



International Journal of Herbal Medicine

Available online at www.florajournal.com



International
Journal
of
Herbal
Medicine

ISSN 2321-2187
IJHM 2014; 2 (2): 65-67
Received: 01-04-2014
Accepted: 30-05-2014

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Composition of stem essential oil of *Chromolaena odorata* (L.) from Nigeria

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ABSTRACT

Stem of *Chromolaena odorata* (Asteraceae) was harvested and the oil extracted by hydro distillation method using Clevenger apparatus. The components in the oil were identified and quantified using Gas chromatography (GC) and Gas chromatography – Mass spectrometry (GC-MS). Twenty compounds were identified in the oil, representing 99.46% of the oil. The major components identified in the oil are α -pinene (13.60 %), caryophyllene (9.20%), Bicyclo [7.2.0] undec-4-ene (6.76%), β - pinene (4.83%) and Germacrene D (4.70%).

Keywords: *Chromolaena odorata*, hydro distillation, Gas chromatography-Mass spectrometry (GC-MS)

1. Introduction

Essential oils are valuable natural products that have found application in many fields including perfume, cosmetics, aromatherapy, phytotherapy and in spices and nutrition [1]. Many scientists have therefore focused attention on screening of plants for their essential oil constituents, studying them for their chemical composition and pharmacological activities, thereby gathering information on plant applications and new perspectives on the potential use of the natural products. There are about one hundred and sixty five *Chromolaena* species that have been identified [2] of which *Chromolaena odorata* is one. It is native to Central and South America but is now distributed throughout Africa and tropical Asia [3]. It is an aggressive competitor that occupies different types of lands where it forms dense strands that prevents the establishment of other flora. It is a menace in plantations and other ecosystems. It suppresses young plantations, agricultural crops and smoothers vegetation as it possesses allelopathic potentialities and growth inhibitors [4]. *Chromolaena odorata* is used in traditional medicine in the treatment of coughs, colds and skin diseases among others. Literature is awash with reports on the constituents and biological activity studies of the leaf and root essential oil of the plant [5-8], however to the best of our knowledge, there is no report on the stem essential oil of this plant in the literature. We hereby report on the isolation and characterization of the stem essential oil of this plant.

2. Experimental

2.1 Plant Collection: Stem of *Chromolaena odorata* was collected within the premises of Ladoke Akintola University of Technology, Ogbomoso, Oyo state, Nigeria. Identification had earlier been done at the Department of Agronomy of the same University.

2.2 Oil Isolation: 500 g of the fresh stem were hydro distilled for 4 hrs using the Clevenger apparatus and the oil extracted into hexane to avoid hydro sorption. The oil was later collected into sample bottle, sealed and stored under refrigeration until time of analysis.

2.3 Characterization: GC-MS analysis of the essential oils was performed using a Shimadzu Gas Chromatograph Model QP2010 plus, a gas chromatographic (GC) system, equipped with a Mass selective detector and auto injector. Compounds were separated on a capillary column (30 m x 0.25 mm, film thickness 0.25 μ m). 1.0 μ l of the sample was injected using the split mode (split ratio 1: 100). For GC/MS detection, an electron ionization system with ionization energy of 70 eV was used. Column oven temperature program was the same as previously used in GC analysis.

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Helium was used as a carrier gas at a flow rate of 1.5 ml/m. Mass scanning range was 40-700 m/z while injector and MS transfer line temperatures were set at 220 and 290 °C, respectively.

3. Results and discussion

The volatile compounds identified in the essential oil from the stem of *Chromolaena odorata* is presented in table 1. Twenty compounds were identified in the essential oil, the n-hexane and n-heptane identified in the oil are obviously from the residual hexane that was used in the extraction process. The main monoterpene constituents of the oil are α -pinene (13.60%) and β -pinene (2.60%) while Caryophyllene was the principal sesquiterpene detected in the oil constituting 9.20%. Other sesquiterpenes detected are α -amorphene, muurolene, Germacrene D and aromadendrene which were detected at 4.50%, 4.50%, 5.00% and 6.86% respectively. Other compounds detected in appreciable amounts in the oil

sample are 1, 3, 6-octatriene (4.50%), 1, 3-cycloheptadiene (3.10%), 2-cyclopropylidene-1, 7, 7-trimethylheptane (4.50%). Comparing this result with literature reports on leaf and stem essential oil of this plant, it is observed that the constituents identified are not too different from the constituent of the leaf essential oil except that the leaf essential oil is richer than the stem essential oil. Most of the compounds identified in the stem essential oil have also been reported present in the leaf essential oil. The major constituents reported for leaf essential oil of the plant include α -pinene, geigerene / pregeigerene, β -caryophyllene, germacrene D, Bicyclogermacrene, (Z)- β -farnesene, ascaridole, limonene, camphor, cardinal, β -copaen-4 α -ol and 5,6-diethenyl-1-methylcyclohexene [9 - 15]. However, the composition of the stem essential oil is quite different from the composition of root essential oil of the plant reported in literature [8]. The constituents that are common to the two are α - and β - pinene, muurolene and caryophyllene.

Table 1: Composition of stem essential oil of *Chromolaena odorata*

S. No	Compounds	Retention Index	% Composition
1	Hexane	653	12.00
2	Heptane	717	18.10
3	Cyclopentane	733	1.50
4	1,3-Cycloheptadiene	804	3.10
5	Bicyclo[3.1.1]hept-2-ene	943	4.54
6	β -pinene	943	2.60
7	α -pinene	948	13.60
8	1,3,6-octatriene	976	4.50
9	3-methyl-1,3,4-divinyl-1-cyclohexene	1076	1.50
10	1-methyl-5,6-divinyl-1-cyclohexene	1092	1.50
11	Copaene	1221	0.98
12	2-cyclopropylidene-1,7,7-trimethylheptane	1251	4.50
13	Aromadendrene	1386	6.86
14	1-cyclopropeazulene	1419	0.49
15	Muurolene	1435	4.50
16	α -amorphe ne	1440	4.50
17	δ -cadinene	1469	0.49
18	Caryophyllene	1494	9.20
19	Bicyclo [7.2.0] undecene	1494	6.12
20	Germacrene D	1515	5.00
		TOTAL	99.46

4. Conclusion

This study has shown that the main constituents in the stem essential oil of *Chromolaena odorata* are: α - & β -pinenes, Caryophyllene, Bicyclo [7.2.0] undec-4-ene and Germacrene D and that the composition of the stem essential oil of the plant is not substantially different from the composition of the leaf essential oil but is quite different from the composition of the root essential oil.

5. Acknowledgement

The authors are grateful to Dr. O.A. Ojo of Agronomy department, Ladoke Akintola University of Technology, Ogbomoso, Oyo state, Nigeria for botanical identification of the plant of study.

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