effects [10].

HI generally grows at an altitude of 0-1800 m, on limestone maquis and limestone cliffs. It is grown in Cyprus, Southern Europe, Northwest Africa and the Mediterranean regions, and the plant's flowering time is usually April-May. HS is found at an altitude of 0-700 m, in lime-stony maquis, forest clearings and limestone rocks. It spreads in Italy, the Balkans, Cyprus, Lebanon, Syria, and Northwest Africa, and the plant usually blooms in March-June. HI can be distinguished from HS by its sparse hair cover, straw-coloured, regular imbricate arrangement, reverse pyramid-shaped involucre bracts in the capitulum, and loose but very smooth corimbus. On the other hand, HS has dense hair cover, bright yellow coloured, loose imbricate arrangement in the capitulum [11].

In addition to all these, the essential oils of *Helichrysum* species contribute to the production of aromatherapy, perfumery and cosmetic products thanks to their pleasant smell [2]. According to the results of the essential oil analysis, the main components of HI were determined as  $\alpha$ -pinene (10.2%),  $\alpha$ -cedrene (9.6%), aromadendrene (4.4%),  $\beta$ -caryophyllene (4.2%) and limonene (3.8%) [12]. The main components of HS were determined as P-caryophyllene (27.9%),  $\alpha$ -humulene (13.4%) and  $\alpha$ -pinene (12.0%) [13].

Recently, interest in aromatherapy, which is applied using essential oils and fixed oils, has been increasing in our country and other countries. With the widespread use of aromatherapy, many fake and unidentified oils have also been introduced to the market. Among these oils, the essential oil of HI has an important place. Since the essential oil yield of HI is low, it is known that this oil is used as adulteration and put on the market as in other oils.

The purpose of the production of medicinal and aromatic plants is to obtain high quality and high yield besides the production of standard active substances. For this purpose, first of all, it is necessary to develop varieties suitable for different ecological regions and to determine modern cultivation techniques. There is no literature on the agro-morphological parameters of HI and HS species.

## 2. Material and Method

The research was carried out to compare some agro-morphological properties and essential oil content of HI and HS plants. It was carried out in 2022 at Ege University Ödemiş Vocational School Field Area (38°12'N latitude, 27°52'E longitude, 111 m altitude). HI and HS were used as plant material in the experiment, which was established in three replications according to the Random Blocks Trial Design. Seedlings of HI were obtained from Uludağ-Agro company and seedlings of HS were obtained from Bionorm Natural Products. The seedlings of the species used were planted on 12.04.2022 in 5 rows per plot, 3 m in length, with 20 plants in each row, 40 cm between rows and 20 cm above rows. The climatic data of the experimental area are given in Table 1.

Soil samples taken from different depths from the experimental area before planting were analysed in the laboratory of Ege University Faculty of Agriculture, Department of Soil and Plant Nutrition. The soil has a sandy loam structure with 1% organic matter, 0.08% total salt, 2.7% lime and pH 7.5 and 6 kg da<sup>-1</sup> N was applied according to the analysis result. The cutting was started during the flowering period of the plants.

**Table 1.** Climatic data of the experimental area

Climatic Parameters	April	May	June	July	August
Average Temperature (°C)	16.2	21.5	26.9	29.3	28.6
Maximum Temperature (°C)	28.5	36.6	43.5	44.6	41.8
Minimum Temperature (°C)	7.8	8.3	14.0	14.3	16.2
Relative Humidity (%)	62.5	60.8	49.3	42.1	48.3
Total Rainfall (mm)	48.2	31.7	7.0	-	-

Before cutting, the height of 10 randomly selected plants from each plot from the soil surface to the tip of the plant was measured in cm and the averages were taken. Fresh herb yield and fresh flower yield were determined by cutting and weighing 10 plants at a height of 5 cm above the soil level. Dry herb and dried flower yields per plant were calculated by utilizing the % moisture losses calculated by drying these plants at 35 °C [14]. The essential oil ratios were determined volumetrically with the Clevenger device according to the water distillation method in dried flowers at 35 °C. The essential oil rate in the flower was calculated as ml/100 g (%) on dry matter.

## 2.1. Statistical Analysis

After the homogeneity test of all the data obtained in the research was done using SPSS 20.0 statistical package program, variance analysis was performed. Based on the significance of the analysis of variance, the groupings between the means were made using the Duncan multiple comparison test ( $\alpha = 0.01$ ).

## 3. Results and Discussion

In terms of the parameters examined in the research, the F value, standard error, mean values and significance control of HS and HI are given in Table 2. As a result of the statistical analysis, it is seen that there is a 1% difference in plant height, fresh flower and dry flower values. In addition, it was determined that the examined fresh herb and dry herb yields did not reveal statistically significant results. It was determined that the average plant height was 25.00 cm in HS species and 29.93 cm in HI species. It was showed that the average wet herb yield was 120.90 g and the average dry herb yield was 43.41 g. While the average yield of fresh flowers was 19.39 g in HS species and 16.60 g in HI species, dry flower yield was stated as 7.06 g in HS species and 5.35 g in HI species.

The F value, standard error, mean values and significance control of the herba essential oil ratio and flower essential oil ratios of the species examined in the research are given in Table 2. Herba essential oil ratio was found to be 0.41% in HS species and 0.45% in HI species. In addition, it was stated that the flower essential oil ratio was 0.05% in HS species and 0.48% in HI species.

Helichrysum has very high thermal requirements, preferring warm regions and micro-habitats, as well as dry oligotrophic soils poor in organic matter [14]. The average plant height of Helichrysum was determined as 40.8 cm in the study carried out in Serbian conditions. In addition, the average plant height of plants growing near the sea was 39.4 cm and the height of plants growing inland was 42.2 cm, but these variations were not significant [15]. The existence of two different topographic conditions can be mentioned as the reason for the difference between the reported results and the plant height data obtained in this research.

**Table 2.** The mean, standard deviation, F value and significance levels of the examined parameters of the species used in the research

Species	Plant Height (cm)		Fresh Herb (g)		Dry Herb(g)		Fresh Flower(g)		Dry Flower(g)		Essential Oil (Herb)(%)		Essential Oil (Flower)(%)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
H.stoechas	25.00	2.72	123.96	20.50	40.26	9.16	19.39	2.94	7.06	1.57	0.41	0.28	0.05	0.01
H.italicum	29.93	2.52	115.83	47.51	43.05	17.10	16.60	4.19	5.35	2.62	0.45	0.01	0.48	0.28
Total	27.46	3.61	120.90	36.09	43.41	13.78	17.99	3.83	6.20	2.30	0.43	0.25	0.26	2.38
F Value	24.365**		0.183 NS		1.080 NS		4.070*		4.422**		4.000*		676.000**	
CV (%)	9.96		12.43		11.02		13.99		15.98		4.73		7.70	
Comparison Test	H.stoechas-b H.italicum-a		-		-		H.stoechas-a H.italicum-b		H.stoechas-a H.italicum-b		H.stoechas-b H.italicum-a		H.stoechas-b H.italicum-a	

P < 0.05(\*), P < 0.01(\*\*), NS: Non-significant, Std. Dev.: Standart Deviation

Miloradovic et al. [15] was reported that *Helichrysum* species formed vegetative biomass and a large number of flower stalks and thus a high plant yield was obtained. It has been reported that this situation is caused by the optimum climatic conditions in the period between planting and cutting. It has been reported that this situation is caused by the optimum climatic conditions in the period between planting and cutting. And the same time, they reported that the average fresh herb yield per plant for the researchers varied between 210.3-232.9 grams. The reported results are higher than the results obtained in this study. This situation may have been caused by the cultivation under optimum conditions and the different plant species. Approximately 65% of the mass of the wet herb subjected to drying is lost during drying and the drug herb (dry herb) yield is determined. In the reported study and this research, it was determined that the dry herb yield did not create a significant variation.

When the essential oil ratios in dry herb were evaluated on the basis of species, it was determined that HI had 9% more essential oil than HS. When the essential oil ratios in dry flowers were evaluated on the basis of species, it was stated that HI had 9.6 times more essential oil than HI. The analyses showed that the essential oil content of HI flowers was higher than that of herbaceous, and the opposite was the case in the HS species. One of the most important components in the essential oil ratio is stability. It is thought that HI, which is cultivated, has a higher herb and flower essential oil ratio due to its more stable form.

#### 4. Conclusion

The main purpose in the production of medicinal and aromatic plants is standard active ingredient, quality and high efficiency production. For this purpose, it is necessary to develop varieties suitable for different ecological regions and to determine modern cultivation techniques. Some agro-morphological characteristics and essential oil amounts of HI and HS species grown in İzmir-Ödemiş conditions were compared. As a result of the statistical analysis, it was stated that there were no significant results for both fresh herb and dry herb yields for both *Helichrysum* species. In addition, it was determined that HI showed superior results for İzmir, Ödemiş conditions in terms of plant height, herba essential oil amount and flower essential oil amount compared to HS. It was specified that HS showed superior results for İzmir, Ödemiş conditions in terms of fresh flower and dried flower yield compared to HI.

## Author Contributions

All the authors contributed equally to this work. They all read and approved the last version of the paper.

## Conflicts of Interest

The authors declare no conflict of interest.

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