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# Rocaglamide, aglain, and other related derivatives from *Aglaia testicularis* (Meliaceae)

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## 1. Subject and source

*Aglaia testicularis*, C.Y., Wu is regarded as a species endemic to the limestone area of southeastern Yunnan Province, China, in the evergreen broad-leaved forest. Its aril is edible and the pericarp is used for the treatment of diarrhoea. The material used in this experiment was collected and identified on a field trip by one of the authors (H.P.) in May 2002, at Huangjinyin (southeast of Yunnan Province), the typical locality of the species. A voucher specimen (HP WS-0205) has been deposited at the Herbarium of Kunming Institute of Botany (KUN), Chinese Academy of Sciences.

## 2. Previous work

The plant genus *Aglaia* consists of some 130 species and occurs mainly in the tropical rain forests in the Indo-Malaysian region (Pannell, 1992). Totally, there

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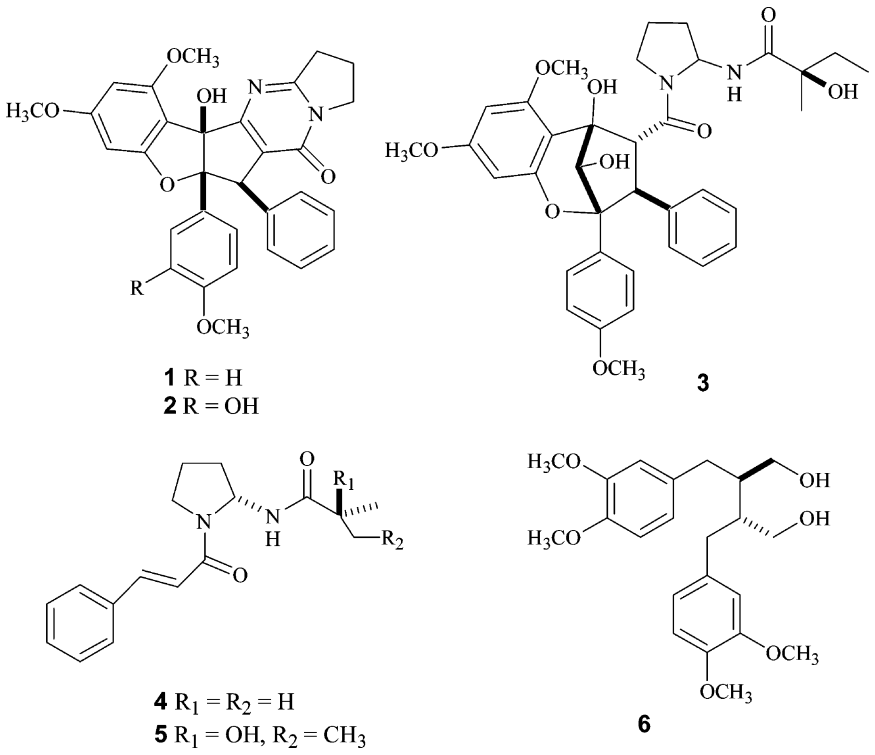
are seven species distributed in southwest and southeast parts of China (Wu, 1977). Previous phytochemical investigations of plants in the genus have revealed the presence of a variety of compounds with interesting biological activities. These including cyclopenta[*b*]benzofurans (the so-called rocaglamides) (Proksch et al., 2001), cyclopenta[*bc*]benzopyrans (the so-called aglains) (Bacher et al., 1999; Dumontet et al., 1996), as well as cinnamic acid-derived bisamides (Saifah et al., 1988, 1999; Brader et al., 1998), triterpenes (Weber et al., 2000), and highly methoxylated lignans (Wang et al., 2002). Among these, rocaglamide derivatives were shown to possess high insecticidal activity as well as significant cytotoxicity in many different cancer cell lines (Proksch et al., 2001; Cui et al., 1997), while bisamides have been reported as exhibiting cytotoxic (Duh et al., 1993) and antiviral activity (Joshi et al., 1987). To our knowledge, there are no previous reports on the chemical composition of the plant species of *A. testicularis*.

## 3. Present study

In continuation of our research on the chemistry of *Aglaia* species (Proksch et al., 2001; Wang et al., 2002), we undertook a chemical study of the methanol extract obtained from leaves of *A. testicularis*. The dried materials (160 g) were ground and stirred with methanol for three times at room temperature (one day for each time). The resulting extractive solution was filtered and evaporated at reduced pressure (40 °C) to give a crude residue (15.5 g), which was then successively partitioned between *n*-hexane and water, between EtOAc and water, and between *n*-butanol (water saturated) and water, to afford *n*-hexane-, EtOAc-, and *n*-butanol-soluble fractions, respectively. Both crude extract and fractions obtained were submitted to a bioassay with neonate larvae of the polyphagous pest insect, *Spodoptera littoralis* (Nugroho et al., 1999). In this bioassay, the insecticidal activity was found to reside in the EtOAc fraction. The EtOAc fraction (2.8 g) was subjected to column chromatography (Si gel), eluted with $CH_2Cl_2$ and $CH_2Cl_2$ with increasing amounts of $CH_3OH$, to give nine sub-fractions (monitored by TLC). The most interesting sub-fraction (450 mg) that was eluted with $CH_2Cl_2$–$CH_3OH$ (50:1) was further subjected to repeated Sephadex LH-20 and silica gel column chromatographic steps. Final purification was achieved by preparative TLC and by reversed-phase semi-preparative HPLC. This procedure led to the isolation of six pure compounds including **1** (1.2 mg), **2** (2.6 mg), **3** (1.5 mg), **4** (1.8 mg), **5** (2.0 mg), and **6** (1.6 mg), respectively.

The structures (Scheme 1) of the isolated compounds **1**–**4** and **6** were unambiguously elucidated by analysis of high-resolution proton NMR data as well as by mass spectroscopic techniques, and confirmed by comparison with the literature values. Compound **5** was identified by comparison with authentic sample as well as by low- and high-resolution mass spectroscopic experiments. The compounds isolated inlcude two rocaglamide derivatives **1** (Kokpol et al., 1994; Chaidir et al., 1999) and **2** (Chaidir et al., 1999), one aglain derivative, aglaxiflorin D **3** (Xu et al., 2000), two cinnamic acid-derived bisamides, piriferine **4** (Saifah et al., 1988) and




Scheme 1. Chemical structures characterized.

odorinol **5** (Shiengthong et al., 1979), and, finally, a diarylbutane lignan, secoisolariciresinol dimethyl ether **6** (Chen et al., 1998), respectively.

## 4. Chemotaxonomic significance

This study reinforces the view that rocaglamides, aglains, and bisamide derivatives are predominant in the chemical composition of *Aglaia*. Based on present knowledge, these three groups of compounds occur only in this genus (Proksch et al., 2001; Bacher et al., 1999). Hence, these natural products may be useful as chemotaxonomic markers for the genus *Aglaia*.

Additionally, according to Pannell's monograph of the plant genus *Aglaia*, the species *A. testicularis* was changed to *A. edulis* (Roxb.) Wall. (Pannell, 1992). Based on the limited phytochemical literature available for this species, leaves of *A. edulis* appear to be mainly characterized by bisamides (Saifah et al., 1999; Brader et al., 1998), whereas the roots were reported to contain rocaglamide and aglain derivatives (Bacher et al., 1999; Engelmeier et al., 2000). In this report, we obtained both bisamides and rocaglamide and aglain derivatives in addition to other compounds

from the leaves of *A. testicularis*. This finding is largely in agreement with the earlier studies. However, in order to obtain more comprehensive phytochemical data further studies are still needed.

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