Communic Acid, a New Diterpene Acid from *Juniperus communis* L.

V. P. ARYA, C ENZELL, H. ERDTMAN and T. KUBOTA

Organisk-kemiska institutionen, Kungl. Tekniska Högskolan, Stockholm, Sweden

A new diterpene acid, communic acid (Ia) has been isolated as its sodium salt, $C_{20}H_{29}O_2Na \cdot H_2O$, m.p. 228–230°, $[\alpha]_D$ +25° (methanol) from the bark of the common juniper, *Juniperus communis* L. The free acid, which easily polymerises, furnishes with diazomethane a stable methyl ester $C_{21}H_{32}O_2$, m.p. 105–106°, $[\alpha]_D$ +47°, λ_{max} 232 mμ (ε 25 000). The ester gave a maleic anhydride adduct, $C_{25}H_{34}O_5$, m.p. 169–171°, $[\alpha]_D$ +85° and on ozonisation furnished formaldehyde in an amount indicative of the presence of two terminal methylene groups.

Methyl communate rapidly consumed one mole of hydrogen on catalytic hydrogenation (Pd/C, ethanol) giving methyl dihydrocommunate (II), $C_{21}H_{34}O_2$, b.p. 148–149°/0.5 mm, n_D^{23} 1.5062, $[\alpha]_D$ +55° which gave formaldehyde on ozonolysis in an amount indicative of one terminal methylene group.

Other products of ozonolysis of methyl dihydrocommunate and methyl communate include a keto-acid, $C_{16}H_{24}O_5$ (III), m.p. 171–172°, $[\alpha]_D$ +12°, semicarbazone, $C_{17}H_{27}O_5N_3$, m.p. 200–201°.

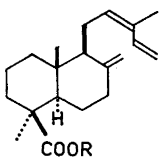
Methyl communate was reduced with lithium aluminium hydride to communol (IV), $C_{20}H_{32}O$, b.p. 65°/0.01 mm. $[\alpha]_D$ +18°, λ_{max} 233 mμ (ε 22 000), 3,5-dinitrobenzoate, $C_{27}H_{34}O_6N_2$, m.p. 115–117°, maleic anhydride adduct, $C_{24}H_{34}O_4$, m.p. 185–187°, $[\alpha]_D$ +49°. Reduction of communol in propanol with sodium gave *iso*dihydrocommunol (V), $C_{20}H_{34}O$, b.p. 95°/0.1 mm, 3,5-dinitrobenzoate, $C_{27}H_{36}O_6N_2$, m.p. 107–108°.

Torulosol [1] (VI), a new diterpene alcohol, which has been correlated with manool and with agathene dicarboxylic acid, gave on treatment with acetic anhydride and acetic acid mixture (1:1), the triene-ol (VII), λ_{max} 227 mμ (ε 27 000), 3,5-dinitrobenzoate, $C_{27}H_{34}O_6N_2$, m.p. 73–74°. Reduction of this triene-ol in propanol with sodium gave the dihydroderivative (V), the 3,5-dinitrobenzoate of which was identical with *iso*-dihydrocommunol 3,5-dinitrobenzoate.

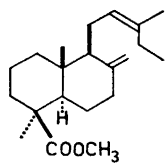
The identity of the two dihydro-derivatives (V) of (IV) and (VII), the difference (5 mμ) between the U.V. absorption maxima of (IV) and (VII) and the formation of the C_{16}-keto-acid (III) on ozonolysis of methyl communate show that communic acid possesses the structure and configuration (Ia).

Full details of this work including spectral data and direct correlations to agathene dicarboxylic acid will be described shortly elsewhere.

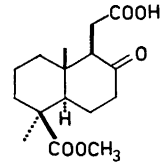
The U.V. spectra were taken in ethanol and optical rotations in chloroform solutions, unless otherwise stated. We thank Miss G. Hammarberg for these measurements. Satisfactory analyses were obtained for the compounds described, and we are grateful to Dr. A. Wettstein, Ciba Ltd., Basel, for several of them.



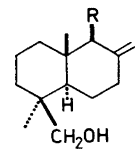
Ia R=H
Ib R=CH_3



II



III



IV R=$-CH_2-CH=C(CH_3)-CH=CH_2$
V R=$-CH_2-CH_2-C(CH_3)=CH-CH_3$
VI R=$-CH_2-CH_2-C(CH_3)(OH)-CH=CH_2$
VII R=$-CH_2-CH_2-C(=CH_2)-CH=CH_2$

This research was supported in part by the *Swedish Technical Research Council* and by the *Office of Research and Development, U.S. Army Department*, through its European Office. Part of this work was carried out during the tenure of a Post-doctoral Fellowship by one of us (V.P.A.) awarded by *Ciba Fellowship Trust*, Cambridge.

1. Enzell, C. *Svensk Kem. Tidskr.* **72** (1960) 602.

Received January 14, 1961.

Cytochrome c from *Salmonella typhimurium*

MARK RICHMOND and NIELS OLE KJELDGAARD

Universitetets Mikrobiologiske Institut, Øster Farimagsgade 2 A, København K, Denmark

In the course of growth experiments with *Salmonella typhimurium*, it was found that organisms grown in a simple synthetic medium with L-glutamate as sole carbon source were pink when looked at in bulk by transmitted light. Glucose grown organisms of the same strain were white or pale cream under similar conditions and a difference spectrum (glutamate cells/glucose cells) taken at high suspension densities showed strong absorption bands in the regions 400—420, 515—530 and 540—560 mμ for glutamate grown cells. These absorption bands suggested that the pink colour was due to cytochromes. Treatment of a dense suspension of glutamate grown bacteria (*ca.* 8 g wet weight of bacteria in all) as described by Tissières [1] produced material with the absorption spectrum shown in Fig. 1. Sharp peaks were found at 416, 525 and 551 mμ in the reduced form and at 409 mμ in the oxidised form. These peaks are located in exactly the same positions as the absorption peaks of the cytochrome C_4 isolated by Tissières [1] from *Azotobacter vinelandii*.

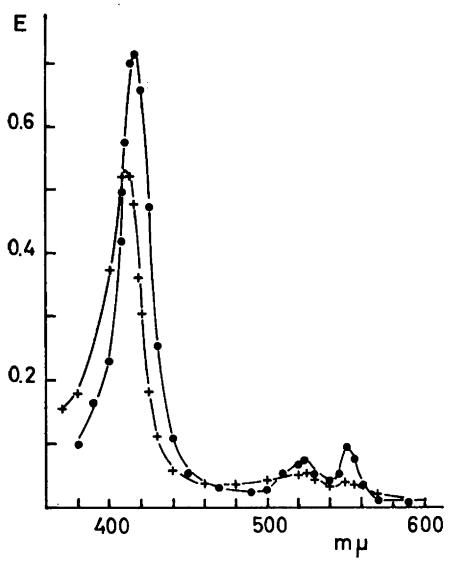


Fig. 1. Absorption spectra (1.0 cm light path) of the oxidised (+) and reduced (●) forms of the cytochrome preparation extracted from *Salmonella typhimurium*. The cytochrome was reduced with $Na_2S_2O_4$.

Table 1. Relative extinction coefficients of bacterial cytochrome c preparations.

Organism	Reduced			Oxidised
A.vinelandii	E_{416}	E_{525}	E_{551}	E_{409}
(C_4)	9.0	1.0	1.32	6.8
S.typhimurium	9.6	1.0	1.3	7.1

Comparison of the quantitative relationship between the extinction coefficients at the absorption peaks for these cytochromes (see Table 1) shows that the *Salmonella typhimurium* cytochrome is very similar to that from *Azotobacter vinelandii*, at least as far as absorption properties are concerned.

One of us (MR) would like to acknowledge the receipt of a CIBA Fellowship in support of this work.

1. Tissières, A. *Biochem. J.* **64** (1956) 582.

Received January 15, 1961.