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Chemical composition and antibacterial activities of essential oils from *Zingiber spectabile* Griff

Y. Sivasothy[a], K. Awang[a*], H. Ibrahim[b], K.L. Thong[b], N. Fitrah[b], X.P. Koh[b] & L.K. Tan[b]

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Abstract

The essential oils of the leaves and rhizomes of *Zingiber spectabile* Griff. were analyzed by capillary gas chromatography (GC) and GC–mass spectrometry (GC–MS) following the isolation by hydrodistillation. In total, 80 compounds were identified in its leaf and rhizome oils. Both oils were sesquiterpenic in nature but with distinctly different odors. The most abundant components in the leaf oil were β-caryophyllene (21.3%) and β-elemene (12.5%), whereas the rhizomes yielded an oil rich in zerumbone (59.1%). The antibacterial activities of both oils against multidrug-resistant strains and food-borne pathogens were evaluated by the disc diffusion assay and by determining their minimum inhibitory concentration (MIC) values. The leaf oil was inactive against all tested microorganisms, whereas the rhizome oil exhibited weak activity against *Escherichia coli, Salmonella enteritidis, Salmonella typhi, Salmonella typhimurium, Shigella flexneri, Klebsiella pneumoniae, Pseudomonas aeruginosa* and methicillin-resistant *Staphylococcus aureus* (MRSA).

Keywords

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Chemical composition and antibacterial activities of essential oils from *Zingiber spectabile* Griff

Y. Sivasothy[a], K. Awang[a]*, H. Ibrahim[b], K.L. Thong[b], N. Fitrah[b], X.P. Koh[b] and L.K. Tan[b]

[a]*Department of Chemistry, Faculty of Science, University Malaya, Kuala Lumpur, Malaysia;* [b]*Institute of Biological Sciences, Faculty of Science, University Malaya, Kuala Lumpur, Malaysia*

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Keywords: *Zingiber spectabile* Griff; Zingiberaceae; essential oil composition; antibacterial activity; zerumbone; β-caryophyllene; β-elemene

Introduction

Zingiber spectabile Griff. (black gingerworth, beehive ginger or *tepus tanah*), a member of the Zingiberaceae family, is native in the moist lowland forests of Peninsular Malaysia. The underground rhizomes produce tall thin-leaved stems up to 2 m high, and leafless fertile stems up to 50 cm high, terminated by the inflorescence. The cylindrical cone-shaped inflorescence, the largest and most conspicuous of any Malaysian species of *Zingiber*, is composed of broad overlapping bracts, which are at first yellow and then turn red. A single short-lived flower with pale yellow petals and a purple lip arises from the axil of each bract. Only a few flowers are produced by the inflorescences at any one time. The leaves of this herb are used to flavor food and in the preparation of traditional medicine. The pounded leaves are applied as a poultice to inflamed eyes and on to the body to reduce swelling. The young rhizomes are sliced, soaked in vinegar and used to flavor food or as an appetizer (1).

The volatile constituents of *Z. spectabile* have been the subject of three previous studies. The first, by Vahairut-Lechat et al. in 1996 who reported on the composition of the oils isolated from the leaves and stems harvested at different stages, with α-pinene (7.44–11.42% and 10.78–13.69%, respectively), β-pinene (35.85–49.35% and 23.52–26.17%, respectively) and β-phellandrene (16.59–18.45% and 23.11–38.05%, respectively) predominating in all of them (2). Later, Zoghbi and Andrade analyzed the volatiles of the inflorescence of Brazilian *Z. spectabile* and found similar results (3). In 2001, Sirat and Leh examined the composition of the rhizome oil of the same species from Malaysia and reported labda-8 (17),12-diene-15,16-dial (24.3%), terpinen-4-ol (23.7%), α-terpineol (13.1%) and β-pinene (10.3%) as the most abundant components (4). A previous phytochemical investigation on the non-volatile constituents of the rhizomes of *Z. spectabile* afforded several flavonoids and sesquiterpenoids, and their cell growth inhibitory assays against colon carcinoma SW480 cells were reported (5).

Essential oils have been known to demonstrate pharmacological effects such as anti-inflammatory, antioxidant, cytotoxic and they are biocides against a broad range of organisms such as bacteria, fungi, viruses and protozoas. Due to their availability, few side-effects or toxicity and their biodegradation ability in comparison with available antibiotics and preservatives, plant essential oils offer great potential for their antimicrobial activities in connection with their usefulness in the medicine and food industry (6). In our continuous efforts to study the essential oils of the Zingiberaceae species and their antimicrobial activities

*Corresponding author. Email: khalijah@um.edu.my

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Author affiliations

- [a] Department of Chemistry, Faculty of Science, University Malaya, Kuala Lumpur, Malaysia
- [b] Institute of Biological Sciences, Faculty of Science, University Malaya, Kuala Lumpur, Malaysia