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To cite this article: D. Nongoué Tchamo, G. Cartier, M.-G. Dijoux-Franca, E. Tsamo & A.-M. Mariotte (2001) Xanthonés and Other Constituents of *Trema orientalis*, *Pharmaceutical Biology*, 39:3, 202-205, DOI: [10.1076/phbi.39.3.202.5930](https://doi.org/10.1076/phbi.39.3.202.5930)

To link to this article: <https://doi.org/10.1076/phbi.39.3.202.5930>



Published online: 29 Sep 2008.



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Xanthones and Other Constituents of *Trema orientalis*

D. Nongoué Tchamo¹, G. Cartier¹, M.-G. Dijoux-Franca¹, E. Tsamo² and A.-M. Mariotte¹

¹Laboratoire de Pharmacognosie, Université de Grenoble I, Faculté de Pharmacie, Domaine de la Merci, France; ²Department of Organic Chemistry, University of Yaounde, Yaounde, Cameroon

Abstract

Chemical investigation of dichloromethane and ethyl acetate extracts from trunk and root barks of *Trema orientalis* led to the isolation of 16 compounds. Methylswertianin, decussatin, glycosides of decussatin, sweroside, scopoletin, (–)-epicatechin, lupeol, *p*-hydroxybenzoic acid, 3,4-dihydroxybenzoic acid, adian-5-en-3-one, 2 α , 3 α , 23-trihydroxyurs-12-en-28-oic acid, 2 α , 3 β -dihydroxyurs-12-en-28-oic acid, β -sitosterol, 3-*O*- β -glucopyranosyl- β -sitosterol and hexacosanoic acid were identified by means of their spectral data.

Keywords: *Trema orientalis* L. Blume; Ulmaceae, xanthones; secoiridoid; triterpenoids; ursene.

Introduction

The genus *Trema* (Ulmaceae) contains approximately 30 tropical species. *T. orientalis* L. is the only one distributed throughout Cameroon (Letouzey, 1968). This common shrub is widely used in African folk medicine for many diseases, for example, asthma, cough, dysentery and hypertension (Iwu, 1993).

Six species of *Trema* have been previously investigated (Oelrichs, 1968a; Oelrichs et al., 1968b; Higa et al., 1983; Ribeiro & Machado, 1952; Tian-Chyuan et al., 1992; Rakotovo et al., 1988), but fewer studies were done on *T. orientalis* (Obafemi et al., 1979; Ogunkoya et al., 1972a, 1972b, 1973, 1977). We present here the isolation of 16 compounds from trunk and root barks of *T. orientalis*. They were identified by comparison of their spectral data with the literature as: methylswertianin (**1**) (Barraclough et al., 1970), decussatin (**2**) (Chaudhuri et al., 1978), 1-*O*-glucosyldecussatin (**3**) (Ishimaru et al., 1990), 1-*O*-primeverosyl-decussatin (**4**) (Miura et al., 1978), sweroside (**5**) (Junior, 1990; Machida et al., 1995), scopoletin (**6**) (Sankar et al., 1982), (–)-epicatechin (**7**) Comte, 1996), lupeol (**8**), *p*-hydroxyben-

zoic acid (**9**), 3,4-dihydroxybenzoic acid (**10**), simiarenone (**11**) (Ogunkoya, 1973; Athur & Hui, 1965), 2 α , 3 α , 23-trihydroxyurs-12-en-28-oic acid (**12**) (Kojima & Ogura, 1989; Mahato & Kundu, 1994), 2 α , 3 β -dihydroxyurs-12-en-28-oic acid (**13**) (Kojima & Ogura, 1989), β -sitosterol (**14**), 3-*O*- β -glucopyranosyl- β -sitosterol (**15**) (Espejo et al., 1982) and hexacosanoic acid (**16**). This is the first report of xanthone, secoiridoid and ursane skeletons in the Ulmaceae.

Materials and Methods

General

Mp were taken on Electrothermal 9100. UV spectra were recorded on a Hitachi® U2000 instrument. Mass spectra were recorded on a quadripolar mass spectrometer R210C coupled to a IPC (P2A) MSCAN Wallise® computer. NMR spectra (experiments in DMSO-*d*₆, CD₃OD or CDCl₃) were conducted on a Bruker® AC-200 (200 MHz for proton and 50 MHz for carbon), and a Bruker® Avance-400 (400 MHz for proton and 100 MHz for carbon).

Plant material

Trunk and root barks of *Trema orientalis* L. Blume (Ulmaceae) were collected in September 1995 in the south of Cameroon and identified by Dr. Achoundong. A voucher specimen is preserved in the National Herbarium of Yaounde (N° 3116: Achoundong).

Extraction and isolation

Dry trunk bark (3 kg) and root bark (1.2 kg) were ground. Trunk bark was extracted with boiling EtOH-H₂O (1:1). After concentration, the aqueous phase was successively extracted with CH₂Cl₂ and EtOAc and yielded 9.4 and

Accepted: September 1, 2000

Address correspondence to: M.-G. Dijoux-Franca, Laboratoire de Pharmacognosie, DPM (UMR 5063 CNRS-UJF), Université de Grenoble I, Faculté de Pharmacie, Domaine de la Merci, 38706 La Tronche cedex, France. E-mail: Marie-Genevieve.Dijoux@ujf-grenoble.fr

23.3 g of crude extracts, respectively. Root bark was extracted directly by boiling EtOAc and afforded 12.5 g of crude extract.

A part of the CH₂Cl₂ extract (9 g) from trunk bark was subjected to CC on silica gel using a gradient of hexane-CH₂Cl₂-MeOH; 49 frs were collected. Compounds **1** (105 mg), **2** (250 mg) and **6** (15 mg) were isolated from frs. 11–14 (1.5 g), and compound **8** (10 mg) from frs. 42–49 (100 mg) by CC on silica gel using a gradient of hexane-CH₂Cl₂.

The EtOAc extract of trunk bark (20 g), by CC on silica gel with a gradient of hexane-CH₂Cl₂-MeOH, afforded 62 frs. Xanthone **2** (40 mg) was obtained from frs. 1–4 after crystallization in Et₂O. **7** (20 mg) and **9** (12 mg) were isolated from frs. 34–47 (5.5 g) by CC and MPLC on silica gel with a gradient of CH₂Cl₂-MeOH. **3** (45 mg) and **4** (5 mg) were

separated from frs. 48–55 (1.3 g) and from frs. 60–62 (3.9 g), respectively, by CC on silica gel with increase polarity of EtOAc-MeOH. **5** (7 mg) was isolated from frs. 56–59 (3.7 g) by MPLC on silica gel with a gradient of mixt EtOAc-MeOH as solvent.

EtOAc root bark extract (12 g), by CC on silica gel with increase polarity of hexane-CH₂Cl₂-MeOH, gave 118 frs. **11** (25 mg) was isolated from fr. 3 (200 mg) by CC on silica gel with a gradient of hexane-CH₂Cl₂. **14** (55 mg) and **16** (23 mg) were separated from frs. 48–67 (830 mg) by CC on silica gel with increase polarity of hexane-EtOAc as eluent. **12** (31 mg) and **13** (33 mg) were obtained from frs. 89–101 (1.4 g) by MPLC on silica gel with a gradient of MeOH-Me₃N. **10** (11 mg) and **15** (35 mg) were isolated from frs. 102–118 (1.5 g) by CC on silica gel with a gradient of CH₂Cl₂-MeOH as solvent.

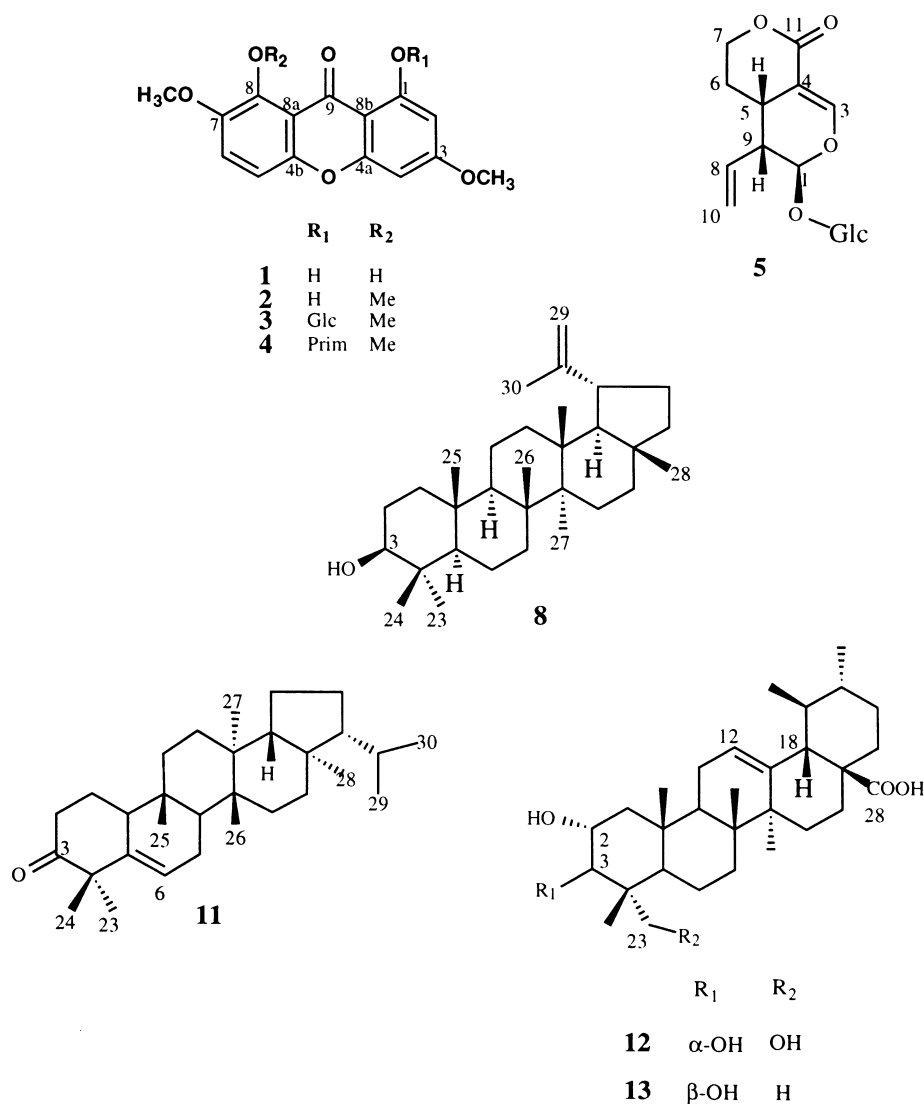


Figure 1. Structures of isolates from *Trema orientalis*. Glc = glucosyl, Prim = primeverosyl.

Results and Discussion

This phytochemical investigation of *Trema orientalis* L. afforded 16 compounds, including four xanthenes, one secoiridoid and two ursane derivatives. It is the first time that these three classes of natural products are described in this genus in particular and in the Ulmaceae in general. The isolation of xanthenes together with a secoiridoid was essentially seen in Gentianaceae (Hostettmann & Wagner, 1977; Hostettmann-Kaldas et al., 1981). The oxygenation patterns (1,3,7,8-) of the xanthenes reported here, readily occurred in this family.

Considering Hutchinson's phylogeny (1973), xanthenes are reported in numerous orders belonging to the Lignosae. In this division and closely related to the Ulmaceae as they are both classified in the same order, the Moraceae was, up to now, the only one reported in the Urtical for its xanthenes (Mandal et al., 1992). In the Herbaceae, the most representative is still the Gentianal with the Gentianaceae and the Loganiaceae (Mandal et al., 1992). Thus, it would be interesting to investigate other families in Urtical such as Cannabaceae, Urticaceae, Barbeyaceae and Cecropiaceae. A genomic study would be helpful to establish a chemotaxonomic relationship between these families, as was done recently for the Malvaceae (Mabberley, 1999).

The other common constituents, except simiarenone (11) (Ogunkoya et al., 1973), are also reported for the first time in *T. orientalis*.

Acknowledgements

The authors are thankful to Dr. Achoundong for the collection and identification of the plant material, and to Dr. Bosso (CERMAV, Grenoble) for the mass spectral data. This investigation was supported by the Ministère de la Coopération (France).

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