Isocomene: a Novel Sesquiterpene from *Isocoma Wrightii*. *X*-Ray Crystal Structure of the Corresponding Diol

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Summary Isocomene (**1**), a new sesquiterpene representing a novel skeletal type, has been isolated from the toxic plant *Isocoma Wrightii*; its structure was confirmed by *X*-ray analysis of its corresponding diol (**2**).

RAYLESS GOLDENROD (*Isocoma Wrightii*†) is a plant toxic to cattle and sheep[1] but the exact nature of the toxin remains unresolved. The plant has been shown to contain the bacteriostatic agent toxol[1,2] and related benzofurans,[3] and the novel steroids 5α-androstane-3β,16α,17α-triol[4] and

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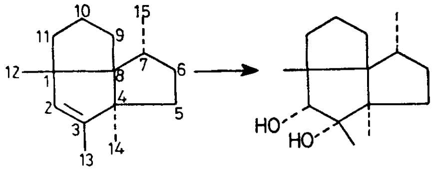
† Formerly known as *Haplopappus heterophyllus* (D. S. Correll and M. C. Johnston, 'Manual of Vascular Plants of Texas,' Texas Research Foundation, Renner, Texas, 1970).

stigmasta-8(14),22-dien-3β-ol.[5] Only recently have sesquiterpenes been found in *I. Wrightii*. Thus, Bohlmann and Zdero[6] reported the presence of three 8-oxo-β-cyperons in the roots and we have isolated caryophylene and caryophylene oxide from the stems and leaves.[7] We report here the isolation and structure of a new sesquiterpene of novel skeletal type from *I. Wrightii* and have given it the trivial name isocomene (**1**).



(1) (2)

Isocomene (**1**) was isolated from the dried stems and leaves by extraction with hexane or from the saponified methanol extract by steam distillation followed by fractional distillation. The fraction of b.p. 65—75 °C at 0·05 mmHg was shown by g.l.c. to be composed of *ca.* 90% caryophyllene and 10% (**1**). Chromatography on silica gel impregnated with silver nitrate (20%) gave (**1**)‡ in the hexane–methylene chloride (95 : 5) eluent as a colourless oil, b.p. 65—70 °C at 0·35 mmHg (bath), *m/e* 204 (M^+, 15%) 189 (19%), 162 (100%), 147 (42%), and 119 (35%); ν_{max} (CCl_4) 3020, 1670, and 840 cm^{-1}; ^{1}H n.m.r.: δ 0·87 (3H, d, *J* 7 Hz), 1·02 (6H, s), 1·67 (3H, d, *J* 1·5 Hz), and 4·83 (1H, m); ^{13}C n.m.r.: δ 56·4, 59·7, 63·6 (s, quaternary C's), 132·1 (d, olefinic C with single H), and 142·1 (s, olefinic C with no H) p.p.m.

Elemental analysis and ^{1}H and ^{13}C n.m.r. and mass spectra indicated that (**1**) was tricyclic, contained a trisubstituted double bond with an attached methyl group, two additional methyl groups attached at quaternary carbons, a methyl group at a tertiary carbon, and finally a quaternary carbon bearing no methyl groups. By analogy to known sesquiterpene skeleta[8] the six-proton n.m.r. singlet at δ 1·02 was assumed to arise from a *gem*-dimethyl group and only after the *X*-ray analysis, described below, was it clear that, in fact, this was not the case and (**1**) actually represented a previously unknown sesquiterpene skeleton.

On treatment with osmium tetroxide in pyridine, (**1**) gave a mixture of diols from which the isomer (**2**)‡ was separated by crystallization from pentane–ether and chromatography on silica gel, m.p. 134—136 °C; *m/e* 238 (M^+, 2%), 220 ($M^+ - H_2O$, 29%), 134 (30%), 122 (90%), and 109 (100%); ν_{max} ($CDCl_3$) 3540 and 3590 cm^{-1}; δ 0·91 (3H, d, *J* 6·5 Hz), 0·94 (3H, s), 1·03 (3H, s), 1·15 (3H, s), and 3·50 (1H, d, *J* 8 Hz). The structure of the diol (**2**) was established by a single crystal *X*-ray analysis (Figure). It crystallized from pentane in the orthorhombic space group $P2_12_12_1$ with $a = 6·898(2)$, $b = 12·397(6)$, $c = 16·042(6)$ Å, $Z = 4$. The intensity data were measured with a Syntex P2, four-circle diffractometer, equipped with a graphite monochromator, using the θ-2θ scan technique. The structure, which was solved by direct methods, was refined by least-squares methods to convergence of $R = 0·069$ for 1046 reflections with $I > 3\sigma(I)$. Variables included a scale factor, co-ordinates of all carbon and oxygen atoms, anisotropic thermal parameters for oxygen and selected carbon atoms, and isotropic thermal parameters for the remaining carbon atoms. However, parameters were not varied for hydrogen atoms; fixed thermal parameters of 5·0 were used.§

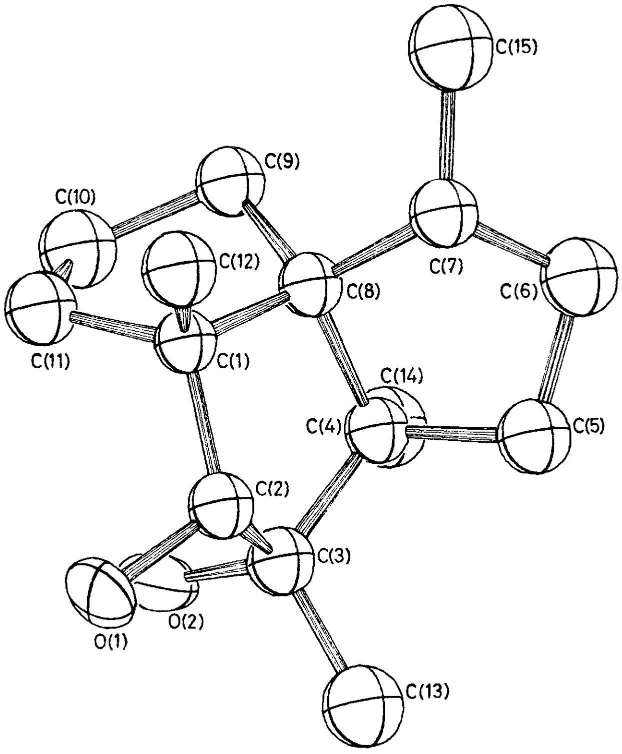


FIGURE. Structure of the diol (**2**).

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‡ These compounds gave satisfactory elemental analyses.

§ The atomic co-ordinates for this work are available on request from the Director of the Cambridge Crystallographic Data Centre, University Chemical Laboratory, Lensfield Rd., Cambridge CB2 1EW. Any request should be accompanied by the full literature citation for this communication. The structure factor table may be obtained as a Supplementary publication (No. 22118, 6 pp.) from the British Library. For details of obtaining this material, see Notice to Authors No. 7, Index Issues of *J.C.S. Perkin I* or *II*.

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