Phytochemistry, 1977, Vol. 16, pp. 2028–2029 Pergamon Press. Printed in England.

CINNAMOYLGRANDIFLORIC ACID FROM *MIKANIA OBLONGIFOLIA**

Walter Vichnewski†‡, Hermógenes de Freitas Leitão Filho§, Ramaswamy Murari‖
and Werner Herz‖

† Nucleo de Pesquisas de Produtos Naturais do Faculdade de Farmácia e Odontologica, 14.100 Ribeirão Preto, Sao Paulo, Brasil; § Departamento de Morfologia e Sistematica Vegetal do Instituto de Biologia, Universidade Estadual de Campinas, Campinas, Sao Paulo, Brasil; ‖ Department of Chemistry, The Florida State University, Tallahassee, FL 32306, U.S.A.

(*Revised received* 28 *June* 1977)

Key Word Index—*Mikania oblongifolia*; Eupatorieae; Compositae; cinnamic acid ester of grandifloric acid; diterpene.

Abstract—Isolation of the cinnamate of grandifloric acid from *Mikania oblongifolia* is reported.

In the course of our work on schistosomicidal principles of Brazilian plants [1] we have isolated [2] from the (non-schistosomicidal) hexane–EtOAc (1:1) extract of *Mikania oblongifolia* (Eupatorieae, Compositae) (aerial parts) a new diterpene ester identified as cinnamoylgrandifloric acid (**1a**). Substance **1a**, $C_{29}H_{36}O_4$ (high resolution MS, elemental analysis) had UV absorption and IR bands indicative of an aromatic ring, a carboxyl group a conjugated ester and at least one double bond. The aromatic unit and ester function was identified as a cinnamate by MS (base peak $m/e = 119$, C_8H_7O), by the NMR spectrum which exhibited diagnostically valuable signals at δ 7.69 *d* and 6.47 *d* (AB system, $J_{AB} = 16$ *Hz*), 7.53 *m* (2H) and 7.38 *m* (3H) and by hydrolysis to **1b** and cinnamic acid. That the other two oxygens of **1a** were those of a carboxyl group was substantiated by the ^{13}C-NMR spectrum which exhibited a singlet at 166.9 ppm; see Table 1 for assignment of frequencies [3–6].

Substance **1b**, $C_{20}H_{30}O_3$ (high resolution MS) was a hydroxy acid whose NMR spectrum exhibited the signal of a proton on a carbon carrying a secondary hydroxyl (*br s* at δ 3.80) allylically coupled to the protons of an exocyclic methylene group at δ 5.20 and 5.07, and was identified as grandifloric acid [7, 8] by comparison with an authentic sample [9].

As far as we are aware, the only other ester of grandifloric acid previously encountered in nature is the acetate **1c** found as a minor constituent of *Espeletia grandiflora* [8]. Also after submission of this article structure **1a** was assigned [10] on spectroscopic evidence to a substance isolated as its methyl ester from *Wedelia trilobata*. The methyl esters of the figlate, angelate and eposyangelate were also found [10].

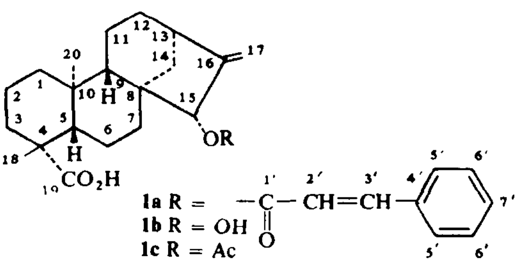

Table 1. ^{13}C-NMR spectrum of **1a***

C-1	40.67 *t*	C-15	83.16 *d*
C-2	18.52 *t*	C-16	155.40 *s*
C-3	37.76 *t*†	C-17	110.14 *t*
C-4	43.80 *s*	C-18	28.87 *q*
C-5	56.75 *d*‡	C-19	166.90 *s*
C-6	20.90 *t*	C-20	15.86 *q*
C-7	34.95 *t*	C-1′	184.25 *s*
C-8	47.86 *s*	C-2′	130.15 *d*
C-9	53.10 *d*‡	C-3′	144.73 *d*
C-10	39.97 *s*	C-4′	134.62 *s*
C-11	19.13 *t*	C-5′	128.82 *d*§
C-12	32.72 *t*	C-6′	128.06 *d*§
C-13	42.69 *d*	C-7′	118.61 *d*
C-14	37.43 *t*†		

* Run in $CDCl_3$, †, ‡, § assignments interchangeable.

EXPERIMENTAL

Aerial parts of *Mikania oblongifolia* DC, (7 kg) collected in 'Cerrado' de Itu, vicinity of Itu, São Paulo State, Brasil, in November 1972, were extracted with hexane–EtOAc. The crude extract, (60 g) was chromatographed over 600 g of Si gel, 250 ml fractions were eluted in the following order: 1–5 (hexane), 16–18 (hexane–EtOAc, 1000:1), 19–21 (hexane–EtOAc 500:1), 22–24 (200:1), 25–27 (100:1), 28–30 (67:1), 31–33 (50:1), 34–36 (25:1), 37–39 (16.7:1), 40–45 (12.5:1), 46–62 (10:1), 63–77 (5:1), 78–86 (2.5:1), 86–89 (EtOAc), 90n91 (EtOAc–EtOH, 200:1), 92–93 (EtOAc–EtOH 50:1), 94–95 (25:1), 96–97 (12.5:1), 98–99 (10:1), 100–102 (5:1), 103–104 (2.5:1), 105–106 (5:4), 107–108 (EtOH). Fractions 58–64 which showed one major spot on TLC (**1a**)

---

* Work at Florida State University supported in part by a grant (CA-13121) from the U.S. Public Health Service through the National Cancer Institute.

‡ On leave of absence 1975–6 at Florida State University on a grant from Fundacão de Amparo a Pesquisa do Estado de São Paulo.

were combined (1 g) and recrystallized from hexane, mp 211–213° $[\alpha]_D^{22}$ + 70°, PMR signals (270 MHz) at 7.69 (*d*) and 6.47 (*d*, J = 16 Hz, H-2′ and H-3′), 7.53, (2H, *m*) and 7.38 (3H, *m*, aromatic protons), 5.41 (*br*, H-15), 5.20 and 5.07 (*br*, H-17), 2.82 (*br*, H-13), 1.21 (C-4 methyl) and 0.99 ppm (C-10 methyl). (Calc. for $C_{29}H_{36}O_4$: C, 77.68; H, 8.03; MW, 448.2612. Found: C, 77.47; H, 8.18%; MW (MS), 448.2617). A soln of 0.20 g **1a** in 5 ml 10% aq. NaOH was heated at 100° for 1 hr, cooled, neutralized and extracted with Et_2O. The washed and dried Et_2O extract was evapd and separated by PLC (EtOAc–C_6H_6, 2:1) into two fractions. Fraction A was cinnamic acid (35 mg), mp 133°, identical with an authentic sample. Fraction B (**1b**, 75 mg) on recrystallization from EtOAc had mp 228–230°, $[\alpha]_D^{24}$ − 117.6° ($CHCl_3$, *c* 1.15), NMR signals at 5.20 and 5.07 (*br*, H-17), 3.80 (*br*, H-15), 2.72 (*br*, H-13), 1.25 (C-4 methyl) and 0.95 ppm (C-10 methyl). (Calc. for $C_{20}H_{30}O_3$: MW, 318.2194. Found: MW (MS), 318.2171). The substance was identical with an authentic sample of grandifloric acid [7, 9]. We wish to thank Professor Tanaka for supplying the sample.

REFERENCES

1. Vichnewski, W., Sarti, S. J., Gilbert, B. and Herz, W. (1976) *Phytochemistry* **15**, 191.
2. Herz, W., Subramaniam, P. S., Murari, R., Dennis, N. and Blount, J. F. (1977) *J. Org. Chem.* **42**, 1720.
3. Hanson, J. R., Siverens, M., Piozzi, F. and Savona, G. (1976) *J. Chem. Soc. Perkin I*, 114.
4. Yamasaki, K., Kohda, H., Kobayashi, T., Kasai, R. and Tanaka, O. (1976) *Tetrahedron Letters* 1005.
5. Temai, B. and Markham, K. R. (1976) *Tetrahedron* **32**, 565.
6. Herz, W. and Sharma, R. P. (1976) *J. Org. Chem.* **41**, 1021.
7. Piozzi, F., Sprio, V., Passannanti, S. and Mondelli, R. (1968) *Gazz. Chim. Ital.* **98**, 907.
8. Brieskorn, C. H. and Pohlmann, E. (1969) *Chem. Ber.* **102**, 2621.
9. Yahara, S., Ishida, M., Yamasaki, K., Tanaka, O. and Mihashi, S. (1974) *Chem. Pharm. Bull.* **22**, 1629.
10. Bohlmann, F. and Le Van, N. (1977) *Phytochemistry* **16**, 579.

Phytochemistry, 1977, Vol. 16, pp. 2029–2030. Pergamon Press. Printed in England.

TRITERPENES FROM THE SEED OF *ENTANDROPHRAGMA* SPECIES

DOMINGO A. OKORIE and DAVID A. H. TAYLOR

Department of Chemistry, University of Ibadan, Nigeria; Department of Chemistry, University of Natal, Durban, Republic of South Africa

(*Received* 30 *April* 1977)

Key Word Index—*Entandrophragma*; Meliaceae; limonoid; sapelin.

Abstract—The seeds of *Entandrophragma angolense* and *E. utile* contained no limonoids, but protolimonoids were isolated and identified.

INTRODUCTION

The genus *Entandrophragma* is the source of sapele, and other important West African timbers. These contain considerable amounts of limonoids [1], *E. angolense* contains the simple limonoid gedunin [2], while other species contain more complex compounds such as utilin [3]. In a more extensive examination of the timber of *E. cylindricum*, Chan *et al.* [4] have isolated as well as limonoids the sapelins, which are highly oxidised triterpenes, probably acting as metabolic precursors of the limonoids. These have been termed protolimonoids, and similar compounds have been isolated from other related plants. In many genera of the Meliaceae we have found the seed to be a richer source of liminoids than the timber, but with *Entandrophragma* this is not the case. We now report a more extensive investigation of the seed, which has yielded no limonoids, but certain compounds in the protolimonoid and triterpene groups which are probably metabolic precursors of the limonoids.

RESULTS AND DISCUSSION

We have investigated the seed of *E. angolense* and *E. utile*, representative of species giving simple and complex limonoids in the timber. The seeds were ground and extracted in the usual way, and the extracts chromatographed on Si gel columns. *E. angolense* gave a compound $C_{30}H_{48}O_2$, mp 125–8°, $[\alpha]_D$−94°. The ^{13}C NMR spectrum of this compound, which we name entandrolide, showed that it was the ester of a tertiary alcohol (C=O, 175.4*s*; C—O, 86.2*s*). The ^1H and ^{13}C-NMR spectra also showed the presence of two double bonds, each carrying one vinyl proton, five quarternary methyl groups, and two methyl groups on a double bond. Two of the quarternary methyl groups appeared in the ^1H-NMR spectrum at chemical shifts (δ 1.45, 1.58) which suggested that they were attached to a carbon atom bearing oxygen, which must be the lactone oxygen. This, and the absence of any other oxygen atoms, suggested the presence of a triterpenoid ring A