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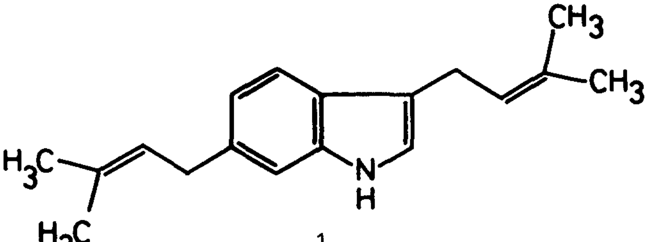
3,6-BIS(γ,γ-DIMETHYLALLYL)-INDOLE FROM UVARIA ELLIOTIANA

Hans Achenbach* and Bernd Raffelsberger

Chemisches Laboratorium, Universität Freiburg, D-7800 Freiburg,
Federal Republic of Germany

Summary - The new title compound 1 has been isolated from the stem bark of Uvaria elliotiana Engl. & Diels (Annonaceae).

Chromatography (on SiO_2 with $CHCl_3$) of the crude methanol extract from the stem bark of Uvaria elliotiana, collected in West Africa, yielded as the main product a new alkaloid (0.15% of dry bark), for which structure 1 was deduced.

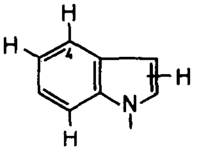
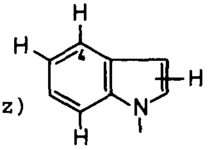


1

1 - $C_{18}H_{23}N$, $[\alpha]_D^{20}=\pm 0^\circ$, m.p. < 20°C - has an electronic spectrum [λ_{max}(MeOH) 293(lg ε 3.72), 283(3.89), 229(4.65) nm] typical for an indole chromophore and an absorption band at 3480 cm^{-1} in the infrared spectrum ($CHCl_3$), which is characteristic for an >NH-group.

Hydrogenation of 1 using Adams catalyst produces a liquid tetrahydro-derivative with an unchanged electronic spectrum.

The ^1H-nmr spectra of 1 and tetrahydro-1 show that the indole nucleus is disubstituted; the ^1H-nmr data consist of 5 groups of signals, which can be attributed to the structural features indicated in Table 1:

1 signal[ppm]	1 structural feature	tetrahydro-1 signal[ppm]	tetrahydro-1 structural feature
7.70 (1H,s broad,exchangeable)	$>NH$	7.68 (1H,s broad,exchangeable)	$>NH$
7.48 (1H,d,J=8Hz) 7.10 (1H,s) 6.93 (1H,dd,J_o=8Hz,J_m=1Hz) 6.83 (1H,d,J=1Hz)		7.50 (1H,d,J=8Hz) 7.10 (1H,s) 6.93 (1H,dd,J_o=8Hz,J_m=1Hz) 6.83 (1H,d,J=1Hz)	
5.40 (2H,m)	2x $-CH_2-\underline{CH}=C<$		
3.41 (4H,2xd,J=7Hz)	2x $>C-\underline{CH_2}-CH<$	2.70 (4H,2xt,J=7Hz)	2x $>C-\underline{CH_2}-CH_2-$
		1.57 (6H,m)	2x $-CH_2-\underline{CH_2}-\underline{CH}<$
1.72 (12H,weakly broadened)	4 x $=\overset{C}{C}-\underline{CH_3}$	0.93 (12H,d,J=5Hz)	2x $-CH<^{\underline{CH_3}}_{\underline{CH_3}}$

Tab.1: ^{1}H-nmr data from 1 and tetrahydro-1 ($CDCl_3$-solution; 90 MHz, standard: TMS)

The chemical shifts of the non-indolic protons of 1 are in agreement with the presence of two γ,γ-dimethylallylic groups.

Irradiation experiments upon 1 and the observed alteration of the ^{1}H-nmr spectrum after hydrogenation prove fully a bis(γ,γ-dimethylallyl)-substituted indole structure.

The position of one of the substituents of the indole system at C-6 could readily be deduced from the ^{1}H-nmr data[1,2]: In the case of a substituent at C-5 the characteristic signal of H-(4) at δ 7.48 ppm should appear as a doublet with $J_{4,6}$=1.6 Hz[3].

From the singlet at δ 7.10 ppm the other substituent was supposed to be at C-3[4]. This was confirmed by the ^{13}C-nmr data: According to Parker and Roberts alkylation of indoles at position-2 or -3 causes a characteristic downfield shift (10-13 ppm) in the ^{13}C-resonance of the substituted carbon atom[5]. The values of interest from indole and the methyl indoles are listed in Table 2, which gives, in addition, the corresponding signals found in the spectrum of 1

atom	indole	2-methylindole	3-methylindole	1
C-2	125.2[5] 123.7[6]	135.7[5]	122.7[5]	123.3
C-3	102.6[5] 101.8[6]	100.4[5]	111.4[5]	110.3

Tab.2: ^{13}C-resonance of C-2 and C-3 in 1 and some indoles (ppm in $CDCl_3$-solution, standard: TMS).

Since there are no other signals between δ 77 ppm (=$^{13}CDCl_3$) and δ 110.3 ppm in the ^{13}C-nmr spectrum of 1 carbon C-3 must be substituted.

Whereas a very few mono-substituted isoprenyl- or γ,γ-dimethylallyl-indoles are known to occur in plants[1,7] 3,6-bis(γ,γ-dimethylallyl)indole (1), isolated from *Uvaria elliotiana*, is the first naturally occurring indole substituted only by two unlinked isoprenoid units.

Furthermore it has to be pointed out, that 1 has been isolated as the main alkaloid from a species of the family Annonaceae, whose plants preferably produce alkaloids of the benzyl-isoquinoline-aporphine group[8,9].

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