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Chemical Composition Analysis of Essential Oil from the Leaves of *Heliotropium angiospermum*

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ABSTRACT

Helitropium Angiospermum commonly called scorpion's tail is an herbaceous annual or short lived perennial plant in the family ofBoraginaceae. It is used in traditional medicine for gastrointestinal disorders, inflammation and in some cases, used for cancer-related diseases. This study investigates the chemical composition of essential oil from the leaves of *H. angiospermum*. Gas chromatography-mass spectrometry (GC-MS) analysis was employed to identify andquantify the constituents present in the oil. At least 20 chemical constituents were identified, including hydrocarbons, esters, cyclic siloxanes, unsaturated compounds, fatty acid derivatives, and other compounds. The percentage composition of these constituents varied, with tridecane, 9-octadecene, and cycloheptasiloxane being themost abundant. The presence of diverse chemical constituents suggests that the oil possesses a complex profile with potential implications for its fragrance, therapeutic properties, and other characteristics.

KEYWORDS: *Helitropium angiospermum*, Essential oil, chemical constituents, Octadecene, Tridecane

1. INTRODUCTION

Aromatic plants have a long history of use in traditional medicine due to their preservative and medicinal properties (digestive, diuretic, expectorant andsedative), in foods to impart flavor and aroma, and as antioxidants and antibacterial agents.[1] Several medicinal properties of aromatic plants are found in their essential oils and are related to their composition.[2] Essential oils are plant secondary metabolites characterized by a strong odor and are natural multicomponent systems consisting mainly ofterpenes and volatile hydrocarbons. The chemical profiles of essential oil products differ not only in the number of molecules but also in the stereochemical species obtained.[3] Harvests can vary inquality, quantity and composition depending on climate, soil composition, plant species, age and plant cycle stage.[4,5] Essential oils and their individual volatile components are important compounds for biomedical or pharmaceutical purposes due to their antiseptic and medicinal properties.[2] Some essential oils exhibit specific therapeutic properties that can prevent or even treat certain organ dysfunctions or systemic disorders.[6,7] *Heliotropium angiospermum* commonly known as scorpion's tail is an herbaceous annual or short lived perennial plant in the family of Boraginaceae. It grows about 1 meter tall, with hispid (hairy) stems, alternate lanceolate leaves, and distinctive scorpoid cymes of small white flowers, giving rise to its name.[8] It is used as a traditional remedy for gastrointestinal disorders. A tea made from its leaves is administered to treat colitis, dysentery and diarrhea.[9] The most common application of the plant involves the treatment of inflammatory skin conditions, generalized inflammation, and in some cases, used for cancer-related symptoms.[10] This study therefore seeks to investigate the chemical composition of the essential oil from the leaves of *H. angiospermum.*

2. MATERIALS AND METHODS

2.1 Sample Collection

The leaves of *Heliotropium angiospermum* were collected at the Botanical Garden of Ahmadu Bello University, Zaria, Kaduna State and was authenticated and verified at the Botany division of the Department of Biological Sciences, Ahmadu Bello University Zaria, Kaduna, Nigeria with the identification number; ABU02768.

2.2 Extraction of essential oils

The essential oil was extracted from the fresh leaves of *Heliotropium angiospermum* successively using hydro distillation in a Clevenger-type apparatus for 6 hours, following standard protocol.[11] 2.1kg of the sample was extracted for the first cycle. The distillate, containing the volatile oil, was collected in the apparatus's receiver arm, where it was dissolved in analytical-grade n-hexane. The oil-hexane mixture was then transferred to sample bottles. To preserve the volatile oil, it was stored in sealed glass vials at 4^0C under refrigeration. The experiment was repeated for the second and third cycle using the same amount of fresh sample in each case.

2.3 GC-MS Analysis of the Essential Oil

GC-MS analysis of the oil extract was carried out on an Agilent Technology 7890A GC system coupled to a 5975 VLSMD Mass Spectrometer with aninjector 7683B series device. An Agilent (9091) 413:325 0C column (30 m x320 Nm x 25) was used with helium as carrier gas at a flow rate of3.3245cm3/min. The GC oven was initially programmed at 500^0C (hold for 1 min) and finally 3000^0C (hold for 5 minutes) at a rate of 8^0C/minute while the trial temperature was 37.25^0C. For MS, electron impact ionization was achievedwith ionization energy of 70ev. The column heater was set at 250^0C while the pressure was 10.143 psi with an average velocity of 66.45 cm/sec andhold–up time of 0.7525 minute was recorded. The oil was diluted with n-hexane and 2µl of diluted sample was injected automatically in the split less mode. Identification of the constituent compounds peaks was made by the Chem-Office software along with the MS-library. The individual constituentswere identified by their retention times identical to the compounds knownfrom the literature data and also by comparing their spectra with those storedin the NIST0.8/Database.

3. RESULTS AND DISCUSSION

3.1 Results

The various chemical constituents present in the essential of *Helitropium angiospermum* leaves are shown in Table 1

Table 1: Essential oil constituents of *H. angiospermum* leaves

S/N	Chemical Constituents	Total percentage constituents (%)	Retention time (mins)
1	Tridecane	3.60	15.006
2	1-Heneicosyl formate	1.06	16.351
3	Decane	2.35	11.579
4	Cyclooctane	1.03	11.722
5	4-Tetradecene, (E)	2.04	16.73
6	3-methyl-decane	3.06	16.803
7	Cycloheptasiloxane	3.66	18.068
8	9-Octadecene	6.28	19.012
9	Cycloeicosane	2.22	23.252
10	11-Octadecenoic acid	3.00	25.28
11	Methyl stearate	2.11	25.678
12	Cyclononasiloxane	1.30	27.332
13	Bis(2-ethylhexyl)phthalate	1.18	29.271
14	Heptasiloxane	1.98	29.323
15	Cannabinol	2.78	29.666
16	Trimethylsilyl ether	2.52	31.795
17	4-Tetradecane	2.04	16.803
18	Cyclopentane	1.14	16.940
19	Heptylcyclohexane	1.50	17.47
20	2,3-Dimercaptobutane-1,4-diol	1.53	19.555

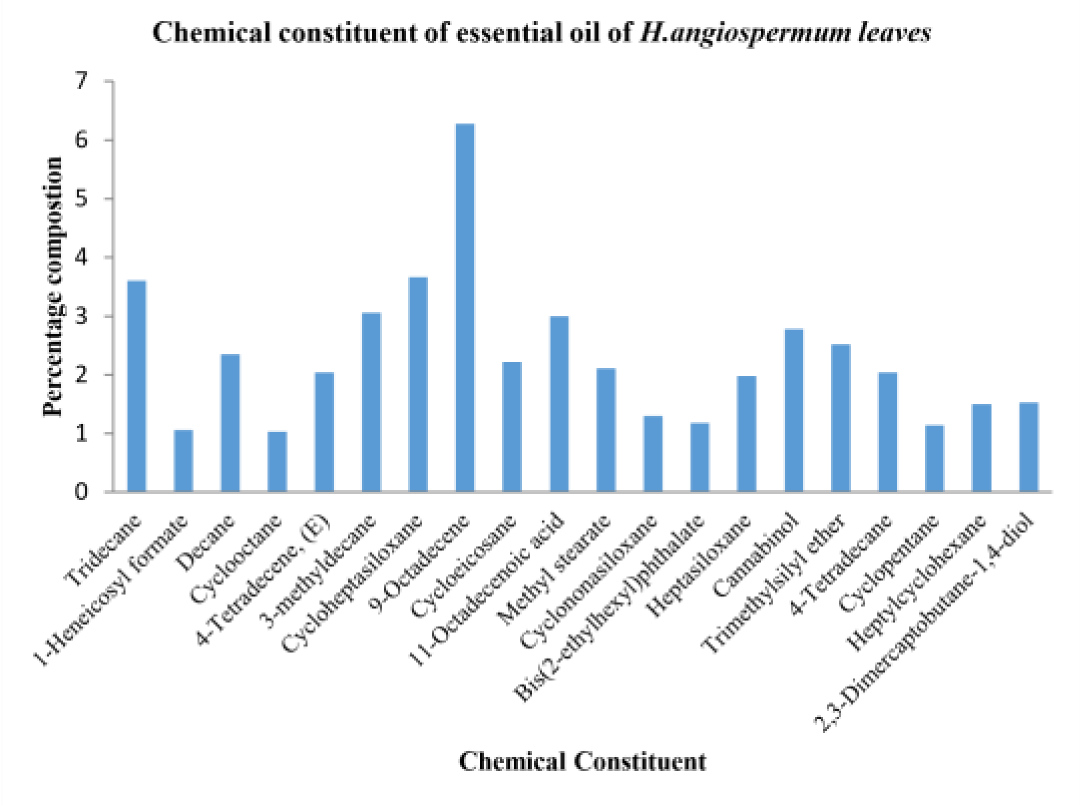

Figure 1: Chemical constituent of essential oil of *H.angiospermum* leaves

3.2 Discussion

GC-MS analysis identified 20 chemical constituents in the essential oil of *Heliotropium angiospermum* leaves, representing a mixture of hydrocarbons, fatty acid derivatives, siloxanes, esters and potentially bioactive compounds. The most abundant constituents were 9-Octadecene (6.28%), Cycloheptasiloxane (3.66%), Tridecane (3.60%), 3-Methyl-decane (3.06%), and 11-Octadecenoic acid (3.00%). These results indicate chemically diverse oil with multiple potential uses.[3] Hydrocarbons like Tridecane and 9-Octadecene contribute to the oil's hydrophobic character and may exhibit insecticidal properties.[3] Fatty acids such as 11-Octadecenoic acid and Methyl stearate are known for their emollient and anti-inflammatory effects.[12] Siloxanes like Cycloheptasiloxane and Cyclononasiloxane are typically attributed to lab contamination, though their detection is not uncommon in GC-MS analysis of natural products.[13] Cannabinol, if present naturally, may suggest anti-inflammatory and neuroprotective effects.[14] The detection of Bis(2-ethylhexyl)phthalate is likely due to laboratory contamination and has known endocrine-disrupting effects.[15] The presence of 2,3Dimercaptobutane-1,4-diol suggests possible antioxidant or metal-chelating potential.[16]

Essential oils from other *Heliotropium* species, such as *H.indicum*, have shown high levels of phytol, hexadecanoic acid, and terpenoids.[17] In contrast, *H. angiospermum* appears to lack classical terpenoids but contains a variety of alkanes, alkenes and siloxanes, suggesting a distinct chemotype or possible environmental influence on secondary metabolism.
The chemical profile suggests the oil may be usefulin antimicrobial, cosmetic, and possibly therapeutic products.

4. CONCLUSION

GC-MS results confirm a complex chemical composition with promising biological and industrial relevance. The unusual presence of certain compounds like Cannabinol requires further verification. Future research should focus on isolation of active components, and bioactivity testing.

CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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