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Review Article

Chemical constituents and bioactivity of Formosan lauraceous plants

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ABSTRACT

Taiwan is rich in lauraceous plants. A review of 197 references based on the chemical analysis and bioactivity of indigenous lauraceous plants carried out by native scientists from 1963 to 2014 has been compiled. About 303 new compounds and thousands of known compounds comprising alkaloids and non-alkaloids with diverse structures have been isolated or identified from indigenous plants belonging to the 11 lauraceous genera. The volatile components, however, have been excluded from this review. This review provides an overview of the past efforts of Taiwan scientists working on secondary metabolites and their bioactivity in native lauraceous plants. The potential of lauraceous plants worthy of further study is also noted. The contents will be helpful for the chemotaxonomy of Lauraceae and be of value for the development of native Formosan lauraceous plants.

1. Introduction

The Lauraceae family is composed of about 45 genera and 2250 species widely distributed throughout the tropics, especially in Southeast Asia and Brazil, together with a smaller number in temperate regions. There are 11 genera, 50 species, 10 varieties, and three forms of indigenous plants in Taiwan [1]. Studies on the secondary metabolites, excluding the volatile components, of Formosan lauraceous plants were initiated by the late Prof. Tomita Masao of Kyoto University, Japan, and the late Prof. Sheng-Teh Lu of Kaohsiung Medical College, Taiwan. Their studies, starting from 1963, focused on alkaloids. Non-alkaloidal constituents, along with alkaloidal components, were thereafter studied mainly by Prof. Shoei-Sheng Lee (School of Pharmacy, National Taiwan University), Prof. Yueh-Hsiung Kuo (Department of Chinese Pharmaceutical Sciences and Chinese Medicine Resources, China Medical University), Prof. Yang-Chang Wu (Graduate Institute of Integrated Medicine, China Medical University), Prof. Sheng-Yang Wang (Department of Forestry, National Chung-Hsing University), Prof. Tian-Shung Wu (Department of Chemistry, National Cheng Kung University), Prof. Ih-Sheng Chen (School of Pharmacy, Kaohsiung Medical University), Prof. Wen-

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Hsiung Li (Department of Agricultural Chemistry, National Pingtung University of Science and Technology), and Prof. Chung-Yi Chen (Department of Medical Technology, Fooyin University). Starting from 1988, chemical studies have been accompanied by bioactivity assays [2,3]. To date, four reviews and one collective issue on natural-product researches in Taiwan [4–8], from 1945 to 1996, have been published. However, the bioactivity of the isolates was not included. Another review of bioactivity research, published in 2007, covered only 27 Formosan lauraceous plants with 40 references [9].

To provide comprehensive information concerning the past achievements of Taiwan scientists in studying native Formosan lauraceous plants, we endeavored to compile all related isolation and bioactivity papers, following the genus order, with the exception of those concerning the volatile oils. The structures of new compounds from these plants, including those first occurring in nature, are depicted. As for the known compounds, their occurrence is provided in Tables S1–S11. The scientific names of those indigenous plants are adopted according to the Flora of Taiwan [1] and a review [10].

Approximately 303 new nonvolatile compounds (Fig. 1–8) and thousands of known ones (Tables S1–S11) have been characterized from native lauraceous plants of 11 genera. This review, with 197 references, reveals the attempts in this field by Taiwan's natural-product chemists and pharmacologists.

2. Phytochemical studies of Formosan lauraceous plants

2.1. *Beilschmiedia*

There are 200 species of the *Beilschmiedia* genus distributed in tropical regions, with two species, *B. erythrophloia* Hayata and *B. tsangii* Merr., found in Taiwan [1]. The latter species grows only in Hengchun Peninsula. In 2006, investigation of *B. tsangii* has led to the isolation of five new compounds from the stem, including two tetrahydrofuran-type lignans, beilschmins A and B (**1**, **2**), a dihydrofuran-type lignan, beilschmin C (**3**), and two 1-phenylbutylbenzoates, tsangins A and B (**4**, **5**) [11]; three new epoxyfuranoid lignans from the leaves, i.e., 4α,5α-epoxybeilschmins A and B (**6**, **7**) and beilschmin D (**8**) [12]; and 15 new compounds from the root, including 10 endiandric acid analogues [tsangibeilins A–D (**9**–**12**), endiandramides A and B (**13**, **14**), endiandric acids K–M (**15**–**17**), and tricyclotsangibelin (**18**)], three lignans [beilschminols A and B (**19**, **20**) and tsangin C (**21**)], and two sesquiterpenes [(+)-5-hydroxybarbatenal (**22**) and (4*R*,5*R*)-4,5-dihydroxycaryophyll-8(13)-ene (**23**)] [13,14]. The structure of beilschmin C (**3**) was erroneously elucidated [11] and was revised to **6** [12,15].

Investigation of *B. erythrophloia* root has led to the isolation of 11 new compounds, including nine endiandric acid

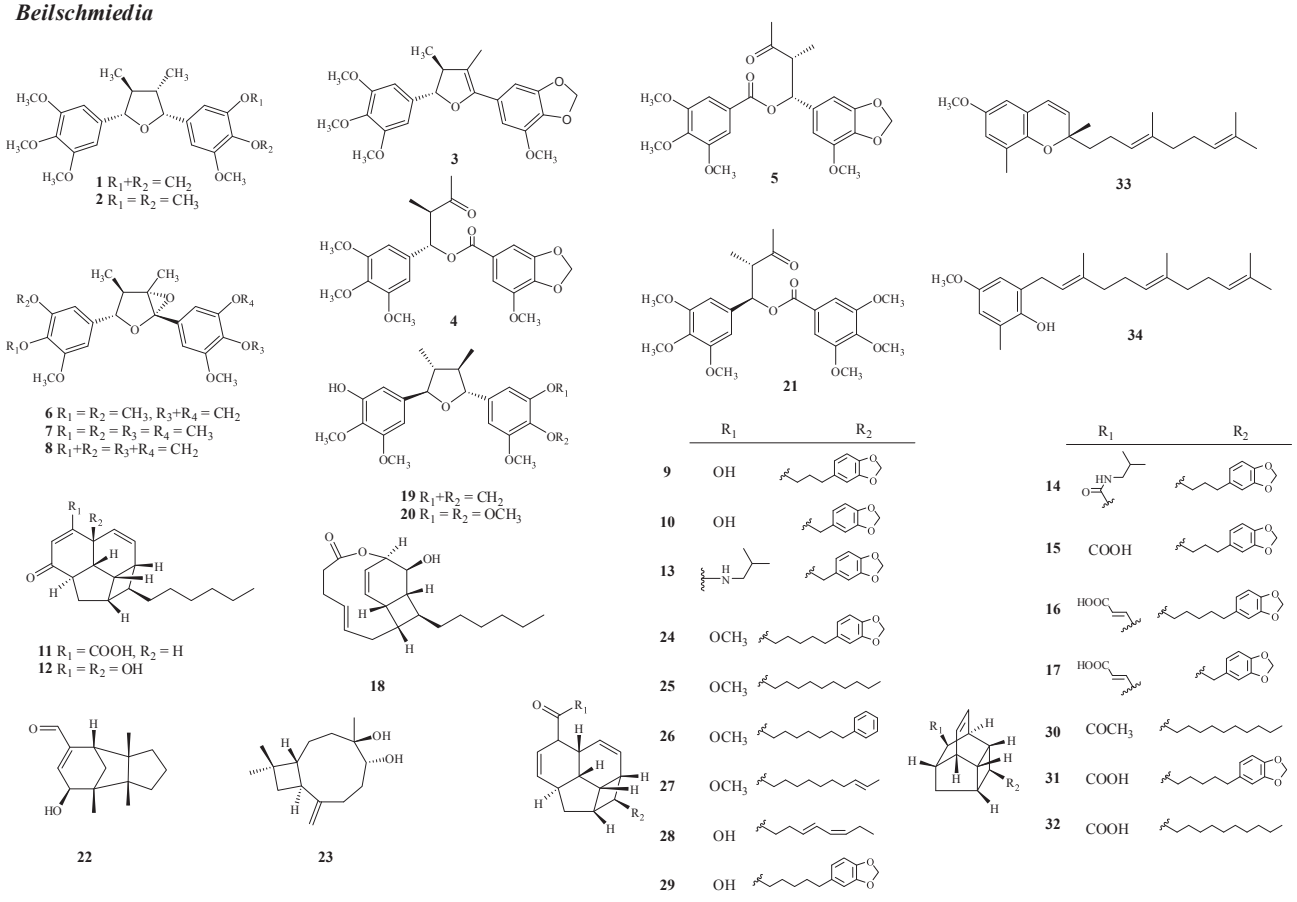

Fig. 1 – Structures of new compounds from *Beilschmiedia* (1–34).