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Effect of Ripening Time of Fruits in the Chemical Composition (%) of Essential Oils in Syrian Laurel Oil

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Abstract

The effect of ripening time of the laurel fruits (from the region of Kassab in Syria) between October to December on the chemical composition of essential oils in laurel oil extracted from the fresh fruits (green, brown and black) by hexane using gas chromatographic analysis was studied. The ratios of essential oils change with the time of growth and with the maturation of the fruits. It was found that, for the first time, the light oils (as Hexanal and 3-Hexen-1-ol) are very large, especially in green fruits. This is due to the fact that, the oil was extracted with hexane from fresh fruits, while their proportions are almost non-existent if the oil is extracted using the old methods (used locally by boiling the fruits). Keeping the extracted oil (or even fruits) at room temperature for a long period (like it is followed industrially) leads to a sharp decrease in the percentage of essential oils in general and light essential oils in particular, or until the light oils disappear completely, this greatly affects the quality of healthy laurel soap, for which its uses laurel oil in Syria. Analysis by GC and GC-MS of the essential oils has allowed to identify 26 compounds representing 99.4% of the total content were directly identified after extracting laurel oil. There are eleven essential oils, which constitute more than 88%, and they are: Hexanal, 3-Hexen-1-ol, alpha-Pinene, Sabinene, beta-Myrcene, alpha-Terpinine, orto-Cymene, 1,8-Cineol, Bornyl acetate, alpha-Terpinyl acetate and Eugenol methyl ether (24.263%, 14.250%, 7.562%, 2.827%, 7.120%, 1.596%, 11.211%, 9.574%, 3.628%, 5.394% and 1.547% in green fruits at October; and 8.667%, 3.098%, 8.385%, 8.956%, 6.222%, 1.538%, 6.216%, 41.311%, 3.089%, 3.378% and 1.002% in black fruits at December).

Keywords: Laurel oil, Essential oils, Gas chromatographic analysis.

Introduction

The laurel plant is widely spread in the Syrian coast, especially in the Kassab [1].There are many studies on the chemical composition of the essential oil obtained from leaves of Mediterranean and European *L. nobilis*. The main components of the essential oil were cineole (44.1%), eugenol (15.2%), sabinene (6.2%), 4-terpineol (3.6%), α-pinene (2.7%), methyl eugenol (2.5%), α-terpin-eol (2.2%), and -pinene (2.1%) [2].

The oil yield was 0.78%, 0.80%, and 3.25% in the fruits, twigs, and leaves, respectively. In the fruit 38 constituents representing 99.3% of the total content were identified. Twelve of the constituents were in concentrations over 1% of the essential oils. The main constituents in the fruit essential oils (above 3%) were 1,8-cineole (33.3%), α-terpinyl acetate (10.3%), α-pinene (11.0%), β-elemene (7.45%), sabinene (6.30%), β-phellandrene (5.2%), bornyl acetate (4.38%), and camphene (4.3%) [3].

The laurel essential oils yield and composition were shown to be influenced by various factors, such as growth environment, harvest season, plant parts, extraction method, and others. The main compounds of the fruit essential oils in previous studies were 1,8-cineole (8.10–48.0%), α-terpinylacetate (3.67–10.4%), sabinene (4.49–11.4%), α-phellandrene, eugenol, methyl eugenol, α-pinene, α -ocimene, α -pinene, etc., (3.91–12.8%) [4-10].

In the present work, the effect of ripening time of the laurel fruits (from the region of Kassab in Syria) between October to December on the chemical composition of essential oils in laurel oil extracted from the fruits (green, brown and black) by hexane using gas chromatographic analysis was applied.

Materials and Methods

Instruments and apparatuses

A Shimadzu GC-2010 gas chromatograph with capillary column (TRB-1, 0.5 µm, 30 m ×0.25 mm, Serial: J-2031612), auto injecter-AOC-20i and FID detector were used. Agilent Technologies (GC-MS), 7890 A GC system, 5975C inert XL EI/Cl MSD with Triple-Axis Detector, made in USA, 2008. For microwave digestion of the samples, a high performance microwave digestion apparatus MLS-1200 MEGA with EM-30 unit (Milestone GmbH) was used. An ultrasonic processor model POWER Sonic 405 was used. The diluter pipette model DIP-1 (Shimadzu), having 100 µL sample syringe and five continuously adjustable pipettes covering a volume range from 10 to 5000 µL (model Piptman P, GILSON). Centrifuge (Centurion Scientific Ltd., Model: K2080-Manufactured in the United Kingdom) was used for the preparation of the experimental solutions. SARTORIUS TE64 electronic balance was used for weighing the samples.

Reagents

Hexane and methanol (extra pure) were purchased from Merck. Two standards of essential oils CAN-TERP-MIX 1 & 2, which each contain 21 compounds by focus each 100µg.mL^{-1} were used.

Samples preparation

Dry the fruits in room temperature in the shade for several days. Then extract the oil with hexane by distillation until the extraction is complete. The oil was extracted by hexane and collected in a glass container [1]. The essential oils were extracted by using a Clevenger apparatus (Figure 1) for three hours, and they were directly bound to the GC-2010 gas chromatograph after extending them with hexane in ratio 2 mg.mL^{-1}. The percentage of essential oils in laurel oil ranged between 4-6%.

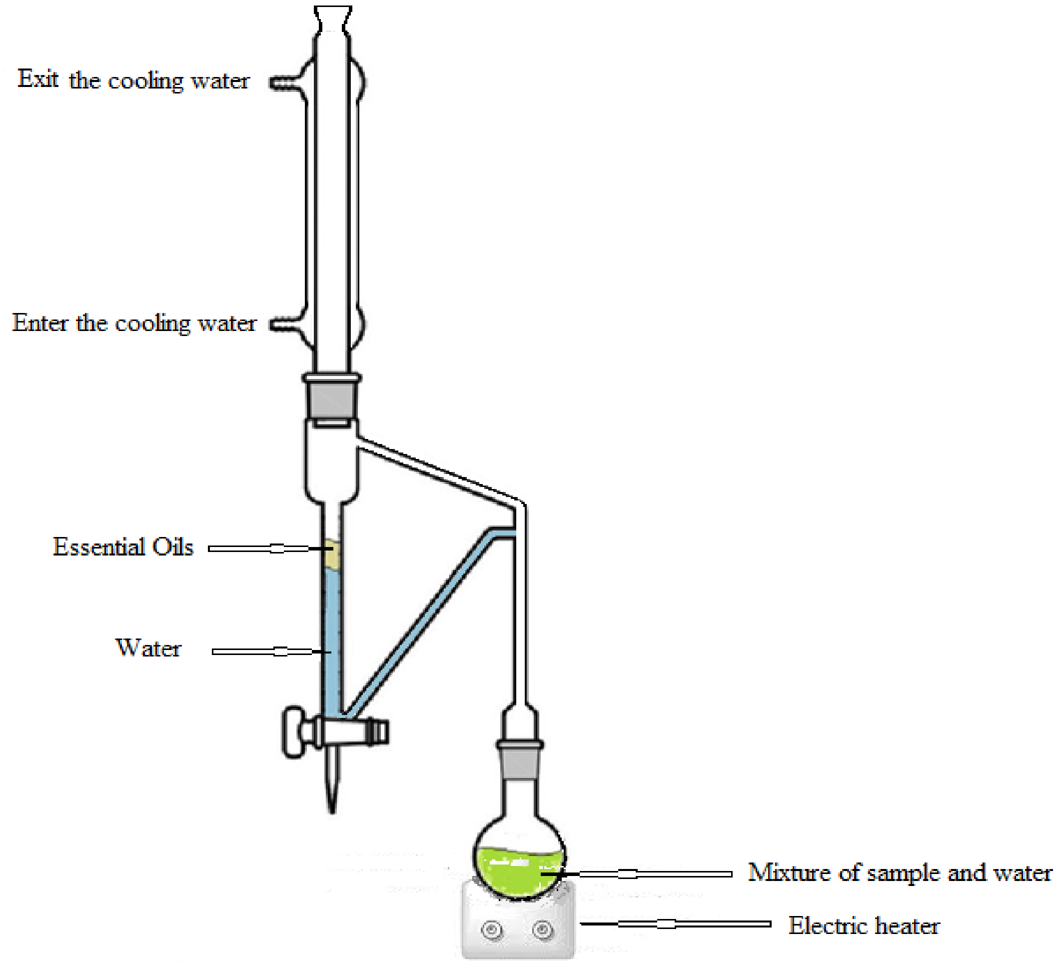

Figure 1. Clevenger apparatus

Results and Discussion

Analytical procedure

The effect of ripening time of the laurel fruits (from the region of Kassab in Syria) between October to December on the chemical composition of essential oils in laurel oil extracted from the fruits (green, brown and black) by hexane using gas chromatographic analysis was studied. Programmed column temperature 60°C for 5 min and then increase to 220°C with increasing temperature rate 2°C/min, flow rate of N_2 carrier gas 2.1 mL.min^{-1}, the injection volume 2 µL with split injection mode 2.5, injected port temperature 250°C, and temperature of FID 250°C.

Effect of ripening time in the chemical composition of essential oils in laurel oil

On October 10.2019

The components of essential oils using gas chromatography with a detector FID for oil extracted from the green, brown and black fruits on October 10.2019 were identified. An analysis by GC and GC-MS of the essential oils has allowed to identify 26 compounds representing 99.4% of the total content were determined, see Figures 2-4. There are eleven main essential oils, which constitute more than 88%, and they are: Hexanal, 3-Hexen-1-ol, alpha-Pinene, Sabinene, beta-Myrcene, alpha-Terpinine, orto-Cymene, 1,8- Cineol, Bornyl acetate, alpha-Terpinyl acetate and Eugenol methyl ether (24.263%, 14.250%, 7.562%, 2.827%, 7.120%, 1.596%, 11.211%, 9.574%, 3.628%, 5.394% and 1.547%), respectively, for green fruits, (18.758%, 10.424%, 8.698%, 5.749%, 6.948%, 1.584%, 12.668%, 14.260%, 3.540%, 4.825% and 1.330%), respectively, for brown fruits and (16.049%, 8.510%, 9.310%, 6.820%, 6.830%, 1.578%, 13.730%, 16.637%, 3.590%, 4.438% and 1.102%), respectively, black fruits, see Tables 1-3 and Figure 5. The previous results show that the amounts of light volatile oils (such as Hexanal and 3-Hexen-1-ol) were very large and were decreasing with the transition from green to black fruits with average percentages of 77.3% and 73.1% of brown fruits, and 66.1% and 59.7% of black fruits, respectively, whereas some other oils (such as 1,8-Cineol, orto-Cymene and Sabinene) increased by an average of 1.49%, 1.12% and 2.03% for brown fruits, and 1.74%, 1.22% and 2.41% of the essential oils for black fruits mentioned in series.

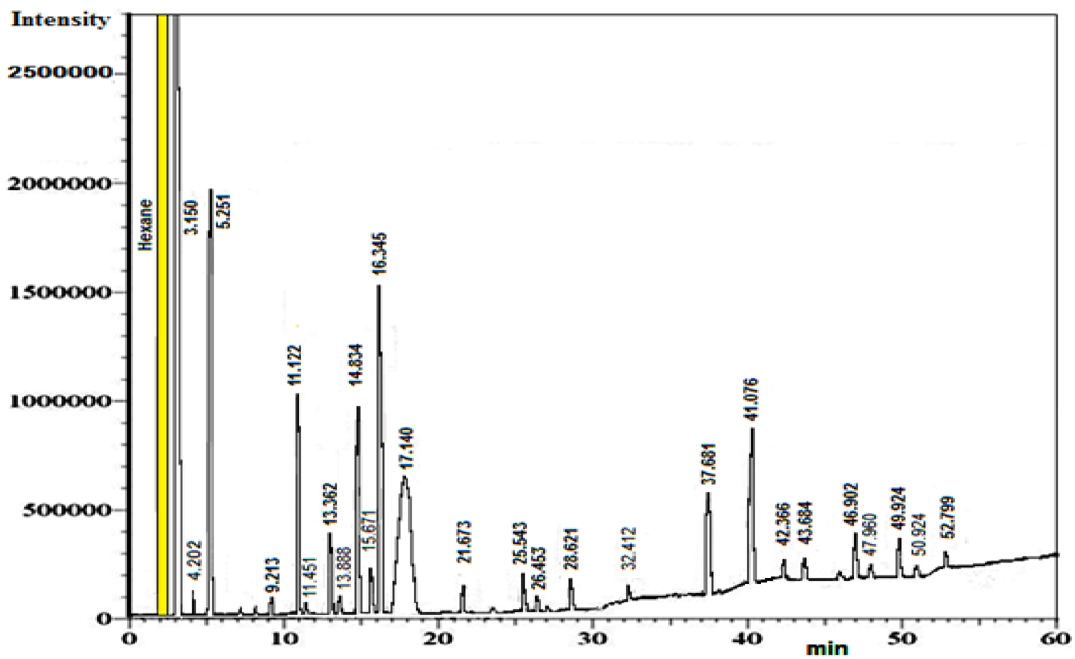

Fig. 2. Gas chromatographic analysis of essential oils in laurel oil extracted from green fruits on October 10.2019 (Programmed column temperature 60°C for 5 min and then increase it to 220°C with increasing temperature rate 2°C/min, flow rate of N_2 carrier gas 2.1 mL.min^{-1}, the injection volume 2 µL with split injection mode 2.5, injected port temperature 250°C, and temperature of FID 250°C).

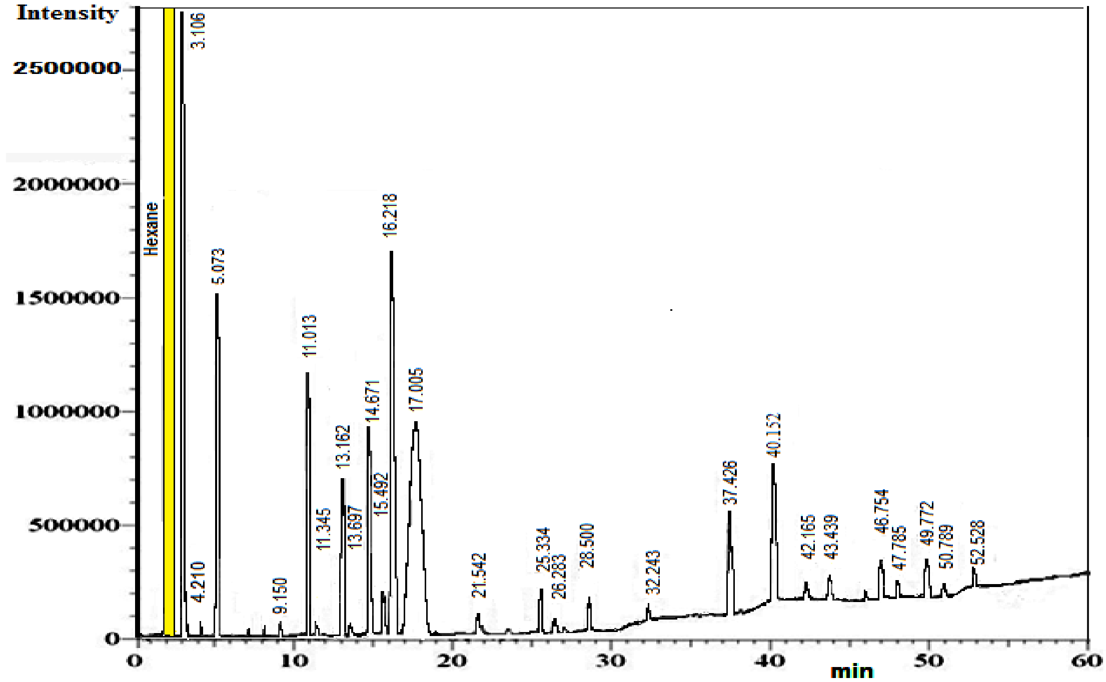

Fig.3. Gas chromatographic analysis of essential oils in laurel oil extracted from brown fruits on October 10.2019 (Programmed column temperature 60°C for 5 min and then increase it to 220°C with increasing temperature rate 2°C/min, flow rate of N_2 carrier gas 2.1 mL.min^{-1}, the injection volume 2 µL with split injection mode 2.5, injected port temperature 250°C, and temperature of FID 250°C).

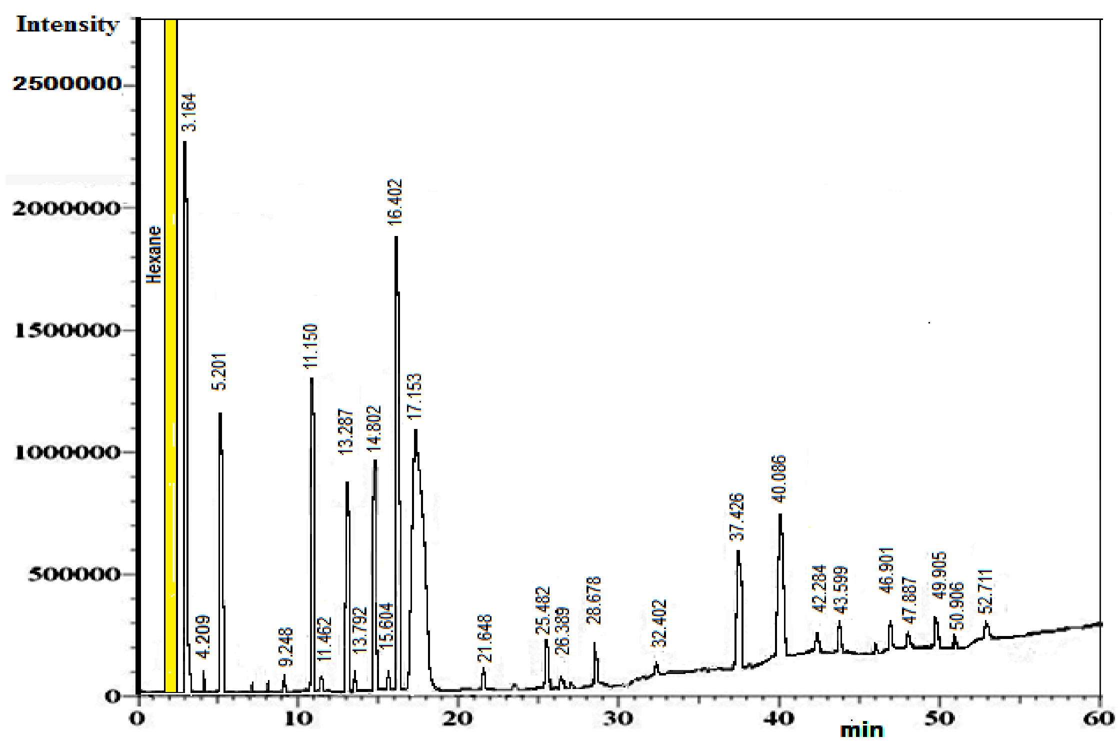

Fig. 4. Gas chromatographic analysis of essential oils in laurel oil extracted from black fruits on October 10.2019 (Programmed column temperature 60°C for 5 min and then increase it to 220°C with increasing temperature rate 2°C/min, flow rate of N_2 carrier gas 2.1 mL.min^{-1}, the injection volume 2 µL with split injection mode 2.5, injected port temperature 250°C, and temperature of FID 250°C).

Table 1. The components of essential oils extracted from the green fruits on October 10.2019 using gas chromatographic analysis with a detector FID.

N°	Name of Essential Oil	Retention time, min	Concentration, %
1	Hexanal	3.150	24.263
2	Unknown	4.202	0.616
3	3-Hexan-1-ol	5.251	14.250
4	*a*lpha-Thujene	9.213	0.621
5	*a*lpha-Pinene	11.122	7.562
6	Camphene	11.451	0.420
7	Sabinene	13.362	2.827
8	*b*eta-Pinene	13.888	0.608
9	*b*eta-Myrcene	14.834	7.120
10	*a*lpha-Terpinene	15.671	1.596
11	o-Cymene	16.345	11.211
12	1.8-Cineol	17.140	9.574
13	gamma-Terpinene	21.673	0.904
14	Linalool	25.543	1.356
15	p-Ment-2-en-1-ol	26.453	0.381
16	Terpinen-4-ol	28.621	1.118
17	*a*lpha-Terpineol	32.412	0.270
18	Bornyl acetate	37.681	3.628
19	*a*lpha-Terpinyl acetate	41.076	5.394
20	Eugenol	42.366	0.780
21	Cyctosativene	43.684	0.912
22	Eugenol methyl ether	46.902	1.547
23	*b*eta-Elemene	47.960	0.301
24	*b*eta-Caryophyllene	49.924	1.389
25	Cinnamyl acetate	50.924	0.258
26	Isoeugenyl methyl ether	52.799	0.514
Total			**99.420**

Table 2. The components of essential oils extracted from the brown fruits on October 10.2019 using gas chromatographic analysis with a detector FID.

N°	Essential Oil	Retention time, min	Concentration, %
1	Hexanal	3.106	18.758
2	Unknown	4.210	0.489
3	3-Hexan-1-ol	5.073	10.424
4	*a*lpha-Thujene	9.150	0.618
5	*a*lpha-Pinene	11.013	8.698
6	Camphene	11.345	0.452
7	Sabinene	13.162	5.749
8	*b*eta-Pinene	13.697	0.615
9	*b*eta-Myrcene	14.671	6.948
10	*a*lpha-Terpinene	15.492	1.584
11	o-Cymene	16.218	12.668
12	1.8-Cineol	17.005	14.260
13	gamma-Terpinene	21.542	0.862
14	Linalool	25.334	1.486
15	p-Ment-2-en-1-ol	26.283	0.370
16	Terpinen-4-ol	28.500	1.217
17	*a*lpha-Terpineol	32.243	0.281
18	Bornyl acetate	37.426	3.540
19	*a*lpha-Terpinyl acetate	40.152	4.825
20	Eugenol	42.165	0.731
21	Cyctosativene	43.439	0.994
22	Eugenol methyl ether	46.754	1.330
23	*b*eta-Elemene	47.785	0.413
24	*b*eta-Caryophyllene	49.772	1.304
25	Cinnamyl acetate	50.789	0.273
26	Isoeugenyl methyl ether	52.528	0.529
Total			**99.418**

Table 3. The components of essential oils extracted from the black fruits on October 10.2019 using gas chromatographic analysis with a detector FID.

N°	Essential Oil	Retention time, min	Concentration, %
1	Hexanal	3.164	16.049
2	Unknown	4.209	0.467
3	3-Hexan-1-ol	5.201	8.510
4	*a*lpha-Thujene	9.248	0.604
5	*a*lpha-Pinene	11.150	9.310
6	Camphene	11.462	0.461
7	Sabinene	13.287	6.820
8	*b*eta-Pinene	13.792	0.612
9	*b*eta-Myrcene	14.802	6.830
10	*a*lpha-Terpinene	15.604	1.578
11	o-Cymene	16.402	13.730
12	1.8-Cineol	17.153	16.637
13	gamma-Terpinene	21.648	0.846
14	Linalool	25.482	1.520
15	p-Ment-2-en-1-ol	26.389	0.362
16	Terpinen-4-ol	28.678	1.340
17	*a*lpha-Terpineol	32.402	0.286
18	Bornyl acetate	37.426	3.590
19	*a*lpha-Terpinyl acetate	40.086	4.438
20	Eugenol	42.284	0.702
21	Cyctosativene	43.599	1.120
22	Eugenol methyl ether	46.901	1.102
23	*b*eta-Elemene	47.887	0.562
24	*b*eta-Caryophyllene	49.905	1.120
25	Cinnamyl acetate	50.906	0.281
26	Isoeugenyl methyl ether	52.711	0.532
Total			**99.409**

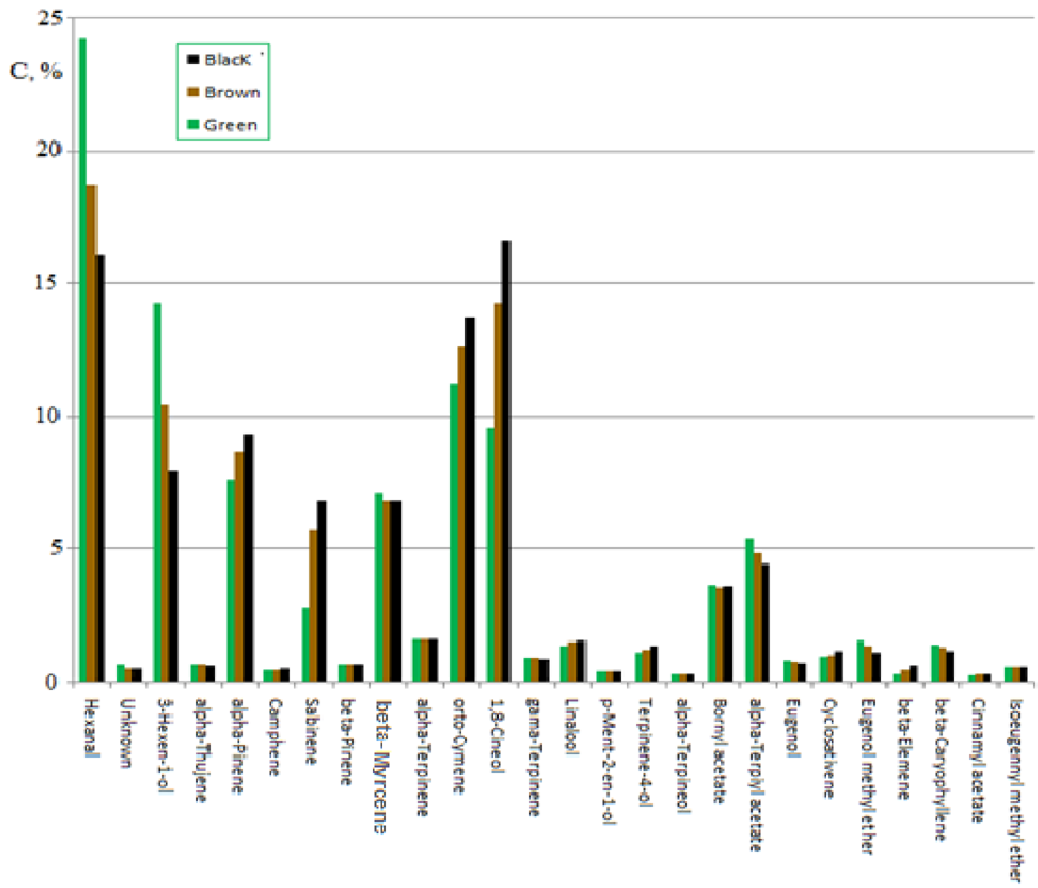

Fig. 5. The percentage of essential oils in laurel oil extracted from the fruits (green, brown and black) collected on October 10.2019.

On November 10.2019

A similar study on essential oils on November was conducted, see Figures 6-8. It was also found that there are eleven main essential oils, which constitute more than 88%.Theyare: Hexanal, 3-Hexen-1-ol, alpha-Pinene, Sabinene, beta-Myrcene, alpha-Terpinine, orto-Cymene, 1,8-Cineol, Bornyl acetate, alpha-Terpinyl acetate and Eugenol methyl ether (20.212%, 12.360%, 6.620%, 3.038%, 7.016%, 1.562%, 6.440%, 23.813%, 3.215%, 4.960% and 1.310%), respectively, for green fruits, (15.046%, 6.430%, 7.989%, 5.080%, 6.818%, 1.558%, 9.437%, 29.020%, 3.329%, 4.610% and 1.143%), respectively, for brown fruits and (12.279%, 4.964%, 8.660%, 7.638%, 6.495%, 1.550%, 9.640%, 30.696%, 3.460%, 3.829% and 1.030%), respectively, black fruits, see Tables 4-6 and Figure 9. The previous results show that the amounts of light essential oils (such as Hexanal and 3-Hexen-1-ol) were large and were decreasing with the transition from green to black fruits with average percentages of 74.4% and 52.0% of brown fruits, and 60.7% and 40.1% of black fruits, respectively. Whereas, some other oils (such as 1,8-Cineol, orto-Cymene and Sabinene) increased by an average of 1.22%, 1.46% and 1.67% for brown fruits, and 1.29%, 1.50% and 2.51% of the essential oils for black fruits, respectively.

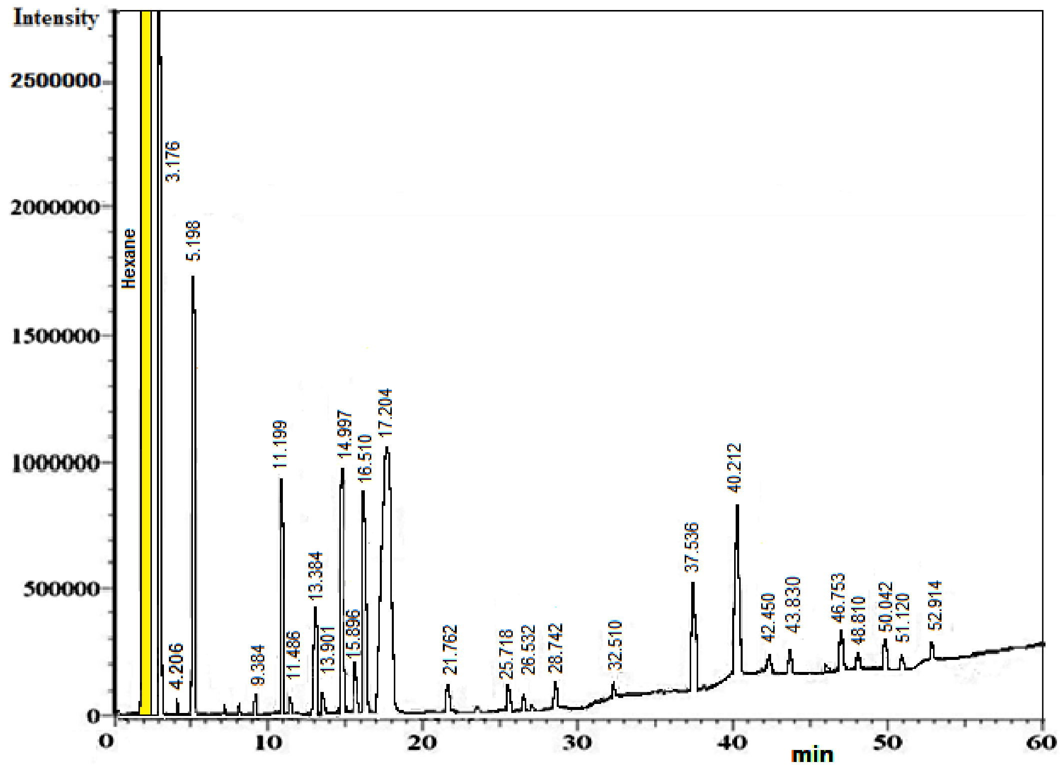

Fig. 6. Gas chromatographic analysis of essential oils in laurel oil extracted from green fruits on November 10.2019 (Programmed column temperature 60°C for 5 min and then increase it to 220°C with increasing temperature rate 2°C/min, flow rate of N_2 carrier gas 2.1 $mL.min^{-1}$, the injection volume 2 µL with split injection mode 2.5, injected port temperature 250°C, and temperature of FID 250°C).

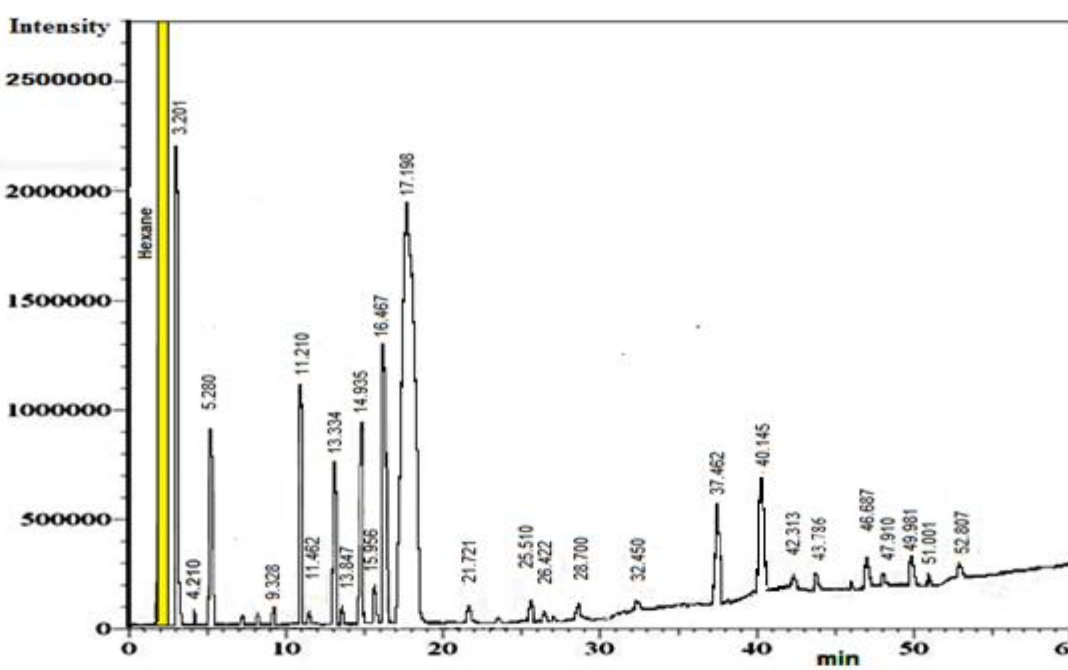

Fig.7. Gas chromatographic analysis of essential oils in laurel oil extracted from brown fruits on November 10.2019 (Programmed column temperature 60°C for 5 min and then increase it to 220°C with increasing temperature rate 2°C/min, flow rate of N_2 carrier gas 2.1 $mL.min^{-1}$, the injection volume 2 µL with split injection mode 2.5, injected port temperature 250°C, and temperature of FID 250°C).

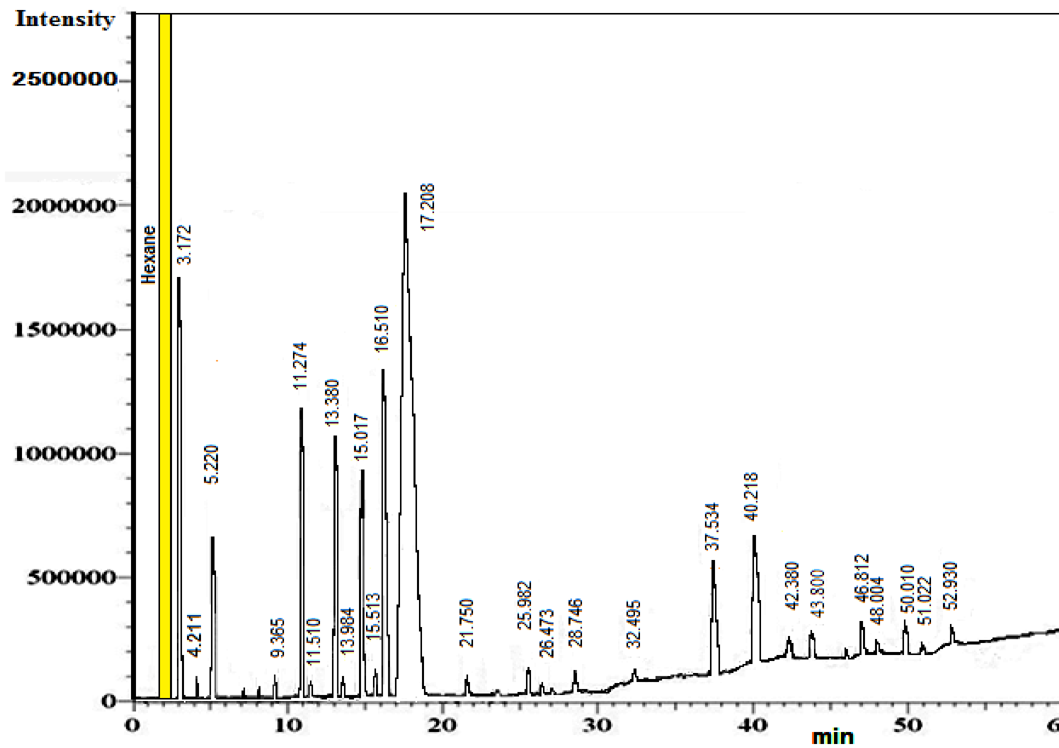

Fig. 8. Gas chromatographic analysis of essential oils in laurel oil extracted from black fruits on November 10.2019 (Programmed column temperature 60°C for 5 min and then increase it to 220°C with increasing temperature rate 2°C/min, flow rate of N_2 carrier gas 2.1 mL.min^{-1}, the injection volume 2 µL with split injection mode 2.5, injected port temperature 250°C, and temperature of FID 250°C).

Table 4. The components of essential oils extracted from the green fruits on November 10.2019 using gas chromatographic analysis with a detector FID.

N^o	Essential Oil	Retention time, min	Concentration, %
1	Hexanal	3.176	20.212
2	Unknown	4.206	0.502
3	3-Hexan-1-ol	5.198	12.360
4	*a*lpha-Thujene	9.384	0.602
5	*a*lpha-Pinene	1.1991	6.620
6	Camphene	11.486	0.412
7	Sabinene	13.384	3.038
8	*b*eta-Pinene	13.901	0.600
9	*b*eta-Myrcene	14.997	7.016
10	*a*lpha-Terpinene	15.896	1.562
11	o-Cymene	16.510	6.440
12	1.8-Cineol	17.204	23.813
13	gamma-Terpinene	21.762	0.884
14	Linalool	25.718	0.903
15	p-Ment-2-en-1-ol	26.532	0.374
16	Terpinen-4-ol	28.742	0.830
17	*a*lpha-Terpineol	32.510	0.275
18	Bornyl acetate	37.536	3.215
19	*a*lpha-Terpinyl acetate	40.212	4.960
20	Eugenol	42.450	

21	Cyctosativene	43.830	0.743
22	Eugenol methyl ether	46.753	1.310
23	*b*eta-Elemene	48.810	0.264
24	*b*eta-Caryophyllene	50.042	1.100
25	Cinnamyl acetate	51.120	0.243
26	Isoeugenyl methyl ether	52.914	0.501
Total			**99.407**

Table 5. The components of essential oils extracted from the brown fruits on November 10.2019 using gas chromatographic analysis with a detector FID.

N^{o}	Essential Oil	Retention time, min	Concentration, %
1	Hexanal	3.201	15.046
2	Unknown	4.210	0.401
3	3-Hexan-1-ol	5.280	6.430
4	*a*lpha-Thujene	9.328	0.584
5	*a*lpha-Pinene	11.210	7.989
6	Camphene	11.462	0.415
7	Sabinene	13.334	5.080
8	*b*eta-Pinene	3.8471	0.599
9	*b*eta-Myrcene	14.935	6.818
10	*a*lpha-Terpinene	15.956	1.558
11	o-Cymene	16.467	9.437
12	1.8-Cineol	17.198	29.020
13	gamma-Terpinene	21.721	0.852
14	Linalool	25.510	1.068
15	p-Ment-2-en-1-ol	26.422	0.361
16	Terpinen-4-ol	28.700	0.850
17	*a*lpha-Terpineol	32.450	0.286
18	Bornyl acetate	37.462	3.329
19	*a*lpha-Terpinyl acetate	40.145	4.610
20	Eugenol	42.313	0.603
21	Cyctosativene	43.786	0.792
22	Eugenol methyl ether	46.687	1.143
23	*b*eta-Elemene	47.910	0.372
24	*b*eta-Caryophyllene	49.981	1.018
25	Cinnamyl acetate	51.001	0.258
26	Isoeugenyl methyl ether	52.807	0.516
Total			**99.435**

Table 6. The components of essential oils extracted from the black fruits on November 10.2019 using gas chromatographic analysis with a detector FID.

N°	Essential Oil	Retention time, min	Concentration, %
1	Hexanal	3.172	12.279
2	Unknown	4.211	0.392
3	3-Hexan-1-ol	5.220	4.964
4	*a*lpha-Thujene	9.365	0.579
5	*a*lpha-Pinene	11.274	8.660
6	Camphene	11.510	0.418
7	Sabinene	13.380	7.638
8	*b*eta-Pinene	13.984	0.598
9	*b*eta-Myrcene	15.017	6.495
10	*a*lpha-Terpinene	15.513	1.550
11	o-Cymene	16.510	9.640
12	1.8-Cineol	17.208	30.696
13	gamma-Terpinene	21.750	0.837
14	Linalool	25.982	1.200
15	p-Ment-2-en-1-ol	26.473	0.353
16	Terpinen-4-ol	28.746	0.860
17	*a*lpha-Terpineol	32.495	0.291
18	Bornyl acetate	37.534	3.460
19	*a*lpha-Terpinyl acetate	40.218	3.829
20	Eugenol	42.380	0.598
21	Cyctosativene	43.800	0.841
22	Eugenol methyl ether	46.812	1.030
23	*b*eta-Elemene	48.004	0.418
24	*b*eta-Caryophyllene	50.010	0.990
25	Cinnamyl acetate	51.022	0.262
26	Isoeugenyl methyl ether	52.930	0.526
Total			**99.404**

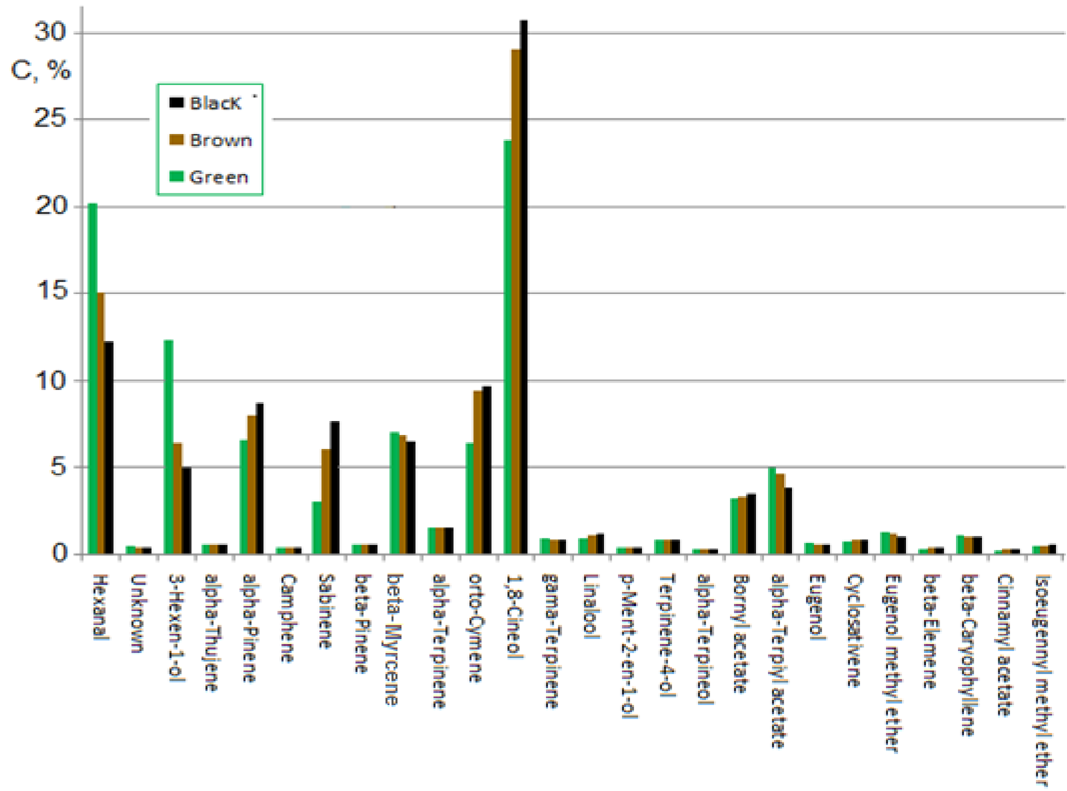

Fig. 9. The percentage of essential oils in laurel oil extracted from the fruits (green, brown and black) collected on November 10.2019.

On December 10.2019

A similar study on essential oils on December10.2019 was conducted, see Figures 10-12. There are eleven main essential oils, which constitute more than 88%, and they are: Hexanal, 3-Hexen-1-ol, alpha-Pinene, Sabinene, beta-Myrcene, alpha-Terpinine, orto-Cymene, 1,8-Cineol, Bornyl acetate, alpha-Terpinyl acetate and Eugenol methyl ether (16.068%, 8.065%, 5.739%, 3.168%, 6.994%, 1.554%, 3.368%, 38.830%, 3.077%, 4.119% and 1.143%), respectively, for green fruits, (11.702%, 4.246%, 7.818%, 6.820%, 6.659%, 1.543%, 5.220%, 40.394%, 3.060%, 3.565% and 1.014%), respectively, for brown fruits and (8.667%, 3.098%, 8.385%, 8.956%, 6.222%, 1.538%, 6.216%, 41.311%, 3.089%, 3.378% and 1.002%), respectively, black fruits, see Tables7-9 and Figure13.The previous results show that the amounts of light essential oils (such as Hexanal and 3-Hexen-1-ol) were large and were decreasing with the transition from green to black fruits with average percentages of 72.8% and 52.6% of brown fruits, and 53.9% and 38.4% of black fruits, respectively. Whereas, some other oils (such as 1,8-Cineol, orto-Cymene and Sabinene) increased by an average of 1.04%, 1.55% and 2.15% for brown fruits, and 1.06%, 1.85% and 3.00% of the essential oils for black fruits, respectively.

The previous study shows that the ratios of essential oils change with the time of growth and with the maturation of the fruits. It was found that, for the first time, the light oils (as Hexanal and 3-Hexen-1-ol) are very large, especially in green fruits. This is due to the fact that we extract oil with hexane and from fresh fruits, while their proportions are almost non-existent if the oil is extracted using the old methods (used locally by boiling the fruits). Also, keeping the extracted oil (or even fruits) at room temperature for a long period (as it is followed industrially) leads to a sharp decrease in these light oils, or even their absence.

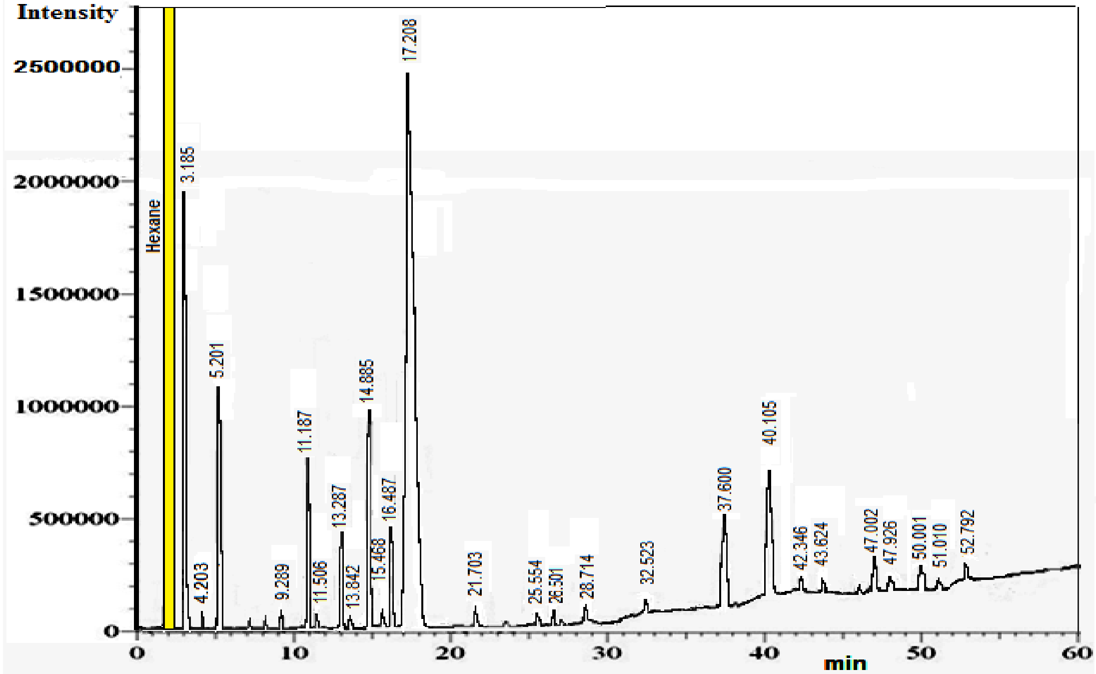

Fig.10. Gas chromatographic analysis of essential oils in laurel oil extracted from green fruits on December 10.2019 (Programmed column temperature 60°C for 5 min and then increase it to 220°C with increasing temperature rate 2°C/min, flow rate of N_2 carrier gas 2.1 $mL.min^{-1}$, the injection volume 2 µL with split injection mode 2.5, injected port temperature 250°C, and temperature of FID 250°C).

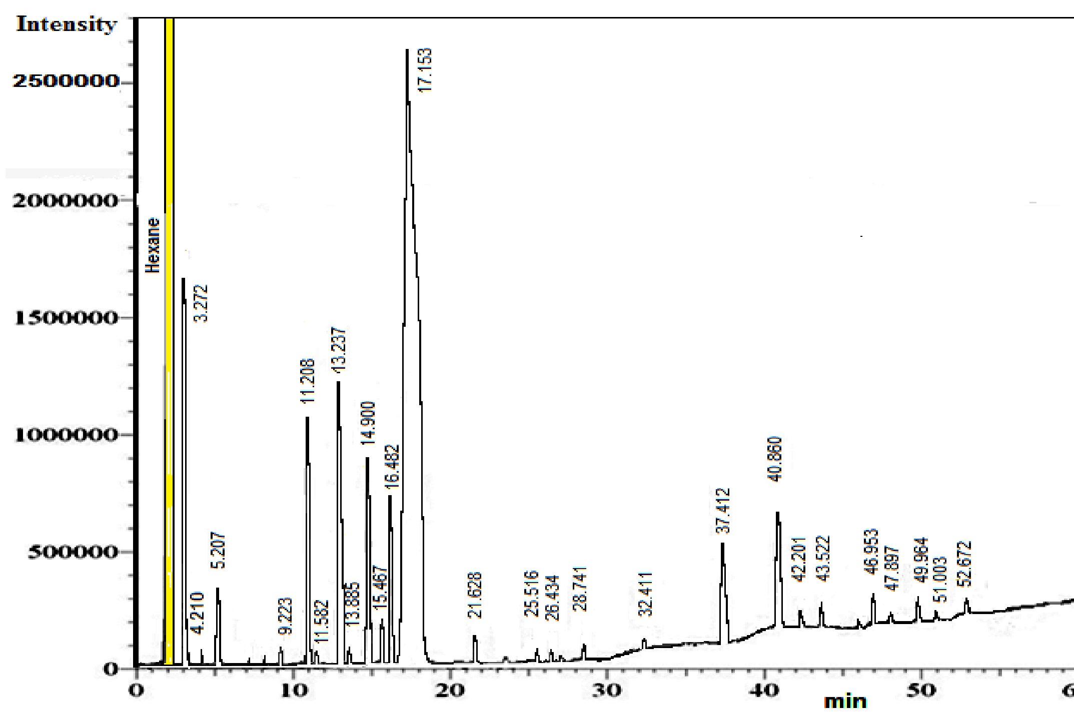

Fig.11. Gas chromatographic analysis of essential oils in laurel oil extracted from brown fruits on December 10.2019 (Programmed column temperature 60°C for 5 min and then increase it to 220°C with increasing temperature rate 2°C/min, flow rate of N_2 carrier gas 2.1 $mL.min^{-1}$, the injection volume 2 µL with split injection mode 2.5, injected port temperature 250°C, and temperature of FID 250°C).

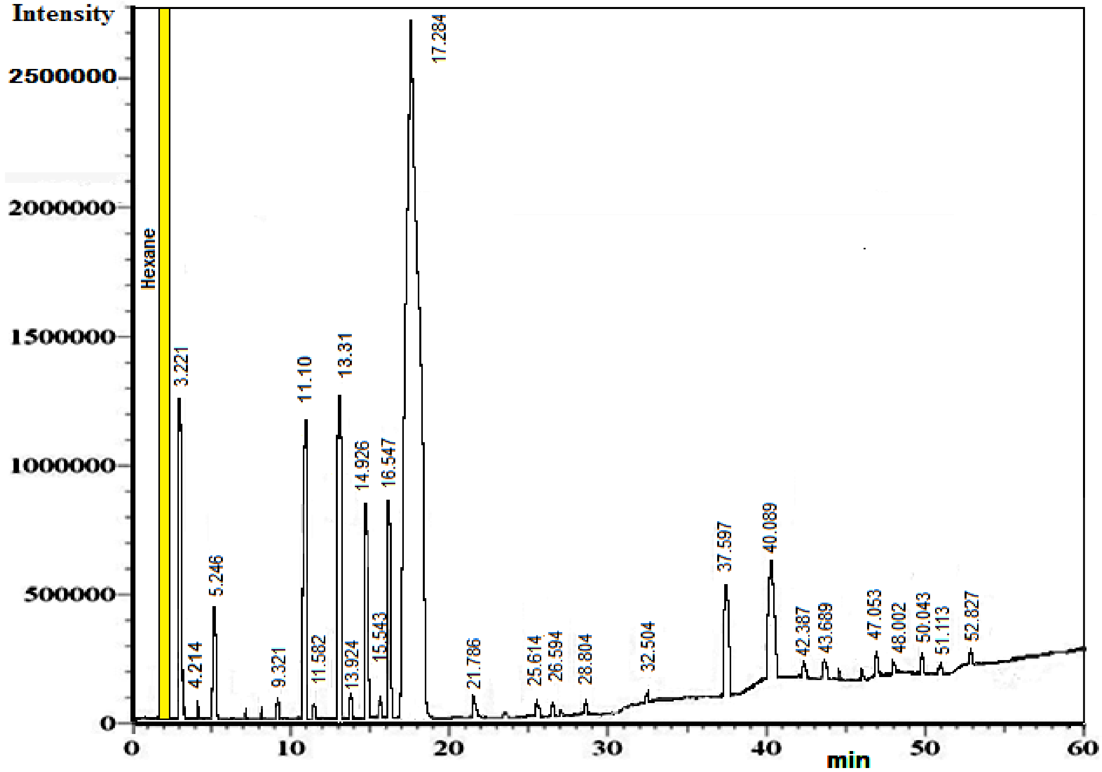

Fig.12. Gas chromatographic analysis of essential oils in laurel oil extracted from black fruits on December 10.2019 (Programmed column temperature 60°C for 5 min and then increase it to 220°C with increasing temperature rate 2°C/min, flow rate of N_2 carrier gas 2.1 mL.min^{-1}, the injection volume 2 µL with split injection mode 2.5, injected port temperature 250°C, and temperature of FID 250°C).

Table 7. The components of essential oils extracted from the green fruits on December 10.2019 using gas chromatographic analysis with a detector FID.

N^o	Essential Oil	Retention time, min	Concentration, %
1	Hexanal	3.185	16.068
2	Unknown	4.203	0.462
3	3-Hexan-1-ol	5.201	8.065
4	*a*lpha-Thujene	9.289	0.590
5	*a*lpha-Pinene	11.187	5.739
6	Camphene	11.506	0.401
7	Sabinene	13.287	3.168
8	*b*eta-Pinene	13.842	0.591
9	*b*eta-Myrcene	14.885	6.994
10	*a*lpha-Terpinene	15.468	1.554
11	o-Cymene	16.487	3.368
12	1.8-Cineol	17.208	38.830
13	gamma-Terpinene	21.703	0.874
14	Linalool	25.554	0.317
15	p-Ment-2-en-1-ol	26.501	0.360
16	Terpinen-4-ol	28.714	0.419
17	*a*lpha-Terpineol	32.523	0.279

18	Bornyl acetate	37.600	3.077
19	*a*lpha-Terpinyl acetate	40.105	4.119
20	Eugenol	42.346	0.601
21	Cyctosativene	43.624	0.620
22	Eugenol methyl ether	47.002	1.143
23	*b*eta-Elemene	47.926	0.237
24	*b*eta-Caryophyllene	50.001	0.807
25	Cinnamyl acetate	51.010	0.239
26	Isoeugenyl methyl ether	52.792	0.492
Total			**99.414**

Table 8. The components of essential oils extracted from the brown fruits on December 10.2019 using gas chromatographic analysis with a detector FID.

N^o	Essential Oil	Retention time, min	Concentration, %
1	Hexanal	3.272	11.702
2	Unknown	4.210	0.411
3	3-Hexan-1-ol	5.207	4.246
4	*a*lpha-Thujene	9.223	0.580
5	*a*lpha-Pinene	11.208	7.818
6	Camphene	11.582	0.412
7	Sabinene	13.237	6.820
8	*b*eta-Pinene	13.885	0.587
9	*b*eta-Myrcene	14.900	6.659
10	*a*lpha-Terpinene	15.467	1.543
11	o-Cymene	16.482	5.220
12	1.8-Cineol	17.153	40.394
13	gamma-Terpinene	21.628	0.843
14	Linalool	25.516	0.398
15	p-Ment-2-en-1-ol	26.434	0.352
16	Terpinen-4-ol	28.741	0.447
17	*a*lpha-Terpineol	32.411	0.288
18	Bornyl acetate	37.412	3.060
19	*a*lpha-Terpinyl acetate	40.860	3.565
20	Eugenol	42.201	0.592
21	Cyctosativene	43.522	0.712
22	Eugenol methyl ether	46.953	1.014
23	*b*eta-Elemene	47.897	0.240
24	*b*eta-Caryophyllene	49.964	0.788
25	Cinnamyl acetate	51.003	0.248
26	Isoeugenyl methyl ether	52.672	0.513
Total			**99.452**

Table 9. The components of essential oils extracted from the black fruits on December 10.2019 using gas chromatographic analysis with a detector FID.

N°	Essential Oil	Retention time, min	Concentration, %
1	Hexanal	3.221	8.667
2	Unknown	4.214	0.417
3	3-Hexan-1-ol	5.246	3.098
4	*a*lpha-Thujene	9.321	0.576
5	*a*lpha-Pinene	11.100	8.385
6	Camphene	11.582	0.414
7	Sabinene	13.310	8.956
8	*b*eta-Pinene	13.924	0.583
9	*b*eta-Myrcene	14.926	6.222
10	*a*lpha-Terpinene	15.543	1.538
11	o-Cymene	16.547	6.216
12	1.8-Cineol	17.284	41.311
13	gamma-Terpinene	21.786	0.829
14	Linalool	25.614	0.450
15	p-Ment-2-en-1-ol	26.594	0.346
16	Terpinen-4-ol	28.804	0.490
17	*a*lpha-Terpineol	32.504	0.294
18	Bornyl acetate	37.597	3.089
19	*a*lpha-Terpinyl acetate	40.089	3.378
20	Eugenol	42.387	0.587
21	Cyctosativene	43.689	0.826
22	Eugenol methyl ether	47.053	1.002
23	*b*eta-Elemene	48.002	0.243
24	*b*eta-Caryophyllene	50.043	0.758
25	Cinnamyl acetate	51.113	0.251
26	Isoeugenyl methyl ether	52.827	0.513
Total			**99.439**

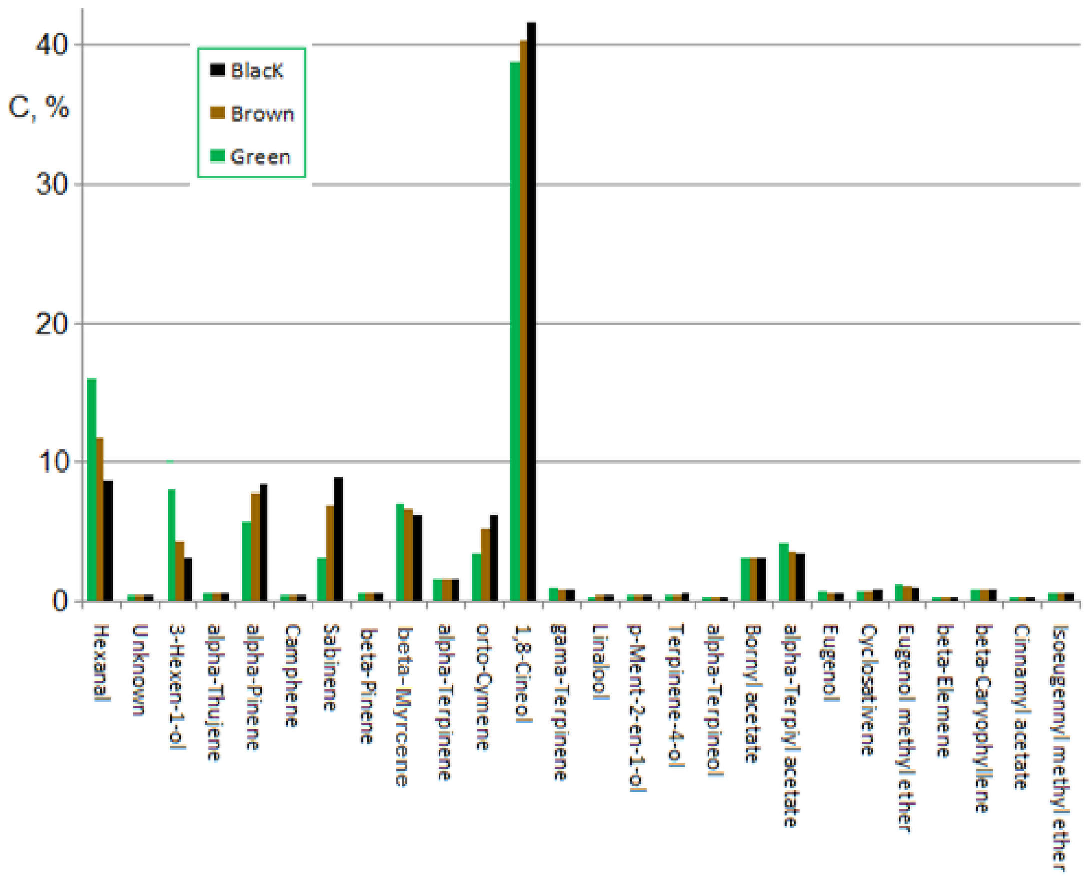

Fig.13. The percentage of essential oils in laurel oil extracted from the fruits (green, brown and black) collected on December 10.2019

Conclusion

The effect of ripening time of the laurel fruits (from the region of Kassab in Syria) between October to December on the chemical composition of essential oils in laurel oil extracted from the fresh fruits (green, brown and black) by hexane using gas chromatographic analysis was studied. The ratios of essential oils change with the time of growth and with the maturation of the fruits. It was found that, for the first time, the light oils (as Hexanal and 3-Hexen-1-ol) are very large, especially in green fruits. This is due to the fact that, the oil was extracted with hexane from fresh fruits, while their proportions are almost non-existent if the oil is extracted using the old methods (used locally by boiling the fruits). keeping the extracted oil (or even fruits) at room temperature for a long period (as it is followed industrially) leads to a sharp decrease in the percentage of essential oils in general and light oils in particular, or until the light oils disappear completely, this greatly affects the quality of healthy laurel soap, for which laurel oil is made in Syria. An analysis by GC and GC-MS of the essential oils has allowed to identify 26 compounds representing 99.4% of the total content were directly identified after extracting laurel oil. There are eleven essential oils, which constitute more than 88%, and they are: Hexanal, 3-Hexen-1-ol, alpha-Pinene, Sabinene, beta-Myrcene, alpha-Terpinine, orto-Cymene, 1,8-Cineol, Bornyl acetate, alpha-Terpinyl acetate and Eugenol methyl ether.

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