

THE DITERPENIDS OF ERYTHROXYLON MONOGYNUM - III
FURTHER CONSTITUENTS, THE ABSOLUTE STEREO-
CHEMISTRY OF MONOGYNOL, AND HYDROXYMONOGYNOL

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Further constituents

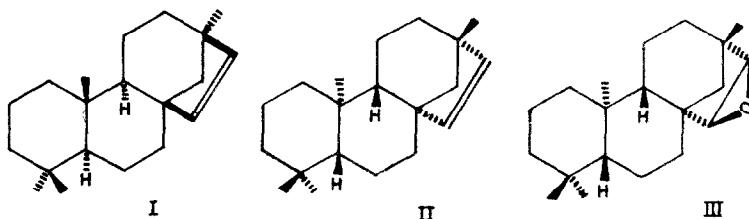
In a previous publication¹ on the subject, we reported the isolation of six new diterpenoids. Now, we describe three more constituents² of the wood - two new and one of known structure (Table 1). These compounds,

TABLE 1. DITERPENIDS FROM ERYTHROXYLON MONOGYNUM:
FURTHER CONSTITUENTS

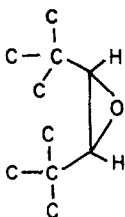
No.	Trivial name	Mol.formula	m.p.	$[\alpha]_D^{28}$ (CHCl ₃)
1	(+)-Hibaene	C ₂₀ H ₃₂	29.5-30°	+50.14
2	-	C ₂₀ H ₃₂	84-85°	-73.99
3	(+)-Hibaene epoxide	C ₂₀ H ₃₂ ⁰	74-75°	+16.30

which are ordinarily difficult to separate from each other, could be readily resolved by column chromatography over SiO₂-gel-AgNO₃³.

(+)-Hibaene. The hydrocarbon⁴ (AgNO_3 complex, m.p. 152 - 153.5°), from its NMR spectrum (four sharp 3H signals at 44, 50, 52 and 59 cps; an AB quartet: 319, 325, 335 and 341 cps), appeared to be related to monogynol¹. A hydrocarbon (hibaene, m.p. 30°, I) of this class, answering the above NMR spectral characteristics, has been described⁶, and a direct comparison showed that the two hydrocarbons have the same IR spectra, but that hibaene is levorotatory. Since, the absolute stereochemistry of hibaene has been established^{6,7} as I, the hydrocarbon from Erythroxyton monogynum must be its enantiomorph (II), and is appropriately termed (+)-hibaene.



(+)-Hibaene epoxide. The compound $\text{C}_{20}\text{H}_{32}\text{O}$ (m.p. 74-75°) was clearly an oxide from its IR spectrum. NMR spectrum showed the presence of four quaternary methyls (53, 55, 57 and 62 cps), while an AB quartet centred at 183 cps ($J_{AB} = 8$ cps; $J_{AB}/(\delta_B - \delta_A) = 0.13$) indicated the presence of the grouping:



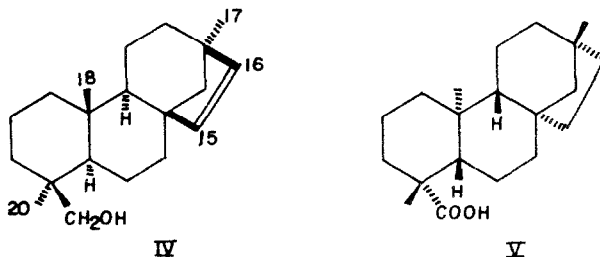
These findings strongly suggested that the oxide may well be the 1,2-epoxide (III) derived from (+)-hibaene described above. This was readily confirmed by its stereospecific preparation from II by the action of perbenzoic acid. The synthetic product had m.p. 74-75°, $[\alpha]_D^{28} +15.81^\circ$ and was indistinguishable from the natural material (mixed m.p., IR, TLC).

New hydrocarbon. Its NMR spectrum showed the presence of three quaternary methyls (49, 52 and 57 cps), one methyl on an ethylenic linkage (102 cps; doublet, $J = 1.5$ cps), and one vinyl proton (331 cps; essentially unsplit singlet). Since the hydrocarbon, $C_{20}H_{32}$, is mono-olefinic (NMR; end absorption: $\epsilon_{215} 640$, $\epsilon_{220} 230$, $\epsilon_{225} 50$), it must be tetracyclic. We plan to report on its structure at a later date.

Absolute stereochemistry of monogynol

In a previous communication¹ we presented evidence for the structure and absolute configuration (IV) of monogynol. On this basis the acid (m.p. 183-84°, $[\alpha]_D -43.5^\circ$) derived from dihydromonogynol should be the enantiomorph

of isostevic acid (V)¹⁰ of known absolute stereochemistry⁸. However, a direct comparison* (mixed m.p. and IR of the acids and their methyl esters) established their complete identity (rather than antipodal character). Since, our assignment of absolute configuration of monogynol had been



based on a comparison of desoxy-dihydromonogynol (m.p. 39-40°, $[\alpha]_D -3.9$) with beyerane⁹ (isostevane¹⁰, m.p. 39-40°, $[\alpha]_D +4.0$), the above results lead us to the only alternative that the $[\alpha]_D$ measurements of isostevane (beyerane) must be in error*. We now find that isostevane is indeed levorotatory like desoxy-dihydromonogynol (Table 2) and consequently monogynol must be represented by the mirror-image of IV¹¹.

*Though at the time of writing up of our first communication¹, we had known from literature¹⁰ that isostevic acid has the same sign and almost the same magnitude of $[\alpha]_D$ as our acid and, thus, the two cannot be enantiomeric, we had doubted the assignment of configuration of COOH at C₄ in isostevic acid (as this rested on not very compelling evidence), rather than the reported dextrorotation of isostevane.

TABLE 2. OPTICAL ROTATION OF DIFFERENT PREPARATIONS OF ISOSTEVANE

Hydrocarbon derived from:	m.p.	[α] _{λ} in CHCl ₃							Conc. %
		λ (m μ)							
		589	578	546	436	364	313		
Isosteviol *	41-42°	-1.02	-1.07	-1.1	-2.66	-5.84	-9.7	0.88	
(+)-Hibaene ^{††}	41-42°	-1.15	-1.38	-1.49	-3.21	-6.16	-10.5	1.17	
Monogynol *	39-40°	-3.9	-	-	-	-	-	0.51	
Beyerol ¹²	41.5° - 43.5°	-1.0	-	-	-	-	-	-	

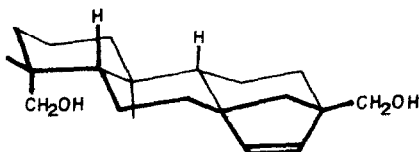
* Measurements made on Perkin-Elmer model 141 Polarimeter at $\sim 28^\circ$

[†] By the hydrogenation of (+)-hibaene over 10% Pd-C in acetic acid.

Hydroxymonogynol

We have previously suggested that hydroxymonogynol is 17-hydroxymonogynol¹. We now present chemical evidence in favour of the same. Dihydrohydroxymonogynol (m.p. 205-206°) was converted to the bis-tosylate (m.p. 180-181°), which was refluxed with one mole equivalent of benzylmercaptan and sodium in dimethylformamide¹³; the resulting product on being treated with Raney nickel in ethanol underwent desulphurisation and detosylation to yield dihydromonogynol (33%). Finally, hydroxymonogynol was converted to its dihydrodiacetate (m.p. 76-77°, [α]_D³² -9.45°) which was found to be identical (mixed m.p., NMR,

IR) with 17,19-diacetoxybeyerane (m.p. 78-80°, $[\alpha]_D -10^\circ$), recently described⁹. Thus the structure and absolute stereochemistry of hydroxymonogynol is established as VI.



VI

Acknowledgement. The authors wish to record their indebtedness to Prof. Y. Kitahara for a sample of (-)-hibaene, to Dr. J.A. Waters for samples of isostevane and isostevic acid, and Prof. P.R. Jefferies for carrying out the comparison of our product with 17,19-diacetoxybeyerane.

REFERENCES

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- 2 Still some more components are present and work towards their isolation is in progress.
- 3 N.P. Damodaran and Sukh Dev, Tetrahedron Letters 1941 (1963).
- 4 The presence of this hydrocarbon (termed stachene) in this wood has been recently reported from another laboratory⁹, however their sample would appear, from physical properties, to be somewhat contaminated.
- 5 R.D.H. Murray and R. McCrindle, Chem. and Ind. 500 (1964).
- 6 Y. Kitahara and A. Yoshioka, Collection of Lectures Inaugurating New Shionogi Research Lab. p.268 (Sept. 1961 - April 1962). We are grateful to Prof. P.R. Jefferies for drawing our attention to this.

- 7 Y. Kitahara and A. Yoshikoshi, Tetrahedron Letters 1771 (1964).
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- 11 Murray and McCrindle⁵ have also recently isolated this compound from the same source, and arrived at the same structure.
- 12 Value now kindly supplied by Prof. P. R. Jefferies for their purest sample of beyerane.
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