

TRITERPENES OF BETULA PLATYPHYLLA SUKATCHEV VAR. JAPONICA HARA AND
THE CONFIGURATION AT C-24 OF OCOTILLOL-II AND ITS RELATED COMPOUNDS

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Betulafolienetriol(I, dammar-24-ene-3 α ,12 β ,20S-triol), first obtained from Betula alba L. by Fischer and Seiler(1,2,3), has been isolated also from the leaves of Japanese white birch, B. platyphylla var. japonica in our laboratory(4). In addition to I, three minor triterpenes A, B, and C have now been obtained from the unsaponifiable fraction of the ethereal extract of the leaves of this plant.

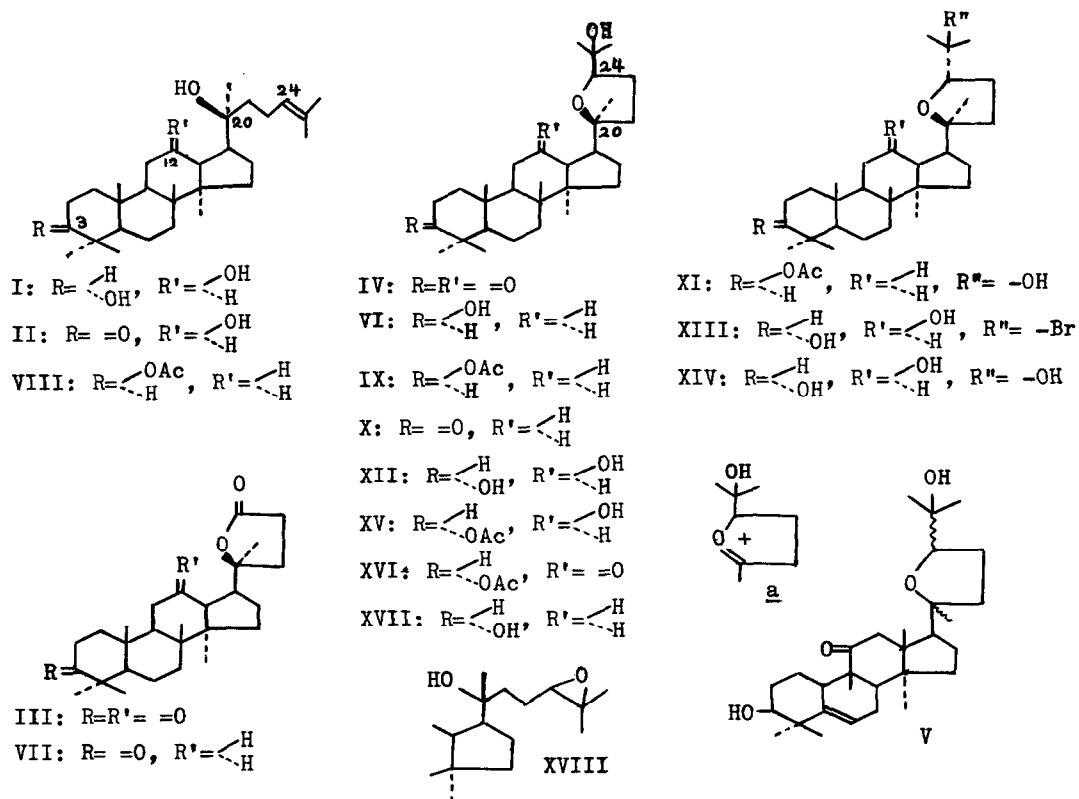
Triterpene A, m.p.250° and triterpene B, m.p.197°; were found to be identical with hydroxyhopanone(5) and dammar-24-ene-12 β ,20S-diol-3-one(II) respectively by the direct comparisons with the authentic samples. The latter compound(II) has already been prepared from I by means of the mild oxidation(1) but this is the first example of its occurrence in nature.

Triterpene C, m.p.240°; C₃₀H₅₂O₄; $[\alpha]_D^{22} + 2.6^\circ$ (CHCl₃), shows hydroxyl bands at 3420 (concentration independent) and 3620cm⁻¹ in its IR spectrum in CHCl₃. Its NMR spectrum in CDCl₃ shows no vinylic proton signal but exhibits eight tertiary methyl signals at τ 9.15(3H), 9.13(3H), 9.07(6H), 9.01(3H), 8.91(3H), and 8.74(6H) and signals due to protons on carbon atoms bearing oxygen functions at τ 6.15(1H, broad), 6.47(1H, sextet), and 6.61(1H, triplet), the latter two of which are similar to those of protons on C-12 and C-3 of I. On oxidation with Jones reagent, triterpene C yielded a compound, m.p.235-237°; being identical with the trisnordiketolactone(III), previously derived from I(1). Whereas, oxidation of triterpene C with chromic acid in pyridine afforded a diketone(IV), m.p.178°; $[\alpha]_D^{23} + 77.2^\circ$ (CHCl₃), whose IR spectrum in CCl₄ still showed a hydroxyl band at 3581cm⁻¹ (concentration independent) along with a carbonyl band at 1714cm⁻¹. The

NMR spectrum of IV in CDCl_3 lacks the signals observed at τ 6.47 and 6.61 in that of triterpene C (vide supra). These evidences strongly suggest that triterpene C would be a homolog of betulafolienetriol(I) having a hindered and intramolecularly hydrogen-bonded hydroxyl on the modified side chain. Referring the assignment of the mass spectrum of gratiogenin(V)(6), the base peak at m/e 143 of the mass spectrum of triterpene C would be attributed to the ion a, indicating the presence of the side chain of the same type as that of V.

Warnhoff and Halls isolated a triterpene named ocotillol-II from Fouquieria splendens Englm. and assigned its structure as VI, whose configuration at C-24 has been left unsolved(7,3). They reported the formation of the trisnorketolactone (VII) from VI by oxidation with chromic acid and the transformation of 3-O-acetyldammarenediol-II(VIII) to 3-acetate of VI(IX) by oxidation with monopero-phthalic acid. Afterwards, Bisset et al. isolated ocotillone-II(X) and its C-20 epimer from the resin of Dipterocarpus hispidus Thw.(8). Hirose et al. also isolated X and its C-20 epimer from the wood of Kapur(Dryobalanopus sp.)(9). It is evident that X has the same configuration at C-24 as that of VI, since X gave VI on reduction with NaBH_4 (8,9). Recently, Biellmann found that oxidation of VIII with p-nitroperbenzoic acid gave the C-24 epimer(XI) of IX in addition to IX (3).

Betulafolienetriol(I) was subjected to oxidation with perbenzoic acid and the reaction mixture was separated by chromatography on alumina to give two crystalline compounds, tentatively named oxide-I and -II, the former of which was proved to be identical with triterpene C. On the basis of these results, the structure of triterpene C can be formulated as XII excepting the stereochemistry at C-24. Another product, oxide-II, m.p.144-148°; $\text{C}_{30}\text{H}_{52}\text{O}_4$, $[\alpha]_D^{25} +13.1^\circ(\text{CHCl}_3)$, was assumed to be the C-24 epimer of XII because of the similarities of its chemical properties and the spectral data to those of XII. In our preceding paper(10), it has been reported that on the action of N-bromosuccinimide, I yielded the bromo-compound(XIII), whose structure was rigorously determined by its X-ray crystallographic analysis. The transformation of XIII to oxide-II was achieved by treatment of XIII with silver oxide in boiling aqueous ethanol, establishing the structure



of oxide-II(XIV) including the stereochemistry(C-24S configuration). Accordingly, the stereochemistry at C-24 of triterpene C(XII), the C-24 epimer of XIV, should be expressed in term of R configuration (the hydroxyisopropyl at C-24/ the methyl at C-20: trans).

On acetylation with acetic anhydride in pyridine at room temperature, triterpene C(XII) gave the 3-O-acetyl derivative(XV), which was oxidized with chromic acid in pyridine yielding the 12-ketone(XVI). Wolff-Kishner reduction of XVI and the subsequent oxidation of the resulted diol(XVII) with chromic acid in pyridine afforded a ketone, m.p.170-171; which was proved to be identical with ocotillone-II(X) by mixed melting point and comparisons of the IR spectrum and the thin layer chromatogram with those of the authentic sample. This chemical correlation led to establish unequivocally R configuration at C-24 of ocotillol-II(VI) as well as ocotillone-II(X), then S configuration at C-24 of XI.

It should be noted that the compounds with the tetrahydrofuran ring, such as XII, VI, X, and the C-20 epimer of X(ocotillone-I) might be the artifacts formed from their corresponding epoxides(XVIII type) during the process of the extraction or the separation, since the epoxide of this type has been shown to be quite unstable and be converted easily to the corresponding tetrahydrofuran derivative(3,7).

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