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Study of The Chemical Composition of *Syzygium Cumini* (L.) Skeels

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Abstract. Throughout history, medicinal plants have been the primary source for preventing and treating infectious diseases and other health issues. Researchers are conducting investigations to search for novel, affordable, and secure sources of antibiotics, antioxidants, and antidiabetic compounds. The more effective the medicinal plant is, the higher its demand will be, and the likelihood of non-availability will rise. Different parts of the plant must be explored to accommodate the increased demand. The study examined the chemical composition based on the essential oil of *Syzygium cumini*. The most abundant compound was Bicyclo[3.1.1]hept-2-ene, 2,6-dimethyl-6-(4-methyl-3-pentenyl)- (27.5%). Hexadecanoic acid, methyl ester (9.89%), 1,2-benzenedicarboxylic acid, butyl 2-methylpropyl ester (8.36%). The study involves a thorough examination of the chemical composition of the essential oil extracted from Syzygium cumini leaves. The study lays the groundwork for future research on the specific plant.

Keywords. Medicinal plants, Syzygium cumini, Distilled oil.

1. Introduction

Traditional medicine makes extensive use of medicinal plants due to the presence of bioactive compounds in their composition [1,2]. In the past, medicinal plants were of worldwide significance, both once they were fresh and after they had been treated. More than eighty percent of the world's population relies on these plants for their fundamental health requirements, and they also play an important part in the prevention and treatment of diseases [3,4]. Furthermore, more than half of all newly developed and commercialised pharmaceuticals are derived from modified products of medicinal plants or the active compounds found in such plants. Essential oils are gaining popularity as

a result of the multiple applications they have in contemporary society, which include applications in the fields of agriculture, food, health, and beauty [5-7]. The volatile oils that are produced by members of the Myrtaceae plant family have garnered a lot of attention in recent years. Syzygium cumini is a tree that belongs to the family of plants known as the Myrtaceae. There is a substantial body of evidence indicating that Syzygium cumini has anti-diabetic, antimicrobial, and antioxidant properties [6]. There has been an increase in the use of plant products in industrialised, developing, and emerging countries. This is mostly attributable to the growth of new illnesses and the presence of microbial resistance. Despite this, their potential as a source of innovative drugs has yet to be explored, as only a tiny percentage of therapeutic plants have been examined for phytochemicals and physiologically. Since volatile oils can be found in plants across many different taxonomic categories, it is crucial to fully identify and quantify the chemical compounds in these oils to understand their pharmacological effects. In light of this, the purpose of the study was to determine the chemical composition of the essential oil extracted from *Syzygium cumini*, which is native to northern Nigeria. The pharmaceutical industry could use the bioactive ingredients or extracts of *Syzygium cumini* to Support the development of vaccines and medications to address the communicable and non-communicable diseases that disproportionately affect developing nations. Create a new formulation for the discovery of innovative medicines.

2. Material and Methods

2.1. Study Area

Kaduna is a state in northern Nigeria situated at coordinates 10° 35' N, 7° 19' E. It covers a total area of 46,056 km^2 and has a population of 6,066,562. The region has two main climatic seasons: a dry period from October to May and a rainy period from June to August. The majority of the population consists of the nomadic Hausa and Fulani peoples. The economy is largely supported by the government, agriculture, animal husbandry, fishing, and hunting.

2.2. Plant Material

Leaves of the Syzygium cumini plant (Figure 1) were collected simultaneously from their natural habitat in Kaduna state, Nigeria. Herbarium specimens of the medicinal plants collected in the field were identified using a combination of literature review and expert confirmation by botanists at Ahmadu Bello University (ABU Zaria) and archived in the University Herbarium (ABU090027).

Figure 1. Syzygium cumini.

2.3. Essential Oil Distillation

The newly harvested leaves were carefully washed to remove any remaining plant stains, air-dried in the shade until completely dry, and then ground into a powder in a blade mill. The Clevenger apparatus was utilised to dissolve one hundred grams of the leaves in two litres of water that was contained within a flask with a circular bottom. Following the completion of the hydro-distillation process, which lasted for five hours, the essential oil was dried with anhydrous sulphate, placed in a dark container, and then cooled to a temperature of -4 degrees Celsius [7].

Equation illustrates the yield computation as follows [8]:

$$\text{Yield of the extract: Weight of extract /Dry weight of the leaves} \times 100 \quad (1)$$

Gas chromatography-mass spectrometry (GCMS) The GC/MS analysis was performed using an Agilent Technologies (Malaysia) 7890A/5975C gas chromatography/coupled mass spectrometer. Using a temperature-programmed chromatographic approach, the chemical mixtures were separated on an HP-5MS column that was 30 metres long and 0.25 millimetres thick, with a film thickness of 0.25 millimetres. ten minutes at sixty degrees Celsius, followed by three degrees Celsius every minute up to 230 degrees Celsius, and then held for one minute. The injector was heated to 245 degrees and released 1 ml/min of carrier helium gas [8]. The ion source and analyzer temperatures used for the MS were 260 °C and 70 E V, respectively.

3. Results and Discussion

Through the process of hydrodistillation, the leaves of Syzygium cumini were able to produce 2.9% of the distilled oil, which was collected as a yellow oil. The qualitative data allowed for the identification of 34 different compounds, which had a recovery rate of 98.029% (Reference: Table 1). It is a sign that the plant has a significant amount of essential oil if oil is recovered from the leaf. The findings of our study are in line with those of other research [9, 10]. The variation in extract yield from different portions of medicinal plants is mostly determined by the extraction process, the extraction solvent, the chemicals that are present, and the polarity of the metabolites [11]. The predominant chemical identified was Bicyclo [3.1.1] hept-2-ene, 2,6-dimethyl-6-(4-methyl-3-pentenyl), constituting 27.5% of the total compounds. Hexadecanoic acid, methyl ester accounts for 9.89% and 1,2-Benzenedicarboxylic acid, butyl 2-methylpropyl ester for 8.36% (Figure 2). Essential oils from the same species may exhibit significantly different chemical compositions based on the timing and place of collection.

Table 1. Chemical composition of the essential oil extracted from the leaves of Syzygium cumini.

S/N	RT	Compounds	Area
1	7.7424	Copaene	1.2638
2	8.6381	(Z, Z)-.alpha.-Farnesene	1.9381
3	8.7569	Tricyclo[2.2.1.0(2,6)]heptane, 1,7-dimethyl-7-(4- methyl-3-pentenyl)-, (-)-	1.4954
4	9.1297	Bicyclo[3.1.1]hept-2-ene, 2,6-dimethyl-6-(4- methyl-3-pentenyl)-	27.5123
5	9.4468	2-Pentenal, (E)-	0.6079
6	10.1526	(1S,5S,6R)-6-Methyl-2-methylene-6-(4- methyl pent-3-en-1-yl)bicyclo[3.1.1]heptane	3.0854
7	10.8576	Cyclopentane, (3-methyl butyl)-	0.5252
8	10.8867	Naphthalene, 1,2,3,4-tetrahydro-1,6-dimethyl-4- (1-methyl ethyl)-, (1S-cis)-	0.5675
9	11.0077	Epizonarene	1.3614
10	11.2329	Dodecanoic acid, methyl ester	5.8709
11	11.3741	Nonanoic acid, 9-oxo-, methyl ester	0.3949
12	12.9821	Cycloundecane, (1-methyl ethyl)-	1.956
13	13.1916	1-Octanol, 2-butyl-	0.4047
14	13.2202	3-Methyl-4-(Phenylthio)-2-prop-2-enyl-2,5- dihydrothiophene 1,1-dioxide	0.5562

S/N	RT	Compounds	Area
15	14.2137	Methyl jasmonate	0.2745
16	17.359	5-Eicosene, (E)-	2.3491
17	17.4203	1-Octadecene	0.4859
18	17.5452	2-Tridecenal, (E)-	1.6829
19	19.8904	Hexadecanoic acid, methyl ester	9.8906
20	20.0838	1,2-Benzenedicarboxylic acid, butyl octyl ester	5.0588
21	20.1061	1,2-Benzenedicarboxylic acid, butyl 2- methyl propyl ester	8.3644
22	23.117	7-Hexadecenoic acid, methyl ester, (Z)-	3.8175
23	23.7002	Heptadecanoic acid, 16-methyl-, methyl ester	0.9024
24	26.4679	Oxacyclotridecan-2-one	1.0453
25	34.6375	1,5,9-Undecatriene, 2,6,10-trimethyl-, (Z)-	1.6317
26	35.9826	Eicosane	14.1264
27	36.2182	1,2-Benzisothiazole, 3-(hexahydro-1H-azepin-1- yl)-, 1,1-dioxide	0.6629
28	37.3934	trans-13-Octadecenoic acid	0.5045
29	37.479	9-Octadecenoic acid (Z)-, 2,3-dihydroxypropyl ester	0.0567
30	37.5378	trans-13-Octadecenoic acid	0.075
31	37.8189	1,2-Benzisothiazole, 3-(hexahydro-1H-azepin-1- yl)-, 1,1-dioxide	0.3013
32	37.927	2-Methyl-Z,Z-3,13-octadecadienoic	0.1781
33	38.086	9-Octadecenoic acid (Z)-, 2,3-dihydroxy propyl ester	-0.0028
34	38.2052	Eicosane	1.0554

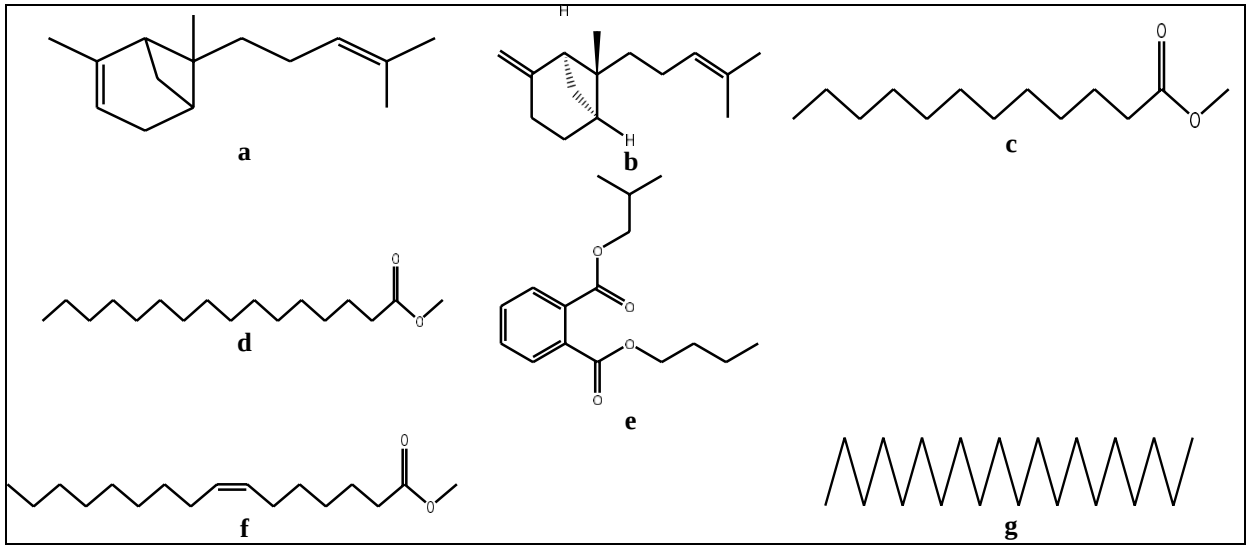

Figure 2. Major compounds in the essential oil of *Syzygium cumini* leaves; (a) Bicyclo [3.1.1] hept-2-ene, 2,6-dimethyl-6-(4-methyl-3-pentenyl)- (b) (1S,5S,6R)-6-Methyl-2-methylene-6-(4-methyl pent-3-en-1-yl)bicyclo[3.1.1]heptane (c) Dodecanoic acid, methyl ester (d) Hexadecanoic acid, methyl ester (e) 1,2-Benzenedicarboxylic acid, butyl 2-methyl propyl ester (f) 7-Hexadecenoic acid, methyl ester, (Z)- (g) Eicosane

Conclusion

Numerous ancient communities all over the globe, especially those that are located in Africa, have a significant dependence on plant life for their nutrition. The use of plants is held in very high esteem in traditional medical practices. Plants with medicinal and aromatic properties have been used by humans for thousands of years to treat a wide range of diseases. A wide variety of ailments, including as cancer, malaria, typhoid fever, and many more, have been medically treated and managed using the

plant for a very long time. It was found that Bicyclo [3.1.1] hept-2-ene, 2,6-dimethyl-6-(4-methyl-3-pentenyl)- was the most prevalent chemical, accounting for 27.5% of the total. With a methyl ester of hexadecanoic acid (9.89%), butyl 2-methylpropyl ester of 1,2-benzenedicarboxylic acid (8.36%), and hexadecanoic acid. Within the scope of this research is a comprehensive investigation of the chemical composition of the essential oil that was extracted from the leaves of Syzygium cumini. The study lays the groundwork for further investigation into the plant in issue, as well as investigations into other plants.

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