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Effects of Diurnal Variability on Essential Oil Composition of Sweet Basil (*Ocimum basilicum* L.)

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Sweet basil (*Ocimum basilicum* L.) plants were grown under the field conditions and herb samples collected at the beginning of flowering stage. Herb samples were gathered at three different times in a day such as just before sunrise (6:00 h), midday (12:00 h) and after sunset (21:00 h), respectively. Essential oils obtained by hydrodistillation method of herb samples were analyzed by GS-MS. A total of 52 compounds were identified representing 93.34, 92.89 and 93.13% of total oil, respectively. Linalool (41.23%), α-cadinol (9.69%) and eugenol (5.37%) were found as major constituents. Essential oil ratios were recorded such as 0.67% at 6:00 h, 0.62% at 12:00 h and 0.74% at 21:00 h.

Key Words: Sweet basil, *Ocimum basilicum*, Essential oil, Linalool, α-Cadinol, Eugenol.

INTRODUCTION

Sweet basil (*Ocimum basilicum* L.) is an aromatic plant, belonging to the Lamiaceae family, which grows in several regions all over the world[1]. It is a popular culinary herb and a source of essential oils extracted by distillation from leaves and the flowering tops which are used to flavour foods, in dental and oral products and in fragrances[2, 3]. Also basil is a condimental plant cultivated in some part of Turkey and used frequently in soups, pickles, cheese dishes, salads, meat products and some juices as a flavouring agent. It has long been also a herbal remedy for diseases of the brain, heast, lungs, kidneys and bladder[2, 4].

There are usually considerable variations in the contents of the major components within this species. Also percentage of components can change during day. In this study, we aimed to determine changes in component amounts at different times of a day in *Ocimum basilicum* species.

EXPERIMENTAL

This study was carried out at the field and laboratories of Field Crops Department, Faculty of Agriculture and University of Ankara in 2004. Sweet basil plants were grown under the field conditions with two times irrigation. The fresh herb samples were harvested three times in a day such as just before sunrise (6:00 h), midday (12:00 h) and after sunset (21:00 h), respectively. Harvesting time was at the beginning of the flowering stage in the field. The fresh herb was dried in shadow.

Essential oils obtained by hydrodistillation method of herb samples were analyzed by GC-MS. The analysis was performed using a Hewlett Packard 6890 N GC, equipped with HP-5 MS capillary column (30 m × 0.25 μm) and HP 5973 mass selective detector. For GC-MS detection an electron ionization system with ioniza-

tion energy of 70 eV was used. Helium was used as carrier gas at a flow rate of 1 mL/min. Injector and MS transfer line temperatures were set at 220 and 290°C, respectively. Column temperature was initially kept at 50°C for 3 min, then gradually increased to 150°C at a 3°C/min rate, held for 10 min and finally raised to 250°C at 10°C/min. Diluted samples (1/100 in acetone, v/v) of 1.0 µL were injected automatically and in the splitless mode[5]. Individual components were identified by spectrometric analyses using computer library.

RESULTS AND DISCUSSION

The maximum essential oil ratio was recorded in the collection time of after sunset as 0.74% while the minimum value was in the collection time of midday as 0.62%. Previous studies reported[6, 7] 0.50% essential oil which is lower than our results.

Fiftytwo constituents were identified in *Ocimum basilicum*, representing 93.34, 92.89 and 93.13% of the oil in the three different harvesting times, respectively. The maximum total compound ratio was obtained in the collection time of before sunrise as 93.34% while the minimum value was in the collection time of midday as 92.89%. 15 components were found over 1% regarding average values. Linalool (41.23%), α-cadinol (9.69%), eugenol (5.37%), β-cubebene (3.43%), 1,8-cineole (3.16%) and elemene (3.10%) were found as major constituents (Table-1). In previous studies[1, 6–8], linalool ratios were reported as 10.8, 42.8, 67.84 and 42.5%, respectively.

The highest linalool ratio was obtained at 6:00 h with 43.08% when the lowest ratio was at 12:00 h with 40.07%. The content of α-cadinol showed similarity at all collection times. The content of eugenol decreased from 6:00 h to 21:00 h in descending order as 5.89%, 5.33% and 4.88%, respectively (Fig. 1).

In conclusion, some differences were recorded among harvesting times with respect to essential oil content and major component. Maximum essential oil was obtained at the collection time of after sunset while maximum linalool content was determined in the collection time of before sunrise.

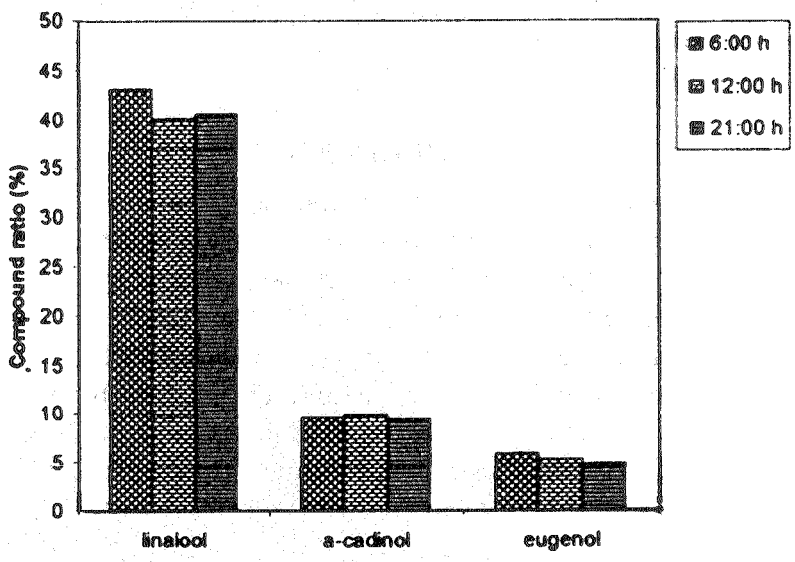

Fig. 1. Changing of linalool, α-cadinol and eugenol content by harvesting time during day

TABLE-1
ESSENTIAL OIL COMPOSITION OF *OCIMUM BASILICUM* AT DIFFERENT HARVESTING TIMES (%)

Compounds	RT	Harvesting times during day			Average
		6:00 h	12:00 h	21:00 h	
Thujene	8.32	0.04	0.03	0.03	0.03
α-pinene	8.55	0.17	0.20	0.19	0.19
Camphene	9.13	0.06	0.07	0.08	0.07
β-Phellandrene	10.20	0.05	0.06	0.09	0.07
β-Prinene	10.29	0.14	0.19	0.23	0.19
β-Myrcene	11.00	0.17	0.22	0.26	0.22
α-Terpinene	12.07	0.08	0.06	0.06	0.07
p-Cymene	12.43	0.26	0.16	0.22	0.21
1,8-Cineole	12.70	2.68	3.26	3.53	3.16
Ocimine	13.59	0.54	0.54	0.48	0.52
γ-Terpinene	14.02	0.38	0.19	0.32	0.30
cis-Sabinene	14.37	0.33	0.28	0.24	0.28
cis-Linalool oxide	14.66	0.11	0.16	0.13	0.13
α-Terpinolene	15.39	0.21	0.22	0.20	0.21
Linalool	16.29	**43.08**	**40.07**	**40.54**	**41.23**
Camphor	17.96	1.29	1.40	1.41	1.37
Borneol	18.95	0.16	0.17	0.19	0.17
3-Cyclohexen-1-ol	19.53	2.32	1.81	1.43	1.85
α-Terpineol	20.14	0.63	0.74	0.77	0.71
Nerol	21.92	0.06	0.05	0.04	0.05
Neral	22.50	0.05	0.04	—	0.03
Geraniol	23.18	1.21	1.24	1.45	1.30
Citral	23.85	0.09	0.07	0.04	0.07
Bornyl acetate	24.53	2.02	3.30	2.15	2.16
Thymol	24.84	0.08	0.12	0.18	0.13
α-Cubebene	27.31	0.14	0.14	0.17	0.15
Eugenol	27.71	5.89	5.33	4.88	5.37
α-Copaene	28.42	0.18	0.18	0.22	0.19
Geranyl acetate	28.86	1.39	1.72	1.51	1.54
Elemene	29.16	3.01	2.89	3.41	3.10
Methyl eugenol	29.71	0.09	0.12	0.10	0.10
Caryophyllene	30.24	0.32	0.31	0.39	0.34
β-Cubebene	30.65	3.14	3.44	3.70	4.43

Compounds	RT	Harvesting times during day			Average
		6:00 h	12:00 h	21:00 h	
α-Bergamotene	30.99	2.30	3.05	2.61	2.65
α-Guaiene	31.10	0.95	0.86	1.12	0.98
β-Farnesene	31.28	0.40	0.87	0.45	0.57
δ-Cadinene	31.38	0.23	0.22	0.16	0.20
α-Humulene	31.65	1.11	1.03	1.33	1.16
Bicyclogermacrene	33.42	0.70	0.71	0.78	0.73
α-Gurjunene	33.53	0.24	0.24	0.29	0.26
α-Bulnesene	33.82	2.08	2.12	2.63	2.28
β-Bisabolene	33.97	0.05	0.07	0.07	0.06
γ-Cadinene	34.15	2.66	2.76	2.95	2.79
Calamenene	34.48	0.24	0.29	0.27	0.27
β-Cadinene	34.53	0.31	0.30	0.34	0.32
Phenol	34.71	0.43	0.63	0.18	0.41
α-Cadinene	35.04	0.06	0.07	0.07	0.07
Nerolidol	36.12	0.23	0.29	0.32	0.28
Spathulenol	36.58	0.91	1.08	0.90	0.96
Caryophyllene oxide	36.81	0.10	0.12	0.11	0.11
α-Cadinol	38.96	9.60	9.96	9.52	9.69
β-Eudesmol	39.18	0.37	0.44	0.39	0.40
Total		93.34	92.89	93.13	

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