IJP (2019), Vol. 7, Issue 10 **(Research Article)**

Received on 06 May 2020; received in revised form, 22 September 2020; accepted, 24 September 2020; published 01 October 2020

COMPARATIVE ESSENTIAL OIL COMPOSITION OF *LAURUS NOBILIS*, *SYZYGIUM GUINEENSE* AND *SYZYGIUM EUCALYPTOIDES* IN SEARCH FOR NIGERIAN BAY LEAF - PART I

Okhale Samuel Ehiabhi [*1] and Ogunfowokan Ifeoluwapo Modupeoluwa [2]

Department of Medicinal Plant Research and Traditional Medicine [1], National Institute for Pharmaceutical Research and Development (NIPRD), P. M. B. 21, Garki, Abuja, Nigeria.
Department of Biochemistry [2], Bingham University, P. M. B 005, KM 26 Abuja-Keffi Expressway Kodope, Karu, Nasarawa State, Nigeria.

Keywords:

Nigerian bay leaf, *Laurus nobilis*, *Syzygium guineense*, *Syzygium eucalyptoides*, Essential oil

Correspondence to Author:
Dr. Okhale Samuel Ehiabhi

Department of Medicinal Plant Research and Traditional Medicine, National Institute for Pharmaceutical Research and Development (NIPRD), P. M. B. 21, Garki, Abuja, Nigeria.

E-mail: samuelokhale@gmail.com

ABSTRACT: Bay leaf is an aromatic leaf commonly used in cooking for its distinctive flavor and fragrance. The bay leaf sold in Nigerian markets being *Laurus nobilis* (*L. nobilis*) is imported. The leaf of *Syzygium guineense* (*S. guineense*) and *Syzygium eucalyptoides* (*S. eucalyptoides*) have a long history of use as vegetables and spices in Nigeria. In this study, leaf of *S. guineense*, *S. eucalyptoides*, and a commercial sample of *L. nobilis* being the gold standard for bay leaf, were evaluated for comparative essential oil composition in search of Nigerian bay leaf. The essential oil was obtained by hydrodistillation using a Clevenger-type apparatus. The essential oils were analyzed by gas chromatography-mass spectrometry (GC-MS). The major chemical constituents of the essential oil of *L. nobilis* were eucalyptol (9.33%), α- pinene (8.31%), and camphene (3.17%). *S. guineense*c contained β-myrcene (12.29%), globulol (7.60%), phytol (6.63%) and trans-ocimene (6.08%). *S. eucalyptoides* leaf essential oil contained 6-octadecanoic acid (16.37%), phytol (8.46%), 6-octadenanoic acid (9%), pentadenanoic acid (7.26%), caryophyllenyl alcohol (6.17%). *L. nobilis* leaf essential oil contained 75 constituents; 16 out of *S. guineense* essential oil constituents (21%) matched those of *L. nobilis* and *S. eucalyptoides* had 6 correspondings to 8% match. This study provided preliminary information for; further, assessment of *S. guineense*, *S. eucalyptoides* and other aromatic plants for possible use as Nigerian bay leaf and a replacement for *L. nobilis*.

INTRODUCTION: Bay leaf is an aromatic leaf commonly used in cooking for its distinctive flavor and fragrance. Fresh or dried bay leaf is used in cooking. Some are used whole, while some are used as dried and ground powder.

QUICK RESPONSE CODE

DOI:
10.13040/IJPSR.0975-8232.IJP.7(10).248-56

The article can be accessed online on
www.ijpjournal.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.7(10).248-56

Bay leaves come from several plants and from different lands of the world, such as Mediterranean bay leaf (*Laurus nobilis*), Indian bay leaf (*Cinnamomum tamala*), Indonesian bay leaf (*Syzigium polyanthum*), and californian bay leaf (*Umbllularia californica*).

Mediterranean bay leaf (*Laurus nobilis*) is an evergreen shrub or small tree variable in size and sometimes reaching 7-18 m (23-59ft) tall. It is dioecious (unisexual). Its flowers are pale yellow-green about 1 cm (0.39 inches) in diameter and are borne in pairs beside a leaf.

Its leaves are glabrous, 6-12 cm (2.4-4.7 inches) long and 2-4 cm (0.79-1.57 inches) broad with an entire (Untoothed) margin. On some leaves, the margin undulates. Its fruit is a small, shiny, black, berry-like drupe about 1cm (0.39 inches) long that contains one seed. The bay tree is indigenous to Asia Minor, from where it spread to the Mediterranean and then to other countries with similar climates. It grows widely in scrubland woods in Europe and California.

It is widely cultivated in Europe, America, and Arabian countries. *Laurus nobilis* is traded as sweet bay leaf and true Romanor Turkish laurel **Fig. 1**. It is a small evergreen tree of Lauraceae family. It is a hardy multi-branched tree with smooth bark that grows to about 10 m high. It has alternate, narrowly oblong-lanceolate leaves. The flowers are small and four-lobed; the male has 8-12 stamens and female 2-4 staminodes. The fruit is 10-15 mm, ovoid and black when ripe [1].

FIG. 1: MEDITERRANEAN BAY LEAF *LAURUS NOBILIS*

FIG. 2: INDIAN BAY LEAF *CINNAMOMUM TAMALA*

*Laurus nobilis*is the standard bay leaf recognized internationally because bay leaf originates from the Mediterranean before other countries found their substitutes such as Indian bay leaf (*Cinnamomum tamala*), Indonesian bay leaf (*Syzygium poly-anthum*) and Californian bay leaf (*Umbllularia californica)*. The fatty acid composition of *Laurus nobilis* leaf comprised lauric acid (28.2%), myristic acid (0.6%), palmitic acid (15%), stearic acid (1.2%), oleic acid (35%), and linoleic acid (18.5%) [2]. *Laurus nobilis* has antimicrobial activity against both Gram-negative and Gram-positive bacteria.

The essential oil of *Laurus nobilis* is more effective against gram-negative than gram-positive bacteria. *Laurus nobilis* is one of the most widely used culinary spices. The leaves and berries are commonly used as a spice and enhancer for foods, especially for meats, sauces, and soups. The infusion of its leaves is used to improve appetite. The infusion of leaves is used to improve appetite. The leaves and fruits are not to be chewed [3]. The essential oil of two commercial *Laurus nobilis* samples consisted of oxygenated monoterpenes (29.82 and 37.60%), oxygenated sesquiterpenes (15.98 and 22.99%), and phenylpropanoids (24.78 and 26.33%), respectively. High content of methyl eugenol (19 ± 4%; 21 ± 1%) and α-terpinyl acetate (18 ± 5%; 17 ± 7%) was found in samples, whereas 1,8-cineole (51%) and α-terpinyl acetate (10%) were the main compounds in another commercial pharmaceutical sample [4-6]. Phytochemical investigation on *Laurus nobilis* leaf infusion revealed the presence of several flavonoid derivatives were detected, including flavonoid C-glycosides, catechin, and cinnamtannin B1 [7].

Indian bay leaf **Fig. 2** is also named malabathrum; this type of bay leaf is distinguished by smell and taste typical of cinnamon but in lower quantities. Usually, Indian bay leaf looks like the other varieties, which is also why it bears this name. However, this is incorrect, since it is of the same family as laurel, but of a different genus. Indian bay leaf is not used as the other types, since it is closer to Chinese cinnamon in smell and in taste. *Cinnamomum tamala* known as tejpat in trade, found in the Himalayan region, is a promising medicinal plant species. Its leaves are widely used as a spice throughout the world since ancient times. It is used in the Indian system of traditional medicines in various Ayurvedic formulations. Its leaves and bark have aromatic, astringent, stimulant, and carminative qualities used in rheumatism, colic, diarrhea, nausea, and vomiting [8]. Also known as salam leaf, this subspecies of bay

leaf is used mainly in Indonesia and Malaysia. The fresh or dried leaves are primarily used to season meat and, in rare cases- vegetables. Indonesian bay leaf has a different and fainter smell than the other varieties. Furthermore, to release its flavor, it needs to go through specific heat treatment. Leaves, fruits, and barks of *Syzygium polyanthum* **Fig. 3** are traditionally used for various medicinal and non-medicinal purposes. The roots and the fruits are consumed to reverse the hangover effect of alcohol, whereas the leaves are traditionally consumed for treating various illnesses such as diabetes mellitus, hypertension, gastritis, ulcers, diarrhea, skin diseases, as well as infections [9].

FIG. 3: INDONESIAN BAY LEAF
SYZYGIUM POLYANTHUM

FIG. 4: CALIFORNIAN BAY LEAF
UMBELLULARIA CALIFORNICA

Californian bay leaf (*Umbellularia californica*) is also known as Oregon myrtle. The leaves are incredibly similar to the ones of the Mediterranean bay leaf but differ in that they are more intense and more saturated in taste. For this reason, caution must be taken when using it. It is broad-leaved, evergreen, and matures either as a shrub or tall forest tree. It grows naturally in the extreme western United States of America from mid-Oregon southward to the Mexican border. The ovoid mature seeds of the species are slightly less than 2cm in length and surrounded by a thin shell. The seeds are rich in triglycerols which have been reported to contain between 43 and 70% lipid by weight [10].

Syzygium guineense **Fig. 5**, also known as water berry, is a medium-sized or tall evergreen tree, 13-30 m high. The bark varies in subspecies and is grayish-white or silver mottled and smooth in young trees, turning rough, flaky, creamy, light grey, dark brown, or black in older trees. Leaves narrow at both ends, length 5-17.5 cm, width 1.3-7.5 cm; simple, opposite, elliptic, lanceolate or ovate-elliptic; with margins that are untoothed and sometimes slightly wavy and rolled inward; apex obtuse to acuminate and rounded, occasionally notched; base cuneate; stalk short and grooved; midrib sunken on top, raised below, with many fine, lateral veins; glaborous, grey-green, tough, shiny; fragrant when crushed. Its flowers (filaments) are 1.5 cm in diameter, sessile or subsessile, fragrant, creamy-white; borne in terminal pinnacles forming heads up to 10 × 10 cm, or with 4-8 widely spaced flowers in branched heads up to 3cm in diameter; calyx persistent with 4 petals; stamens numerous, about 6mm long. Petals fall early, but the white stamens are showy, making a conspicuous short brush or puff contrasting with the red or pink calyx tips. The fruits are ovoid or ellipsoid drupes, 1.2-3.5 m, 2-3 celled, in brunches of 20-30, whitish-green when immature, turning to shiny purplish-black and juicy after ripening; 1-seeded. Seeds are 1.3-1.4 cm in diameter, yellowish to brownish, and rounded. A root infusion is used to treat epilepsy. Bark decoction is used against stomach ache, diarrhea, and malaria. They are also considered mildly laxative and are applied in baths as a tonic. An infusion is taken against cough, asthma, and throat problems [11].

Essential oils extracted from dried leaves of *Syzygium guineense* harvested at Natitingou-Centre, Peperkou, Tchaourou, and Terou were analyzed by gas chromatography coupled to mass spectrometry (GC-MS). The main constituents were caryophyllene oxide (7%), δ-cadinene(7.5%), viridiflorol (7.5%), *epi-α*-cadinol (9.8%), α-cadinol (12.7%), *cic*-calamenen-10-ol (14%), citronellyl pentanoate (15.2%), β-caryophyllene (20.1%) and α-humulene (39.5%) [11].

Syzygium guineense has long history of use as folklore medicine for various ailments by the people of Nigeria and other African countries. Investigation of this plant was carried out to evaluate antioxidant and antimicrobial properties of characterized essential oil of the leaf of *Syzygium guineense*. An essential oil obtained by hydro-distillation was characterized by gas chromatography coupled with mass spectrometry (GC-MS). The antioxidant potential was determined by measuring the inhibition of 2, 2-diphenyl-1-picrylhydrazyl hydrate radical (DPPH). The inhibitory effects of the essential oil were tested against five bacteria namely *Mycobacterium bovis*, *Escherichia coli*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* and one fungus: *Candida albicans* using broth microdilution method. The GC-MS analysis revealed the presence of 46 components accounting for 92.63% of the essential oil constituents. Sesquiterpenoids (73.15%) and monoterpenoids (14.17%) were the main classes of the essential oil. Aromadendrene (6.98%), germacrene-B (5.52%) and β-selinene (3.94%) were the predominant sesquiterpene hydrocarbons. The oxygenated sesquiterpenes were α-cadinol (6.68%), τ-cadino (6.64%) and caryophyllene oxide (5.44%). Butylated hydroxytoluene (BHT) exhibited higher antioxidant activity compared to the essential oil. The essential oil exhibited strong antimicrobial activities against the tested microorganism with MIC ranging between 25-100 µg/ml. Results indicated that the essential leaf oil of *S. guineense* had a high proportion of sesquiterpenoids (73.15%) with strong antioxidant and antimicrobial activities.

Syzygium eucalyptoides **Fig. 6** is an evergreen shrub or tree that can grow up to 6 meters tall, also known as white apple or native apple. *Syzygium eucalyptoides* is native to Western Australia and is found in the parts of Nigeria with a humid tropical climate like Abuja and Enugu. Its fruit is taken to lower the risk of diabetes, prevent cancer, and to fight asthma [12].

FIG. 5: *SYZYGIUM GUINEENSE*

FIG. 6: *SYZYGIUM EUCALYPTOIDES*

Many Nigerians make use of imported bay leaf (*Laurus nobilis*) in cooking. The importation of bay leaf to Nigeria could have health risks and negative impacts on the Nigerian economy. Nigeria has a rich biodiversity of aromatic leaf used in cooking and does not need to import bay leaf. It is against this background that needs to be arose to find a Nigerian substitute for *Laurus nobilis*. Hence, this study aimed at the GC-MS evaluation of *Laurus nobilis*, *Syzygium guineense*, and *Syzygium eucalyptoides* leaf essential oils toward comparing their chemical constituents for similarity assessment in search of Nigerian bay leaf.

MATERIALS AND METHOD:

Plant Material: The leaves of *Syzygium eucalyptoides* and *Syzigium guineense* were collected from Sulejain April 2019 while the dried leaves of *Laurus nobilis* were purchased from Karmo market Abuja Nigeria as a packaged commercial product. The leaves of *Syzygium guineense* and *Syzygium eucalyptoides* were dried for 7 days at ambient temperature (25-30 ºC).

Isolation of Essential Oils: The dried leaves of *Laurus nobilis*, *Syzygium eucalyptoides*, and *Syzygium guineense* were chopped into small pieces and hydro distilled separately for four hours. The essential oils were collected separately, dried with anhydrous sodium sulphate, and used within four hours for analysis.

Gas Chromatography-Mass Spectrometry (GC-MS) Analysis: The essential oils were analyzed by

GC-MS using Shimadzu QP-2010 GC with QP-2010 Mass Selective Detector [MSD, operated in the EI mode (electron energy = 70eV), scan range of 45-400 amu and scan rate of 3.99 scans/sec], and Shimadzu GC-MS solution data system. The Gas chromatography column was Optima-5 ms fused silica capillary with 5% phenyl-methylpolysiloxane stationary phase, with length of 30 m, the internal diameter of 0.25 mm and film thickness of 0.25 µm. The carrier gas was helium with a flow rate of 1.61 mL/min. The program used for Gas chromatography oven temperature was 60-180 ºC at a rate of 10 ºC / min and then held at 280 ºC. Helium was used as a carrier gas at a flow rate 1.61 mL/min. A diluted sample (1/100 in hexane, v/v) of 1.0µL was injected using autosampler and in the split mode with ratio of 10:90. Individual constituents were identified by comparing their mass spectra with known compounds and NIST Mass Spectral Library (NIST). The percentages of each component were reported as raw percentages on dry weight basis. The essential oil constituents of *Laurus nobilis*, *Syzygium guineense* and *Syzygium eucalyptoides* are shown in **Table 1**.

RESULTS:

TABLE 1: LEAF ESSENTIAL OIL CONSTITUENTS OF *LAURUS NOBILIS*, *SYZYGIUM GUINEENSE* AND *SYZYGIUM EUCALYPTOIDES*

S. no.	Names	RT	% Essential Oil Composition		
			LN	ZG	ZE
1	α-Pinene	3.568	8.31	1.49	-
2	Camphene	3.729	3.17	-	-
3	α-Phellandrene	4.073	4.94	0.23	-
4	3-Carene	4.126	2.54	-	-
5	Eucalyptol	4.906	9.33	-	-
6	gamma-Terpinene	5.163	1.78	0.81	-
7	cis-beta-Terpineol	5.269	0.33	-	-
8	4-Carene	5.557	1.25	0.46	-
9	Linalool	5.692	2.58	0.97	-
10	Fenchol	5.956	0.67	-	-
11	4-Isopropyl-1-methyl-2-cyclohexen-1-ol	6.050	0.51	-	-
12	Isopinocarveol	6.334	1.01	-	-
13	Isobornyl formate	6.730	1.55	-	-
14	4-Terpineol	6.887	1.55	-	-
15	Terpineol	7.104	2.45	-	-
16	Myrtenol	7.183	3.00	-	0.56
17	Trans-Piperitol	7.309	1.18	-	-
18	Isopulegol acetate	7.458	0.32	-	-
19	Nerol	7.595	0.46	-	-
20	Cuminaldehyde	7.783	1.48	-	-
21	Linalool	7.932	0.30	0.97	-
22	Myrtenyl acetate	8.248	1.28	-	-
23	Bornyl acetate	8.467	1.25	-	-
24	Cuminol	8.649	3.10	-	-
25	Carvacrol	8.753	0.79	-	-
26	α-terpineol acetate	8.868	0.37	-	-
27	Terpinyl acetate	9.547	1.74	0.92	-
28	Eugenol	9.625	1.35	-	-
29	Ylangene	9.762	1.70	-	-
30	Copaene	9.833	0.86	-	-
31	Elemol	9.906	0.23	-	-
32	β-Elemene	10.002	0.29	-	-
33	Methyleugenol	10.070	1.81	-	-
34	Ipha-Gurjunene	10.285	1.22	-	-
35	Caryophyllene	10.458	0.28	3.59	-
36	α-Farnesene	10.575	1.48	-	0.41
37	Cinnamyl acetate	10.665	0.27	-	-
38	Geranyl acetone	10.752	0.75	-	-
39	11-Dodecen-2-one	10.838	0.81	-	-

40	Valencene	0.81	0.99	-	-
41	6,9-Pentadecadien-1-ol	0.99	1.55	-	-
42	Germacrene D	1.55	1.24	-	-
43	α-guaiene	1.24	1.42	-	-
44	Patchoulene	11.672	1.55	-	0.47
45	α-Bulnesene	11.803	0.68	-	-
46	Gamma-Cadinene	11.982	1.29	-	-
47	Delta-Cadinene	12.115	1.38	2.04	-
48	Caryophyllene oxide	12.175	0.59	2.18	3.20
49	α-Cubebene	12.300	0.30	0.20	-
50	gamma-Muurolene	12.379	0.81	0.57	-
51	Isoaromadendrene epoxide	12.465	0.88	-	-
52	Elemicin	12.603	1.27	-	-
53	Spathulenol	13.162	1.77	-	-
54	Longifolenaldehyde	13.229	1.62	-	-
55	Veridiflorol	13.373	1.26	-	-
56	Globulol	13.521	1.27	7.60	-
57	gamma-Eudesmol	13.753	1.04	-	-
58	gamma-Eudesmol	13.867	1.64	-	-
59	Linolenic acid, methyl ester	14.161	1.95	-	-
60	Lanceol	14.605	2.43	-	-
61	α-Bisabolene epoxide	14.932	0.29	-	-
62	Vitamin A aldehyde	15.249	0.51	-	-
63	Alloaromadendrene oxide	15.504	0.36	-	-
64	Cubenol	15.689	0.71	0.74	-
65	Cycloisolongifolene, 8,9-dehydro-9-formyl-	16.115	0.34	-	-
66	Cycloisolongifolene, 8,9-dehydro-9-formyl	16.611	1.18	-	-
67	Farnesyl acetone	17.145	0.54	-	-
68	Thujopsene	17.655	0.13	-	-
69	Abietatriene	18.117	0.31	-	-
70	Phytol	18.339	0.42	6.63	8.46
71	Octadec-9-enoic acid	18.514	0.34	-	3.27
72	Eicosane	19.554	0.11	0.84	-
73	Abieta-8,11,13-trien-18-ol	20.257	0.15	-	-
74	Frenchol	5.956	0.67	-	-
75	B-Myrcene	4.162	-	12.29	-
76	p-Cymene	4.630	-	0.60	-
77	D-Limonene	4.688	-	1.23	-
78	trans-Ocimene	4.759	-	6.08	-
79	B-Ocimene	4.908	-	4.81	-
80	Nonanal	5.690	-	0.61	-
81	cis-Allo-ocimene	6.065	-	2.10	-
82	Neryl acetate	9.424	-	1.11	-
83	α-Bergamotene	10.524	-	0.81	-
84	α-Caryophyllene	10.911	-	3.28	1.21
85	γ-Selinene	11.232	-	4.35	-
86	α-Selinene	11.636	-	8.81	-
87	Juniper camphor	13.600	-	3.72	-
88	tau-Cadinol	13.950	-	1.33	-
89	Δ- Cadinol	14.010	-	0.43	-
90	γ – Gurjenne	14.241	-	0.44	-
91	Tetradecanoic acid	15.228	-	0.47	-
92	Benzyl benzoate	15.410	-	0.44	-
93	Hexahydrofarnesyl acetone	16.102	-	1.00	3.76
94	Palmitic acid	17.153	-	3.90	-
95	7-Hexadecanal	18.506	-	3.55	-
96	Dotriacontane	18.784	-	0.70	1.46
97	Tetrapentacontane	20.161	-	0.48	-
98	β - Selinene	11.488	-	8.19	-
99	8-Methy-2-decene	7.996	-	-	-

100	Camphor	10.269	-	-	-
101	Geranyl acetone	10.716	0.62	-	-
102	Geranylgeraniol	12.038	-	-	3.25
103	Linanyl isobutyrate	12.146	-	-	0.50
104	n-dodecanoic acid	12.608	-	-	1.03
105	Trans nerodilol	12.675	-	-	0.85
106	Palustrol	13.117	-	-	5.63
107	Caryophyllene alcohol	12.978	-	-	6.17
108	Ledol	13.426	-	-	5.26
109	Cinerolone	13.880	-	-	2.66
110	Bergamotene	14.614	-	-	0.39
111	3,7,11-trimethyl-2,10-dodedecanoic acid	16.817	-	-	2.12
112	3,5-dimethylcyclohexanol	17.036	-	-	0.46
113	Dipalmitin	19.565	-	-	1.10
114	α-tridecene	18.864	-	-	0.89
115	15-pentadecanediol	19.854	-	-	0.93
116	2-methyldodecane	20.172	-	-	1.30
117	13-tetradecanal	20.381	-	-	1.94
118	1,3,12-Nonadecatriene-5,14-diol	20.731	-	-	4.29
119	n-Dotriacontane	20.830	-	-	1.46
120	Tetracontane	21.554	-	-	0.40
121	Tetratetracontane	22.381	-	-	0.39

Key: LN = *Laurus nobilis*; SE = *Syzygium eucalyptoides;* SG = *Syzygium guineense*; RT = retention time; - Not detected

TABLE 2: LEAF ESSENTIAL OIL CONSTITUENTS COMMON TO *LAURUS NOBILIS* AND *SYZYGIUM GUINEENSE*

S. no.	Names	RT	% Essential Oil Composition	
			LN	ZG
1	α-Pinene	3.568	8.31	1.49
2	α-Phellandrene	4.073	4.94	0.23
3	gamma-Terpinene	5.163	1.78	0.81
4	4-Carene	5.557	1.25	0.46
5	Linalool	5.692	2.58	0.97
6	Linalool	7.932	0.30	0.97
7	Terpinyl acetate	9.547	1.74	0.92
8	Caryophyllene	10.458	0.28	3.59
9	Delta-Cadinene	12.115	1.38	2.04
10	Caryophyllene oxide	12.175	0.59	2.18
11	α-Cubebene	12.300	0.30	0.20
12	gamma-Muurolene	12.379	0.81	0.57
13	Globulol	13.521	1.27	7.60
14	Cubenol	15.689	0.71	0.74
15	Phytol	18.339	0.42	6.63
16	Eicosane	19.554	0.11	0.84

Key: Ln = *Laurus Nobilis;* Sg = *Syzygium Guineense*; Rt = Retention time

TABLE 3: LEAF ESSENTIAL OIL CONSTITUENTS COMMON TO *LAURUS NOBILIS* AND *SYZYGIUM EUCALYPTOIDES*

S. no.	Names	RT	% Essential Oil Composition	
			LN	ZE
1	Myrtenol	7.183	3.00	0.56
2	α-Farnesene	10.575	1.48	0.41
3	Patchoulene	11.672	1.55	0.47
4	Caryophyllene oxide	12.175	0.59	3.20
5	Phytol	18.339	0.42	8.46
6	Octadec-9-enoic acid	18.514	0.34	3.27

Key: LN = *Laurus nobilis*; SE = *Syzygium eucalyptoides*; R = retention time

DISCUSSION: The chemical constituents of the essential oil of *Laurus nobilis* leaf from Northern Cyprus previously studied by gas chromatography-mass spectrometry contained 81 compounds representing 98.74% of the total essential oil. Monocyclic monoterpenes such as eucalyptol or 1, 8-cineole (58.59%), α- terpinyl acetate (8.82%), and terpinene-4-ol (4.25%) were the main components. Bicyclic monoterpenes such as α- and β-pinene (3.39-3.25%) and sabinene (3.32%) were

also identified. The acyclic monoterpenes linalool (0.19%) and myrcenol (0.10%) were present in smaller amounts and so were the sesquiterpenes. Contained O-cymene (1.30%), p-cymene (1.83%), cumin aldehyde (0.24%), dimethylstyrene (0.08%), eugenol (0.16%), methyl eugenol (0.05%) and carvacrol (0.05%) [13, 14].

In the present study, the chemical constituents of the essential oil of L*aurus nobilis* leaf based on the gas chromatography-mass spectrometry (GM-MS) analysis, contained eucalyptol (9.33%), α- pinene (8.31%), camphene (3.17%) as the predominant components. The variation in the percentage composition obtained in the present study compared to L*aurus nobilis* leaf from Northern Cyprus may is due to geographical factors, weather, and soil. Eucalyptol is a terpenoid oxide compound with anti-inflammatory and antioxidant effects; and finds application in respiratory disease, pancreatitis, cardiovascular and neurodegenerative diseases [15].

The chemical constituents of the essential oil of *Syzygium guineense* have been previously identified by gas chromatography mass spectrometry (GC-MS) and contained the highest percentage of α-humulene (39.5%) followed by β-caryophyllene (20.1%), citronellyl pentanoate (15.2%), cis-calamenen-10-ol (14%), α-cadinol (12.7%), epiacadinol (9.8%), viridiflorol (7.5%), δ-cadinene (7.5%) and caryophyllene oxide (7%). In the present study, GC-MS analysis of *Syzygium guineense* leaf essential oil had the highest percentage composition of β-myrcene (12.29%) followed by globulol (7.60%), phytol (6.63%), and trans-ocimene (6.08%). β-myrcene has the potential for enhancing transdermal absorption. It has a significant analgesic effect and has shown powerful anti-inflammatory and anticatabolic effects in a human model of osteoarthritis and is also found in the oil of *Laurus nobilis* [16].

The chemical constituents of *Syzygium eucalyptoides* leaf essential oil have not been previously identified by GC-MS analysis. In the present study, GCMS analysis of *Syzygium eucalyptoides* leaf essential oil has the highest percentage composition of 6-octadecanoic acid (16.37%), phytol (8.46%), 6-octadenanoic acid (9%), pentadenanoic acid (7.26%), and caryophyllenyl alcohol (6.17%) followed by other constituents. 6-octadecanoic acid, also referred to as stearic acid, is a C18 straight chain saturated fatty acid component of many animal and vegetable lipids.

From **Table 2**, the essential leaf oil of *Laurus nobilis* and *Syzygium guineense* had 16 constituents in common, and from **Table 3**, the essential leaf oil of *Laurus nobilis* and *Syzygium eucalyptoides* had 6 constituents in common. From the results, the similar phytochemical compounds found in *Laurus nobilis*, *Syzygium guineense*, and *Syzygium eucalyptoides* leaf essential oils were caryophyllene oxide, which had the highest composition in *Syzygium eucalyptoides* (3.20%), phytol which had the highest composition in *Syzygium eucalyptoides* (8.46%).

Caryophyllene oxide is the oxidized form of caryophyllene or β-caryophyllene, one of the terpenes found in cloves, basil, hops, pepper and rosemary. Caryophyllene oxide not only plays an important role in creating the telltale smell and taste of certain plants, but it also possesses anticancer and analgesic properties. Caryophyllene oxide also serves as a natural insecticide and anti-fungicide to further protect the plant [17].

Phytol is diterpene alcohol from chlorophyll widely used as a food additive and in medicinal fields, processes promising antischistosomal properties *in-vitro* and in a mouse model of S*chistosomiasis mansoni* [18].

CONCLUSION: From the results, essential leaf oils of *Laurus nobilis*, *Syzygium guineense*, and *Syzygium eucalyptoides* had some constituents in common with 16 in *Syzygium guineense* and 6 in *Syzygium eucalyptoides*. Caryophyllene oxide and phytol were found in *Laurus nobilis*, *Syzygium guineense*, and *Syzygium eucalyptoides*.

Caryo-phyllene oxide and phytol had the highest composition in *Syzygium eucalyptoides*. *Syzygium guineense* and *Syzygium eucalyptoides* should be explored for possible use as Nigerian bay leaf and a replacement for *Laurus nobilis*.

ACKNOWLEDGEMENT: Nil

CONFLICTS OF INTEREST: Nil

REFERENCES:

1. Patrakar R, Mansuriya M and Patil P: Phytochemical and pharmacological review on *Laurus nobilis*. International J of Pharmaceut and Chemical Sciences 2012; 1(2): 595-02.
2. AL-Hashimi AG and Mahmood SA: The nutritional value and antioxidant activity of bay leaves (*Laurus nobilis* L.). International Journal of Food Sciences and Nutrition Basrah J of Veterinary Research 2016; 15(2): 246-59.
3. Siriken B, Yavuz C and Guler A: Antibacterial activity of *Laurus nobilis*: a review of literature. Medical Science and Discovery 2018; 374-79.
4. Ayben K, Hafizoglu H, Kollmannsberger H and Siegfried Nitz: Volatile constituents and key odorants in leaves, buds, flowers and fruits of *Laurus nobilis* L. of Agricultural and Food Chemistry 2004; 52(6): 1601-06.
5. Hamrouni SI, Wannes WA, Bettaieb I, Berrima S, Chahed Marzouki TB and Limam F: Qualitative and quantitative changes in the essential oil of *Laurus nobilis* L. leaves as affected by different drying. International Journal of Food Chemistry 2011; 126(2): 691-97.
6. Irene P and Blazquez MA: Comparative GC-MS analysis of bay leaf (*Laurus nobilis* L.) essential oils in commercial samples. International Journal of Food Properties 2015; 757-62
7. Stefano DA, Cervellati R, Speroni E, Costa S, Guerra MG, Stella L, Greco E and Innocent G: Phytochemical composition and antioxidant activity of *Laurus nobilis* L. leaf infusion. J of Medicinal Food 2009; 12(4): 869-76.
8. Sharma G and Nautiyal AR: *Cinnamomum tamala*: a valuable tree from Himalayas. International Journal of Medicinal and Aromatic Plants 2011; 1(1): 1-4.
9. Ismail A and Ahmad WANW: *Syzigium polyanthum* (Wight) Walp: a potential phytomedicine. Pharmacognosy Journal 2019; 11(2): 429-38.
10. Michael HJ, Cichowicz DJ and Dierov JK: Lypolytic activity of california-Laurel (*Umbellularia californica*) Seeds. J of the Ame Oil Chem Soc 2001; 78(10): 1067-71.
11. Jean-Pierre N, Yedomonhan P, Sohounhloue DCK and Claude J: Chalchat gilles figueredo: chemical composition of essential oil of *Syzygium guineense* (Willd.) DC. var. guineense (Myrtaceae) from Benin. Records of Natural Products 2008; 33-38.
12. Hyland BPM: a revision of syzygium and allied genera (Myrtaceae) in Australia; Australian Journal of Botany Supplementary Series 1983; 13(9): 1-164.
13. Hasan Y, Akin M, Sanda AM and Cakir A: Gas Chromatography/ Mass Spectrometry analysis of *Laurus nobilis* essential oil of Northern Cyprus. Journal of Medicinal Food 2007; 10(4): 715-19.
14. Oussama M, Darwish M, Ismail G, Dourgham M and Yara DR: Hamdan: phytochemical study of *Laurus nobilis* in Syria. J of Chem and Pharma Science 2018; 11(01): 49-52.
15. Dimitra CL, Leeuwen KV, Taylor DK, Jeffery DW and Pardon KH, Gordon M Elsey and Mark A Sefton: Evolution and Occurrence of 1, 8-cineole (Eucalyptol) in australian wine. Journal of Agricultural and Food Chemistry 2011; 59(3): 953-59.
16. Delgado IF, Carvalho RR, De Almeida Nogueira ACM, Mattos AP, Figueiredo LH, OliveiraI SHP and Paum-gartten FJR: Study on embryo-foetotoxicity of beta-my-rcene in the rat. Food and Chem Tox 1993; 31(1): 31-35.
17. Klaudyna F, dorowicz A, Strzadala L, and Szumny A: beta-caryophyllene and beta-caryophyllene oxide-natural compounds of anticancer and analgesic properties. Cancer Medicine 2016; 5(10): 3007-17.
18. Bharat CR and Krishna GD: GC-MS Analysis of young leaves of *Allophylus cobbe* (L.) Raeusch and *Allophylus serratus* (Roxb.) Kurz. Indian Journal of Pharmaceutical Education and Research; 2017; 51(3): 472-9.

How to cite this article:
Ehiabhi OS and Modupeoluwa OI: Comparative essential oil composition of *Laurus nobilis*, *Syzygium guineense* and *Syzygium eucalyptoides* in search for Nigerian bay leaf - part i. Int J Pharmacognosy 2020; 7(10): 248-56. doi link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.7(10).248-56.