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ESSENTIAL OIL CONSTITUENTS OF THE LEAVES OF *AMOMUM ANDAMANICUM* (ZINGIBERACEAE)

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ABSTRACT

This study aimed to analyse the chemical composition of essential oil from *Amomum andamanicum* leaves extracted by the hydrodistillation method. Gas Chromatography and Mass Spectrometry were employed to determine the constituents present in the essential oil. The key constituents present in the essential oil predominantly include α-pinene (49.7%), 1,4,7-cycloundecatriene, 1,5,9,9-tetramethyl-Z,Z,Z- (8.32%), caryophyllene (7.54%), terpinen-4-ol (2.27%) and camphene (1.24%). This signifies the initial recording of the composition of essential oil derived from *A. andamanicum*.

Keywords: *Amomum andamanicum*, Zingiberaceae, essential oil, hydrodistillation, GC-MS, α-pinene

INTRODUCTION

The genus *Amomum* Roxb., belonging to the family Zingiberaceae, holds the distinction of being the second largest genus within this family and exhibits a widespread distribution throughout Southeast Asia **[1]**. Notably, the genus *Amomum* is renowned for its distinctive aroma, which is attributable to the presence of essential oils within its species. To date, a total of 108 species of *Amomum* have been documented, with a mere 29 species having been subjected to essential oil composition analysis **[2]**. The essential oils derived from *Amomum* species have demonstrated noteworthy antimicrobial, antifungal, and antioxidant properties **[3]**.

Noteworthy compounds identified within the essential oils of *Amomum* species include 1,8-cineole, α-pinene, β-pinene, bornyl acetate, camphor, and methyl chavicol **[2]**. *Amomum andamanicum* V.P. Thomas, M. Dan & M. Sabu, an enduring rhizomatous herb with pale yellow flowers, is indigenous to the Andaman Islands in India **[4]**. This present study represents the initial endeavor to elucidate the phytochemical constituents present within the leaves of *A. andamanicum*.

MATERIALS AND METHODS

The leaves of *A. andamanicum* were collected from cultivation at the Tropical Botanic Garden, Thiruvananthapuram, originally from Mt Harriet, South Andamans. Voucher specimens (*CATH 23001*) have been deposited at the Herbarium of the Catholicate College (CATH). A quantity of 500 g fresh leaves were weighed and subjected to hydro-distillation for 4 h. Analysis of the essential oil was performed using GC-MS model Shimadzu QP2020 equipped with an autosampler series AOI 20i. An SH RXI 5 ms fused silica capillary column of 0.25 mm diameter, 0.25µm film thickness, and 30 m length was used. An ionization energy of 70 eV was used for GC-MS detection. Carrier gas, helium (99.99%), was used at a constant flow rate of 1.2 ml/min. The oil was injected into the instrument, and the oven temperature was programmed from 70°C (1min), followed by 180°C at the rate of 10°C min^{-1} and 280°C where it was held for 10 min. The injector and ion source temperatures were fixed at 300°C and 220°C, respectively. The total running time was 37 min. The identification of compounds was based on a comparison of their mass spectra with those of the NIST libraries.

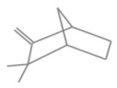
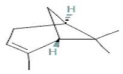
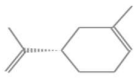
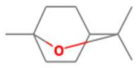
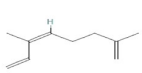
RESULTS AND DISCUSSION

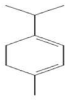
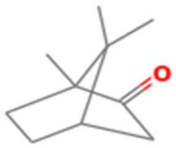
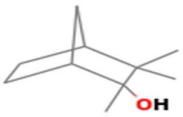
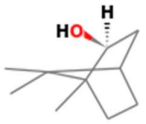
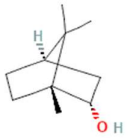
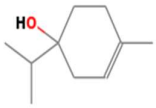
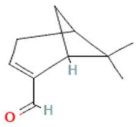
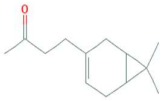
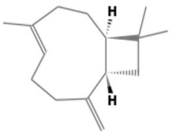
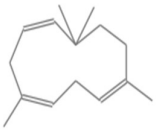
The hydro-distillation process yielded *A. andamanicum* essential oil at a percentage of 0.16%. Through GC-MS analysis, a total of 29 compounds were identified, constituting 94% of the overall essential oil composition. The primary constituents observed in the essential oil were α-pinene (49.7%), 1,4,7-

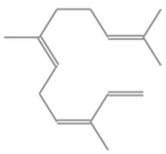
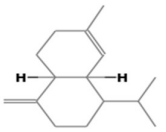
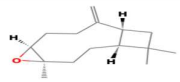
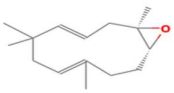
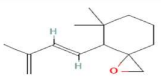
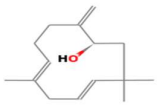
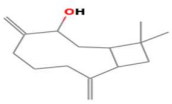
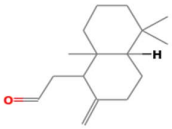
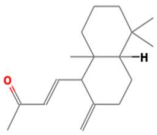
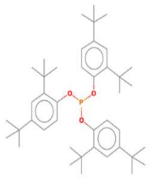
cycloundecatriene, 1,5,9,9-tetramethyl-Z,Z,Z- (8.32%), caryophyllene (7.54%), Sabinene (2.98%), terpinen-4-ol (2.27%), camphene (1.24%), phenol, 2,4-bis(1,1-dimethylethyl)-, phosphite (3:1) (1.04%), ambrial (1.01%), and phytol (0.87%) **(Table 1)**.

The majority of the compounds under investigation fall within the terpenoid class, with a particular emphasis on monoterpenoids and sesquiterpenoids. Monoterpenes, in particular, have been found to possess various pharmacological properties, including antimicrobial, anti-inflammatory, antioxidant, antipruritic, and analgesic effects **[5]**. One prominent monoterpenoid compound, α-pinene, is commonly present in essential oils derived from plants and has demonstrated anticancer, insecticidal, antioxidant, and anti-leishmanial activities **[6, 7, 8, 9]**. On the other hand, caryophyllene, a sesquiterpenoid, exhibits antioxidant, anti-inflammatory, immunomodulatory, and anticancer properties **[10, 11, 12]**.

Table 1: Constituents identified in the essential oil of *A. andamanicum*

Sl. No.	Constituents	RT	Percentage	Molecular Weight	Structure	Biological activity
1	Camphene	3.67	1.24	136.23		Larvicidal activity [13]
2	Sabinene	3.96	2.98	136.23		Inhibits ROS level [14]
3	α -Pinene	4.03	49.76	136.23		Anticancer [6] , insecticidal [7], antioxidant [8], anti-Leishmanial [9]
4	o-Cymene	4.61	0.77	134.22		Antioxidant [15]
5	Sylvestrene	4.68	2.73	136.23		No activity reported
6	Eucalyptol	4.74	0.73	154.249		Antiparasitic [16], anti-inflammatory [17], antibiofilm activity[18], antioxidant [13]
7	α-Ocimene	4.89	0.30	136.23		No activity reported

8	**Terpinene**	**5.09**	**0.49**	**136.23**		**Antileishmanial and antioxidant[19], larvicidal activity[20]**
9	**Bicyclo[2.2.1]heptan-2-one, 1,7,7-trimethyl-,(1S)-(Camphor)**	**6.41**	**0.66**	**152.23**		**Derivative can be used as anticancer agents[21], antimicrobial and insecticidal [22]**
10	**Bicyclo[2.2.1]heptan-2-ol,2,3,3-trimethyl-**	**6.47**	**0.35**	**154.24**		**No activity reported**
11	**Isoborneol**	**6.58**	**0.29**	**154.24**		**Mosquito repellency[23], leishmanicidal activity[24], usage against atherosclerotic disease[25]**
12	**endo-Borneol**	**6.71**	**0.30**	**154.25**		**antinociceptive and anti-inflammatory [26]**
13	**Terpinen-4-ol**	**6.86**	**2.27**	**154.24**		**Mosquito repellency[23], insect repellency[27]**
14	**Bicyclo[3.1.1]hept-2-ene-2-carboxaldehyde, 6,6-dimethyl-**	**7.15**	**0.70**	**150.21**		**No activity reported**
15	**(+)-3-Carene, 10-(acetylmethyl)-**	**10.61**	**0.63**	**192.30**		**No activity reported**
16	**Caryophyllene**	**11.38**	**7.54**	**204.351**		**antioxidant, anti-inflammatory, and immunomodulator [10,11], anticancer [12]**
17	**1,4,7,-Cycloundecatriene, 1,5,9,9-tetramethyl-,Z,Z,Z-**	**12.08**	**8.32**	**204.351**		**No activity reported**

18	**1,3,6,10-Dodecatetraene, 3,7,11-trimethyl-, (Z,E)-**	**13.03**	**0.54**	**204.351**		**No activity reported**
19	**(1S,4aR,8aS)-1-Isopropyl-7-methyl-4-methylene-1,2,3,4,4a,5,6,8aoctahydronaphthalene**	**13.29**	**0.74**	**204.35**		**No activity reported**
20	**Caryophyllene oxide**	**14.83**	**6.23**	**220.3505**		**Anticancer [28], antiproliferative [29], Acaricidal [30]**
21	**(1R,3E,7E,11R)-1,5,5,8-Tetramethyl-12-oxabicyclo[9.1.0]dodeca-3,7-diene**	**15.36**	**1.17**	**220.35**		**No activity reported**
22	**1-Oxaspiro[2.5]octane,5,5-dimethyl-4-(3-methyl-1,3 butadienyl)-**	**15.78**	**0.38**	**206.32**		**No activity reported**
23	**Humulenol-II**	**15.86**	**0.50**	**220.35**		**No activity reported**
24	**11,11-Dimethyl-4,8-dimethylenebicyclo[7.2.0]undecan-3-ol**	**15.90**	**0.54**	**220.35**		**No activity reported**
25	**Isoaromadendrene epoxide**	**16.60**	**0.50**	**220.35**		**No activity reported**
26	**Ambrial**	**19.299**	**1.01**	**234.37**		**No activity reported**
27	**(E)-15,16-Dinorlabda-8(17),11-dien-13 one**	**22.88**	**0.42**	**260.41**		**No activity reported**
28	**Phytol**	**25.09**	**0.87**	**296.53**		**Antinociceptive effect, antioxidant [31]**
29	**Phenol, 2,4-bis(1,1-dimethylethyl)-, phosphite (3:1)**	**36.07**	**1.04**	**646.92**		**No activity reported**

CONCLUSION

The present study unveiled the chemical composition of the essential oil extracted from the leaves of *A. andamanicum*. Utilizing gas chromatography-mass spectrometry (GC-MS) analysis, numerous compounds were identified, potentially contributing to the pharmacological activity exhibited by the species. This report represents the initial endeavor in profiling the chemical constituents of *A. andamanicum*. Subsequent investigations are warranted to comprehensively evaluate the therapeutic potential of this species.

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REFERENCE

[1] Xia YM, Kress WJ and Prince LM, Phylogenetic Analyses of Amomum (Alpinioideae: Zingiberaceae) Using ITS and matK DNA Sequence Data, Systematic Botany, 29, 2004, 334–344.

[2] Sabulal N and Baby S, Chemistry of Amomum essential oils, Journal of Essential Oil Research, 33, 2021, 427–441.

[3] Thinh BB, Doudkin RV and Thanh VQ, Chemical Composition of Essential Oil of Amomum xanthioides Wall. ex. Baker from Northern Vietnam, Biointerface Research in Applied Chemistry, 11, 2021, 12275–12284.

[4] Thomas VP, Mathew D, Mamiyil S, *et al*, Amomum andamanicum (Zingiberaceae): A new species from the Andaman Islands, India, Blumea, 55, 2010,295-299.

[5] Zielińska-Błajet M and Feder-Kubis J, Monoterpenes and Their Derivatives—Recent Development in Biological and Medical Applications, International Journal of Molecular Sciences, 21, 2020, 7078.

[6] Jo H, Cha B, Kim H, *et al*, α-Pinene Enhances the Anticancer Activity of Natural Killer Cells via ERK/AKT Pathway, International Journal of Molecular Sciences, 22, 2021, 656.

[7] Langsi JD, Nukenine EN, Oumarou KM, *et al*, Evaluation of the Insecticidal Activities of α-Pinene and 3-Carene on Sitophilus zeamais Motschulsky (Coleoptera: Curculionidae), Insects, 11, 2020, 540.

[8] Türkez H and Aydın E, In vitro assessment of cytogenetic and oxidative effects of α-pinene, Toxicology and Industrial Health, 32, 2016, 168–176.

[9] Rodrigues KAdaF, Amorim LV, Dias CN, *et al*, Syzygium cumini

(L.) Skeels essential oil and its major constituent α-pinene exhibit anti-Leishmania activity through immunomodulation in vitro, Journal of Ethnopharmacology, 160, 2015, 32–40.

[10] Hashiesh HM, Sharma C, Goyal SN, *et al*, A focused review on CB2 receptor-selective pharmacological properties and therapeutic potential of β-caryophyllene, a dietary cannabinoid, Biomedicine & Pharmacotherapy, 140, 2021, 111639.

[11] Scandiffio R, Geddo F, Cottone E, *et al*, Protective Effects of (E)-β-Caryophyllene (BCP) in Chronic Inflammation, Nutrients, 12, 2020, 3273.

[12] Ramachandhiran D, Sankaranarayanan C, Murali R, *et al*, β-Caryophyllene promotes oxidative stress and apoptosis in KB cells through activation of mitochondrial-mediated pathway - An in-vitro and in-silico study, Archives of Physiology and Biochemistry, 128, 2022, 148–162.

[13] Seo SM, Park HM and Park IK, Larvicidal Activity of Ajowan (Trachyspermum ammi) and Peru Balsam (Myroxylon pereira) Oils and Blends of Their Constituents against Mosquito, Aedes aegypti, Acute Toxicity on Water Flea, Daphnia magna, and Aqueous Residue, Journal of Agricultural and Food Chemistry, 60, 2012, 5909–5914.

[14] Ryu Y, D. Lee D, Jung SH, *et al*, Sabinene Prevents Skeletal Muscle Atrophy by Inhibiting the MAPK–MuRF-1 Pathway in Rats, International Journal of Molecular Sciences, 20(19), 2019, 4955.

[15] Shammari BR AI, Antioxidant, Antimicrobial and In Silico NADPH Oxidase Inhibition of Chemically-Analyzed Essential Oils Derived from Ballota deserti (Noë) Jury, Molecules, 27, 2022, 6636.

[16] Hi A, Am A and Ad A, Antiparasitic effects of Elettaria cardamomum L. essential oil and its main compounds, 1-8 Cineole alone and in combination with albendazole against Echinococcus granulosus protoscoleces, Saudi journal of biological sciences, 29, 2022, 2811-2818.

[17] Juergens UR, Anti-inflammatory properties of the monoterpene 1.8-cineole: current evidence for co-medication in inflammatory airway diseases, Drug Research, 64, 2014, 638–646.

[18] Vijayakumar K, Manigandan V, Jeyapragash D, *et al*, Eucalyptol inhibits biofilm formation of Streptococcus pyogenes and its mediated virulence factors, Journal of Medical Microbiology, 69, 2020, 1308–1318.

[19] Nooshadokht M, Mirzaei M, Sharifi I, *et al*, In silico and in vitro antileishmanial effects of gamma-terpinene: Multifunctional modes of action, Chemico-Biological Interactions, 36, 2022, 1109957.

[20] Gong X and Ren Y, Larvicidal and ovicidal activity of carvacrol, p-cymene, and γ-terpinene from Origanum vulgare essential oil against the cotton bollworm, Helicoverpa armigera (Hübner), Environmental Science and Pollution Research International, 27, 2020, 18708–18716.

[21] Singh H, Kumar R, Mazumder A, *et al*, Camphor and Menthol as Anticancer Agents: Synthesis, Structure-Activity Relationship and Interaction with Cancer Cell Lines, Anti-Cancer Agents in Medicinal Chemistry, 23(6), 2022, 614-623.

[22] Chen W, Vermaak I and Viljoen A, Camphor—A Fumigant during the Black Death and a Coveted Fragrant Wood in Ancient Egypt and Babylon—A Review, Molecules, 18, 2013, 5434–5454.

[23] Hwang YS, Wu KH, Kumamoto J, *et al*, Isolation and identification of mosquito repellents in Artemisia vulgaris, Journal of Chemical Ecology, 11, 1985, 1297–1306.

[24] Silva ARST, Scher R, Santos FV, *et al*, Leishmanicidal Activity and Structure-Activity Relationships of Essential Oil Constituents, Molecules, 22, 2017, 815.

[25] Wang Y, Li Z, Liu B, *et al*, Isoborneol Attenuates Low-Density Lipoprotein Accumulation and Foam Cell Formation in Macrophages, Drug Design, Development and Therapy, 14, 2020, 167–173.

[26] Almeida JRGdaS, Souza GR, Silva JC, *et al*, Borneol, a bicyclic monoterpene alcohol, reduces nociceptive behavior and inflammatory response in mice, The Scientific World Journal, 2013, 2013, 808460.

[27] Suthisut D, Fields PG and Chandrapatya A, Contact toxicity, feeding reduction, and repellency of essential oils from three plants from the ginger family (Zingiberaceae) and their major components against Sitophilus zeamais and Tribolium castaneum,

Journal of Economic Entomology, 104, 2011, 1445–1454.

[28] Fidyt K, Fiedorowicz A, Strządała L, β-caryophyllene and β-caryophyllene oxide-natural compounds of anticancer and analgesic properties, Cancer Medicine, 2016, 53007–3017.

[29] Delgado C, Mendez-Callejas G and Celis C, Caryophyllene Oxide, the Active Compound Isolated from Leaves of Hymenaea courbaril L. (Fabaceae) with Antiproliferative and Apoptotic Effects on PC-3 Androgen-Independent Prostate Cancer Cell Line, Molecules, 26, 2021, 6142.

[30] Oh MS, Yang JY and Kim MG, Acaricidal activities of β-caryophyllene oxide and structural analogues derived from Psidium cattleianum oil against house dust mites, Pest Management Science, 70, 2014, 757–762.

[31] Santos CC de MP, Salvadori MS, Mota VG, *et al*, Antinociceptive and Antioxidant Activities of Phytol In Vivo and In Vitro Models, Neuroscience Journal, 2013, 2013, 949452.