

Phytochemical Study of Oligoresveratrol from Some Species of *hopea*

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Abstract

Hopea is one the main genus of Dipterocarpaceae, consisting of approximately 100 species and widely distributed in Indonesia specially in Kalimantan. This genus of plant is known to produce a variety of resveratrol oligomer. These structures are very interesting and showed interesting biological activity, such as antibacterial, anticancer, antihepatotoxic, and anti-HIV. Therefore, the following discussion will focus on the structure diversity of oligoresveratrol that have been found, biogenetic relationship, and biological activity of the compound, that has been reported until 2008.

Keyword : *Hopea*; oligoresveratrol; structure and biological activity

Introduction

Dipterocarpaceae is one of the largest families found in the tropical forest Indonesia. The plants are distributed from the west of Indonesia until Papua (Irian Jaya) and the mostly in Kalimantan, there for the timber of these plants are usually called “meranti” or “Kayu Kalimantan”. Dipterocarpaceae consists of about 16 genus and 600 species and until now only few species have been investigated. Some chemical constituents that can be found from this plants include arylpropanoid, benzofuran, flavanoid, polyphenol, resveratrol oligomers and terpenoid. The resveratrol oligomer from Dipterocarpaceae plants have various structure from simple structure as it monomer, dimer, trimer, until hexamer. These structures are very interesting and showed interesting biological activity, such as antibacterial, anticancer, antihepatotoxic, and anti-HIV (Sothesswaran, 1993; Dai 1998; Sri Atun, 2004; 2005; 2006). Thus Dipterocarpaceae plants are very potential for chemical research in natural product and pharmaceutical industry.

Hopea is one the main genus of Dipterocarpaceae, consisting of approximately 100 species and widely distributed in Indonesia specially in Kalimantan (Conquius, 1991; Heyne, 1987) and until now about ten species have been investigated. This family of plant is known to produce a variety of resveratrol oligomer. These structures are very interesting and showed interesting biological activity, such as antibacterial, anticancer, antihepatotoxic, and anti-HIV (Dai, 1998; Tanaka, 2000; Sri Atun, 2005; 2006^{a,b}). Therefore, the following discussion will focus on the structure diversity of oligoresveratrol that have been found, biogenetic relationship, and the biological activity of the compound, that has been reported until 2008.

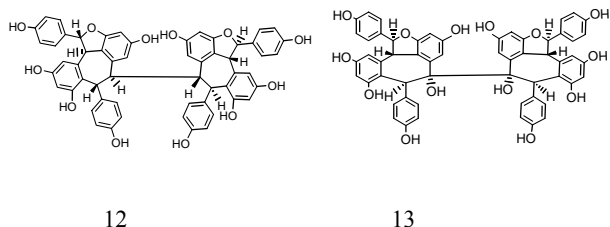
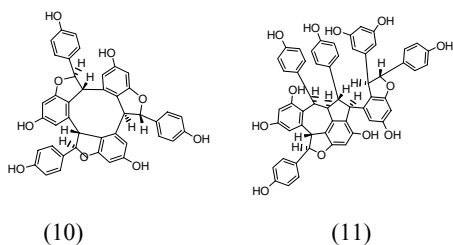
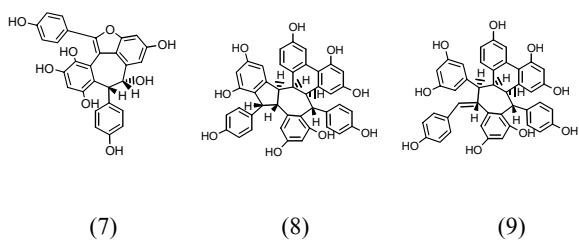
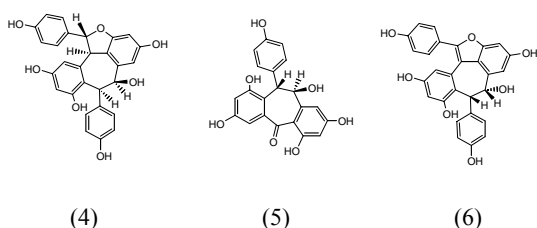
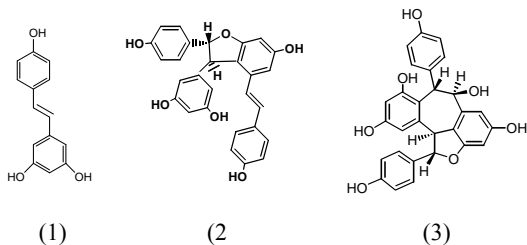
Results and Discussion

1. The diversity oligoresveratrol structure from *Hopea* genus

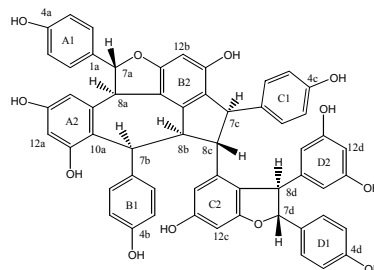
Oligoresveratrol from Dipterocarpaceae which first found in 1951, (-)-hopeaphenol (12), a tetramer of resveratrol that isolated from *Hopea odorata* (Sothesswaran, 1993). Nevertheless, the molecular structure of hopeaphenol can be concluded in 1970 based on analysis of X-ray diffraction (Coggon, 1970). Since that time, research on resveratrol will be continued, consistent with the development methode of determining the structure and the separation by using modern spectroscophyc like NMR one and two dimension. Review of resveratrol on the oligomer distribution plant was first written by Sothesswaran (1993), which discussed the compound in the plant of five family, the Dipterocarpaceae, Vitaceae, Cyperaceae, Gnetaceae, and Leguminosae. After that, a brief review oligomer resveratrol on Dipterocarpaceae also have been written by Hakim (2002).

Up to now, several species plant of the *Hopea* genus that have been investigation of oligoresveratrol compounds from *H. odorata* (Coggon, 1970), *H. cardifolia* (Sothesswaran, 1983), *H. jucunda* (Diyasena, 1985), *H. malibato* (Dai, 1998), *H. parviflora* (Tanaka, 2000), *H. utilis* (Tanaka, 2001), *H. sangal* (Sri Atun, 2004), *H. bancana* (Tukiran, 2004), *H. mengarawan*, *H. odorata*, and *H. nigra* (Sri Atun, 2006). Compound that has been found in several species, among other resveratrol (1) of *H. utilis* (Tanaka, 2001) and a number of oligomer resveratrol consisting of dimer, trimer, and tetramer with a variety of interesting bioactivity. Some of the dimer of resveratrol has been found in the genus *Hopea* is (-)- ϵ -viniferin (2) from the *H. parviflora* (Tanaka, 2000), (-)-ampelopsin A (3) from the *H. parviflora* (Tanaka, 2004), *H. sangal* (Sri Atun, 2004), balanocarpol (4) from the *H. parviflora* (Tanaka, 2000), (+)-parviflorol (5) from the *H. parviflora* (Tanaka, 2000), malibatol A (6) from the *H. malibato* (Dai, 1998), and malibatol B (7) from the *H. malibato* (Dai, 1998). Two trimer resveratrols had been found from the *H. cardifolia* are copaliferol A (8) and stemonoporol (9), which had biological activity as antibacterial (Sultanbawa, 1980; Sothesswaran, 1983), while (+)- α -viniferin (10) found in the *H. bancana* (Tukiran, 2004). Tetramer have found that

resveratrol is vaticanol B (11) from the *H. utilis* (Tanaka, 2001), *H. sangal* (Sri Atun, 2004), *H. mengarawan* (Sri Atun, 2006), hopeaphenol (12) from the *H. odorata* (Coggon, 1970), *H. parviflora* (Tanaka, 2000), *H. utilis* (Tanaka, 2001), and *H. bancana* (Tukiran, 2004), while dibalanokarpol (13) from the *H. malibato* (Dai, 1998). Sri Atun (2005; 2006) has been found tetramer resveratrol from the *H. odorata* are ampelopsin H (14) and hemlesyanol C (15).



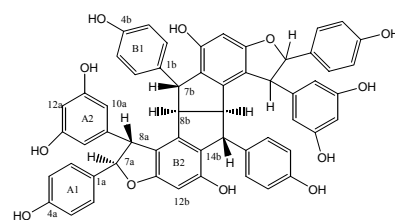
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2. Biogenetic relationship of oligoresveratrol structure from *Hopea* genus

Many oligoresveratrol with various types of the molecular skeleton have been isolated mainly from some species of *Hopea*. The biogenetic relationship of all of compounds isolated from some species of *Hopea* may be suggested to follow one primary biogenetic pathway. Generally, the structures of the resveratrol oligomer isolated contain a heterocyclic ring namely *trans*-2-aryl-2,3-dihydrobenzofuran, originated from oxidative coupling between two unit of resveratrol to produce (-)-ε-viniferin (2) as an immediate precursor. Further couplings of (-)-ε-viniferin (2) produce other resveratrol oligomers. The biogenetic relationship between these oligoresveratrol isolated in this study is shown in Figure 1.



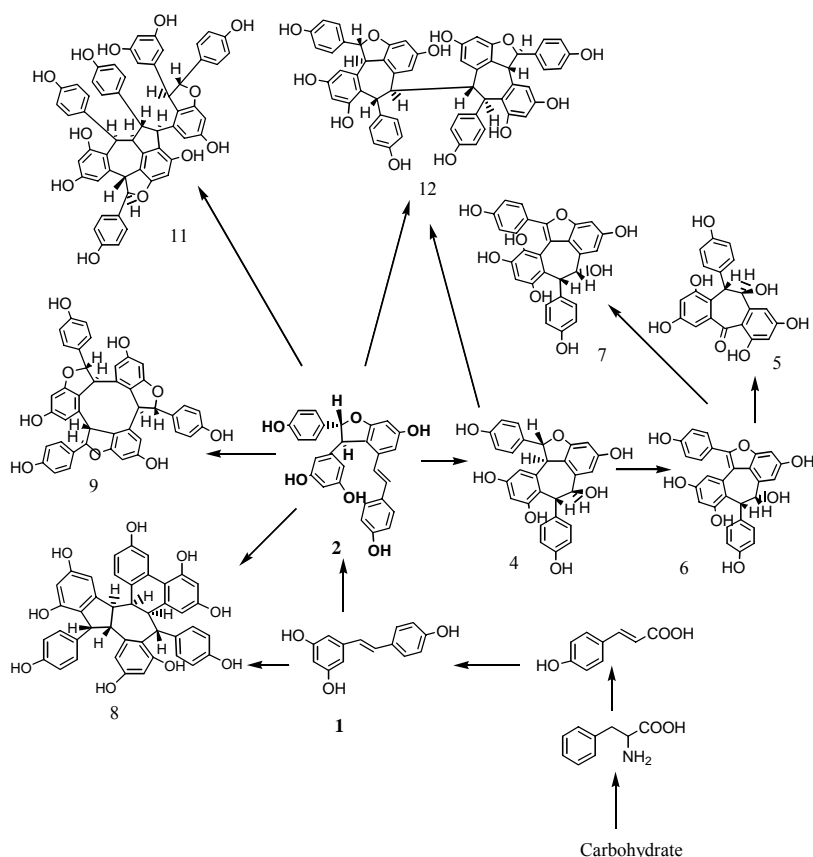


Fig. 1. Biogenetic relationship of oligoresveratrol structure from *Hopea* genus

3. Biological activity of oligoresveratrol compounds from *Hopea*

Oligoresveratrol is a compound found in the main *Hopea* genus, which has some useful bioactivity. Resveratrol (1) is the first compound that was found, the first time isolated as phytoalexins, antimicrobial compound produced by a plants in response to infection or certain other types of physiological stimuli from *Vitis vinifera* leaves in the year 1977 (Langcake, 1977). Research showed that resveratrol (1) have chemopreventive activity against cancer cells (Jang, 1997). Various biological activity of oligoresveratrol compounds has also been reported, for example, ϵ -viniferin (2), and copaliferol A (10), showed activity against antimicrobial some type of microorganism (Sothesswaran, 1993). A number of other oligo resveratrol showed activity against sitotoxic as cancer cell lines, such as (-)-ampelopsin A (3), hopeaphenol (12), are cytotoxic against KB cells carcinoma epidermoid (Tanaka, 2000; Ito, 2001a; Ito, 2001b; Seo, 1999), while malibatol A (6) and malibatol B (7) are cytotoxic of CEM cells in the test antiviral SS. Similarly balanocarpol (4) and dibalanocarpol (13) showed activity as anti-HIV (Dai, 1998). Ampelopsin H (14) and vaticanol B are cytotoxic against as Hela S3 and Raji cell lines (Sri Atun, 2008)

Conclusion

Molecular structure of oligoresveratrol have ben found in the *Hopea* genus included dimer, trimer and tetramer with resveratrol. The structures of the oligoresveratrol isolated contain a heterocyclic ring namely *trans*-2-aryl-2,3-dihydrobezofuran, originated from oxidative coupling between two unit of resveratrol to produce (-)- ϵ -viniferin (2) and other compounds. These structures are very interesting and showed interesting biological activity, such as antibacterial, anticancer, antihepatotoxic, and anti-HIV.

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