Journal of Natural Products
Vol. 51, No. 5, pp. 1023-1024, Sep-Oct 1988

NAPHTHOQUINONE CONSTITUENTS OF *TABEBUIA* SPP.

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As part of chemotaxonomic studies directed toward identification of commercial herbal products sold as Taheebo/Pau d'Arco/Lapacho/Ipe roxo, we have examined the naphthoquinone constituents of bark extracts from *Tabebuia* spp. (Bignoniaceae). Up until now, very little chemical work has been done specifically on bark because it is widely assumed that the naphthoquinone profile is similar in wood and bark for most species (1). Examination of fresh bark extract of *Tabebuia rosea* (Bertol.) DC. collected at Cartagena, Colombia, revealed that, unlike wood extract where mainly lapachol and dehydro-α-lapachone are found, bioactive naphthoquinones 2-acetyl-naphtho-[2,3-*b*]furan-4,9-dione, 2-(1-hydroxyethyl)-naphtho-[2,3-*b*]furan-4,9-dione and 5(or 8)-hydroxy-2-(1-hydroxyethyl)-naphtho[2,3-*b*]furan-4,9-dione are the major naphthoquinone constituents (Table 1). These three lapachol derivatives have been reported previously from *Tabebuia cassinoides* (2) and were shown to be active against KB cells. Only traces of lapachol and dehydro-α-lapachone were detected in that extract.

Bark extracts from two other species, namely, *Tabebuia impetiginosa* (Mart.) ex DC. (Standl.) and *Tabebuia chrysantha* (Jacq.) Nichols ("Tahuari"), also obtained from South America, showed similar profiles.

EXPERIMENTAL

PLANT MATERIAL.—A sample of *T. rosea* was obtained from Cartagena, Colombia, in May 1987; a sample of *T. chrysantha* was collected in Peru in March 1987; a sample of *T. impetiginosa* was obtained from Peru in 1983. Voucher specimens are deposited at the Missouri Botanical Garden.

EXTRACTION AND ISOLATION.—Air-dried material was ground to a fine powder and extracted in a Soxhlet apparatus with petroleum ether (30–60°) for 48 h. An aliquot was withdrawn and evaporated to dryness at room temperature under reduced pressure. The residue was dissolved in a known volume of mobile phase and analyzed by hplc using the standard conditions reported earlier (3). The same aliquot was used for gc-ms analysis using the operating conditions described previously (4).

The bulk of the extract from *T. rosea* was concentrated using a rotary evaporator and extracted

TABLE 1. Naphthoquinones in Extracts from Various *Tabebuia* spp.

Compound	Extract			
	Tabebuia rosea (wood)	*T. rosea* (bark)	*Tabebuia impetiginosa* (bark)	*Tabebuia chrysantha* (bark)
Lapachol	++[a]	tr[b]	–	–
Dehydro-α-lapachone	++	tr	–	–
2-Acetyl-naphtho[2,3-*b*]-furan-4,9-dione	–	+	+	+
2-(1-Hydroxyethyl)-naphtho-[2,3,-*b*]furan-4,9-dione	–	++	+	+
5(or 8)-Hydroxy-2-(1-hydroxy-ethyl)-naphtho[2,3-*b*]furan-4,9-dione	–	++	–	–

[a]0.003% (lapachol).
[b]< 0.0003% (lapachol).

with 2 N Na_2CO_3. The base-soluble fraction was recovered after acidification of the aqueous layer and extraction with Et_2O. Isolation of the individual components from base-soluble and base-insoluble fractions was accomplished by preparative reversed-phase hplc eluting with MeCN-H_2O (1:1). 5(or 8)-Hydroxy-2-(1-hydroxyethyl)-naphtho[2,3-*b*]furan-4,9-dione, 2-(1-hydroxyethyl)-naphtho[2,3-*b*]furan-4,9-dione and 2-acetyl-naphtho[2,3-*b*]furan-4,9-dione were obtained and identified from their respective ^1H nmr, ir, uv, gc-ms, and mp data and by comparison with values reported by Rao and Kingston (2). The structures of the latter two compounds were confirmed by comparison with authentic samples prepared from 2-isopropyl-naphtho[2,3-*b*]furan-4,9-dione (5).

Full details of extraction, identification, and syntheses of these compounds are available upon request.

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Received 15 April 1988

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