

Antibacterial activities of extracts and constituents in the rhizomes of diploid and tetraploid gingers (*Zingiber officinale* Roscoe)

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Abstract

The pungent phenolics were isolated from the rhizome of tetraploid ginger (*Zingiber officinale* Roscoe), and their structures were established as [6]-gingerol and [6]-dehydroparadol by chemical and spectroscopic evidence. And extracts and constituents in the rhizomes of diploid and tetraploid gingers were screened for their antibacterial activity against 6 Gram-negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*, *Salmonella enteritidis*, *Vibrio parahaemolyticus*, and *Yersinia enterocolitica*) and 3 Gram-positive bacteria (*Staphylococcus aureus*, *Listeria monocytogenes*, and *Bacillus cereus*). The minimum inhibitory concentrations (MICs) of extracts and constituents in the rhizomes were determined by the microdilution method ranged from 0.49 to 16,000 µg/ml, and 0.03 to 1,000 µg/ml, respectively. Extracts and constituents in the rhizomes exhibited a fairly high antibacterial activity against the spectrum of most Gram-positive bacteria tested.

Keywords : antibacterial activity, minimum inhibitory concentration (MIC), *Zingiber officinale* Roscoe, diploid ginger, tetraploid ginger

I Introduction

Ginger (*Zingiber officinale* Roscoe, $2n=22$) is a monocotyledonous herbaceous plant belonging to the family Zingiberaceae. It is an important commercial species and has been used as a source of spice and medicine in Africa, Asia, and America since ancient times^{1, 2)}. In addition, ginger is a generally regarded as safe material, due to its extremely low human toxicity, and its rhizome contains the characteristic pungency of a spice. What gives ginger its pungency are gingerols and shogaols, which consist of a homologous series of aldols each containing a phenolic group. And recent studies have determined its antifungal, antioxidation, antitumor, and anti-allergic effects³⁻⁷⁾. On the other hand, Adaniya *et al.* have already succeeded in inducing tetraploid ginger ($2n=44$)⁸⁻¹⁰⁾. As a result, it is known that the tetraploid ginger induced by

in vitro colchicine techniques greatly contributes to pollen fertility and germinability of ginger, and tends to become much bigger in plant and rhizome size than the diploids⁸⁻¹⁰⁾. However, there is little information about the pungent phenolics in the rhizome of tetraploid ginger. In order to determine the possible clinical and/or preventive usefulness of the rhizome of tetraploid ginger, we isolated and identified the pungent phenolics from the rhizome and investigated their biological activity. Because it has pronounced antibacterial activity and is traditionally used and regarded as safe, tetraploid ginger was selected as a candidate for further study as an antibacterial material¹¹⁻¹³⁾. The microdilution method, the primary method in the pharmaceutical and/or food industry, was used to test the extracts and constituents of tetraploid ginger against various foodborne pathogenic bacteria¹⁴⁾.