International Journal of Advanced Research in Chemical Science (IJARCS)
Volume 1, Issue 10, December 2014, PP 1-4
ISSN 2349-039X (Print) & ISSN 2349-0403 (Online)
www.arcjournals.org

Chemical Compositions of the Leaf and Seeds Essential Oils of Callitris Glauca from North Central Nigeria

Larayetan R.A[1], Aliyu A.O.C[1]

[1]Department of chemistry
Kogi State University
Anyigba, Kogi State, Nigeria

Ogunmola O[2]

[2]Department of Chemistry
Emmanuel Alayande College of Education
Oyo State, Nigeria

Abstract: *Twenty nine components were identified in the essential oils of the leaves and seeds of Callitris glauca by hydro distillation and were analysed by means of gas chromatography mass spectroscopy. (GC-MS).Twenty two components were found and identified in the leaf essential oil. The major components are aromandendrene (19.45%) α-limonene (i5.60%), santolinatriene (11.59%) and Patchoulene (6.09%).The oil yield was (0.18%)v/w of wet sample of the leaf essential oil and(0.38%)v/w of the seed essential oil. Eleven components were identified in the seed essential oil with the main components being E-9-tetradecenyl-acetate (21.70%), Z-10-pentadecen-1-ol (21.80%), Hydrofol acid (18.1%), isooctanol (9.80%), trans-β-ocimene (5.50%), and IR-α-pinene (5.00%). The quantitative and qualitative compositions of the two essential oils were considerably different.*

Keywords: *hydro-distillation, essential oil, Callitris glauca, North Central Nigeria.*

1. INTRODUCTION

Essential oil, also defined as essence, volatile oil, etheric oil or aetheroleum is a complex mixture of volatile constituents' biosynthesis by living organisms.

Essential oils can be liberated from their matrix by water, steam and dry distillation or expression in the case of citrus fruit. [1-5]

Extracts of aromatic plant or animal materials obtained using organic solvents or fluidized gasses are not considered as essential oils. [1, 13, 15-18].

The council of Europe describes 'essential oil' as a product obtained from 'vegetable raw material.[17]

Among many others well known families rich in essential oil bearing species are Apiaceae, Myrtaceae, Pinaceae, Piperaceae, Rutaceae, Suntalaceae, Zingiberaceae, Cupressaceae, Hypericaceae, Lamiaceae, Lauraceae and Zygophyllaceae. [1-4, 6-9, 19].

Callitris is a genus of coniferous trees in the cupressaceae (Cyprus family).There are fifteen species in the genus of which thirteen are native to Australia and the other two (C.neocaledonica, C.sulcata) native to new Caledonia. Traditionally the most widely used common name is cypress-pine, a name shared by the closely related genus Actinotrobus. However, this is inaccurate as these are just cypress and in no way pines and they are increasingly being called cypress [26].

White cypress pine is a member of the genus Callitris in the family of Cupressaceae. Other genera of this family in Australia are Diselma andActinostobus.All three genera have scale-like leaves and numerous seeds. The seed cones are formed from a number of valves and in the genus callitris there are six valves per cone. Formerly White Cypress Pine are known as Callitris glauca.R.Br.ex.R.T.Baker et H.G Sm., but Garden (1956) considered the correct name was

C.hugelii (Carr) Franco. Blake (1958) prove the name C.hugelii to be invalid and in addition he considered there was no satisfactory basis for separating the three species C.glauca; C.intratopical R.T.Baker et H.G.Sm., or C.columellaris according to the rule of taxonomic precedence. [24].

Callitris glauca is a shrub or slow growing tree, eventually coming up to 80 feet high with hard furrowed, greenish brown bark. Leafy branches divided into fine bushy sprays. Leaves about 1/10 inch long commonly glaucous, dorsal surface rounded giving the branchlets texted, non-ribbed appearance, cone solitary or in clusters, globase, up to 5/8 inch, in diameter, on stalk about 1/3 inch long. Cone scale 6, varying in size on the same scaled, small ones half to three quarters the size of the larger, woody but thin separating almost to the base, when the cone opens never tubeculate seed reddish brown with 2-3 broad pale wings. [23]. There is a variable number per cone. The number of seeds increases with cone size, and average cone size can vary markedly between individual trees. Small cone have from 18-24 seeds per cone and large cone from 30-36 seeds per cone. [24]. the species are pyramidal in shape especially when young. They borne in whorls of three, the tips thickened and curved inward [21]. It is observed that they reach their peak in areas where winter ice is high [20]. Tanin, resin and fragrant oil which are resistant to termite attack are extracted from the tree [21]. They grow mostly in cold climate region and at high altitude in the hills and are ever green trees or shrubs. Among the families of coniferae, abiataceae is the largest family [22].

Callitris glauca do poorly when planted in soils that do not contain particular fungi mycorrhizaa resulting in smaller quantities of nitrogen, potassium and phosphorus [20]. The main axis of the plant is apparent, the needle-like leaves are photosynthetic, and they are ever green that is they do not shed their leaf after each growing season. The leaf structure of this plant is a macrophyll [20], dark and form clusters in growth, water flow seem not to be embedded, which shows that it's devoid of vessels. It is observed that transpiration is negligible under condition of high humility [21]. The odour is spicy in nature.

2. EXPERIMENTAL

2.1. Plant Material and Essential Oil Isolation

The fresh matured leaves and the seeds of C. gluaca were collected near central bank area in Jos, Plateau state Nigeria. Plant Identification was done by Dr Aina of the department of Botany, Kogi State University Anyigba. Voucher specimens are deposited in the herbarium of the Faculty of biological Sciences, Kogi State University Anyigba, Nigeria.

Fresh leaves (500gm) were pulverised while the seeds (1.2kg) were macerated using a fast rotating blender. The plant materials were subjected separately to hydro-distillation method using an all glass Clevenger apparatus according to European pharmacopoeia (2008).Oils were collected and kept in the refrigerator without further treatment before GC-MS analysis.

2.2. Gas Chromatography/Mass Spectrometry Analysis

The chemical composition of the essential oil was analysed using GC/MS technique. The mass spectrometer was SHIMADZU GCMS-QP2010 Plus (Shimadzu Corporation, Japan) in the electron impact (EI) ionization mode (70eV) and HP-5MS (bonded 0.25µm) Capillary column (restek, Bellefonte, PA). Injector and Detector temperature were set at 250°C. The oven temperature was held at 60°C for 30minutes, then programmed to 240°C at rate of 5°C/min. Helium (99.99%) was the carrier gas at a flow rate of 1ml/min. Diluted samples (1/100 in hexane v/v) of 1.0ml were injected automatically. The linear velocity of the column was 36.8cm/sec, each peak was then analysed and assigned a number in the order that it was detected. The identification of the components was based on comparison of their mass spectra with those of NIST library mass spectra database and literature.

3. RESULT AND DISCUSSION

Hydro distillation of the leaves and seeds of Callitris glauca from north east Nigeria produced a clear light and pale yellowish essential oils. The oil yields were 0.18% (leaf) and 0.38% (seed) v/w of the wet samples.

The chemical components identified by GC-MS are listed in the table 1. Twenty two constituents were identified from the leaf essential oil. The major constituents were aromandendrene

(19.45%), α-limonene (15.60%), santolinatriene (11.59%) and patchuolane (6.09%). Other notable compounds found in the leaf were trans-β-ocimene (4.76%), IR-α-pinene (4.75%), β-terpinyl acetate (4.99%), 1, 2-diisopropenyl cyclobutane (4.90%), γ-elemene (4.58%).

Constituents present in significant amount are fenchene (1.48%), α-caryophyllene (1.06%) β-mycene (0.96%), 3-cyclopentyl-1-propyne (0.82%) and p-menth-1-(7)-en-9-ol (1.89%).

Eleven constituents were detected and identified from the seed essential oil. The major constituents were E-9-tetradecenyl acetate (21.70%), Z-10-pentadecen-1-ol (21.80%), hydrofol acid (18.0%), isooctanol (9.80%), trans-β-ocimene (5.50%) and IR-α-pinene (5.00%). There is a difference in the earlier report by Ogunwande, Ogunbinu, Kubmarawa and Vissiliki (2011) [] on Callitris glauca leaf which was reported to compose of α-pinene and limonene as the major constituents. The differences observed were likely due to genetic differences mediated by geographical origin. [25].

Table1. *Chemical Constituents of the Leaf and Seed Essential Oils of Callitris Glauca*

RI	**COMPONENT**	**PERCENTAGE COMPOSITION %**	
			Seed
857	3-cyclopentyl-1-propyne	0.60%	
894	Santolinatriene	11.59%	
934	1,2-diisopropenylcyclobutane	4.90%	2.42%
935	1,5-heptadiene-2,5-dimethyl-3-methylene	6.10%	
943	Fenchene	1.48%	
948	IR-α-Pinene	4.75%	5.00%
958	Ocimene	2.10%	
976	Trans-β-ocimene	4.76%	5.50%
976	Cis-β-ocimene	1.00%	
990	β-myrcene	0.96%	
995	Isooctanol		9.80%
1002	Bicylo[4.1.0]heptanes-7-(1- methylethylidene)	4.50%	
1018	Limonene	15.60%	2.40%
1096	1,4-cyclohexanediol	0.60%	
1103	1,5-Dimethyl-1,5-cyclooctadiene	0.25%	
1123	1-hydroxylmethyl-2-methyl-1-cyclohexene	0.15%	
1172	Estragole		6.20%
1225	1,4-Cyclohexanedimethanol		2.90%
1282	Metholene		3.36%
1327	P-Menth-1(7)en-9-ol	0.37%	
1348	β-Terpinylacetate	4.99%	
1386	Aromandendrene	19.45%	
1393	Patchoulene	6.09%	
1465	γ-Elemene	4.58%	
1579	α-Caryophyllene	1.06%	
1763	Z-10-Pentadecen-1-ol		21.8%
1787	E-9-tetadecenylacetate		21.7%
2167	Hydrofol-Acid		18.1%
2483	Methyl(13E)-13-Docosenoete	2.64%	
	Total	**98.52%**	**99.18%**

4. CONCLUSION

The results obtained in this study showed that Callitris glauca possess essential oils in the leaves and seeds of the plant and their oils were different qualitatively and quantitatively. This study represents the first to the best of our knowledge analysis of both the leaves and seeds of essential oil of Callitris glauca. Trans-β-ocimene, IR-α-pinene and limonene are notable similarities in both the leaf and seed of Callitris glauca. Further work is in progress on the identification of the essential oil of the root and stem of Callitris glauca.

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