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Biologically active constituents from the fruiting body of *Taiwanofungus camphoratus*

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ABSTRACT

Five new benzenoids, benzocamphorins A–E (1–5), and 10 recently isolated triterpenoids, camphoratsins A–J (16–25), together with 23 known compounds including seven benzenoids (6–12), three lignans (13–15), and 13 triterpenoids (26–38) were isolated from the fruiting body of *Taiwanofungus camphoratus*. Their structures were established by spectroscopic analysis. Selected compounds were examined for cytotoxic and anti-inflammatory activities. Compounds 9 and 21 showed moderate cytotoxicity against MCF-7 and Hep2 cell lines with ED₅₀ values of 3.4 and 3.0 µg/mL, respectively. Compounds 21, 25, 26, 29–31, 33, and 36 demonstrated potent anti-inflammatory activity by inhibiting lipopolysaccharide (LPS)-induced nitric oxide (NO) production with IC₅₀ values of 2.5, 1.6, 3.6, 0.6, 4.1, 4.2, 2.5, and 1.5 µM, respectively, which were better than those of the nonspecific nitric oxide synthase (NOS) inhibitor *N*-nitro-*L*-arginine methyl ester (*L*-NAME) (IC₅₀: 25.8 µM). These results may substantiate the use of *T. camphoratus* in traditional Chinese medicine (TCM) for the treatment of inflammation and cancer-related diseases. The newly discovered compounds deserve further development as anti-inflammatory candidates.

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1. Introduction

Niu-chang-chih also named *Taiwanofungus camphoratus* (synonym: *Ganoderma camphoratum*, *Antrrodia cinnamomea*, *Antrrodia camphorata*) (Polyporaceae, Aphyllophorales) is a rare and precious medical fungus in Taiwan.¹ The fruiting bodies of *Niu-chang-chih* have been used as a Chinese folk medicine for the treatment of liver diseases, food and drug intoxication, diarrhea, abdominal pain, hypertension, itchy skin and tumorigenic diseases in Taiwan.^{2,3} *Niu-chang-chih* has thus received huge attention by the

public. Previous studies have revealed that *Niu-chang-chih* exerts several biological activities, such as hepatoprotective effects, anti-hepatitis B virus effects, anticancer activity, antioxidant properties, and anti-inflammatory activities.^{4,5} Our ongoing study on the chemical constituents of an ethanol extract of the fruiting body of *T. camphoratus* has now led to the isolation of five new benzenoids, benzocamphorins A–E (1–5) (Fig. 1), 10 recently isolated triterpenoids, camphoratsins A–J (16–25) (Fig. 2), together with 23 known compounds including seven benzenoids (6–12) (Fig. 3), three lignans (13–15) (Fig. 4), and 13 triterpenoids (26–38) (Fig. 5).

Inflammation, which is related to morbidity and mortality of many diseases, is part of the complex biological response of vascular tissues to harmful stimuli, and is the host response to infection or injury, which involves the recruitment of leukocytes and the release of inflammatory mediators, including nitric oxide (NO). NO is the metabolic by-product of the conversion of *L*-arginine to *L*-citrulline by a class of enzymes termed NO synthases (NOS). Numerous cytokines can induce the transcription of inducible NO synthase

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