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COLOURING MATTER OF TEAK LEAVES : ISOLATION AND CONSTITUTION OF TECTOLEAFQUINONE

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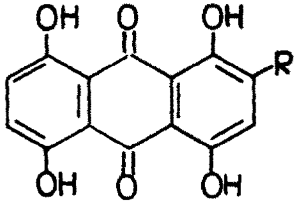
Teak leaves are reported to contain an yellow or red dye which has been used and strongly recommended for dyeing silk yellow, olive or related shades. Crushed leaves were known in India from early times to produce a red colour when rubbed with saliva; this test had been used to recognise genuine teak (1). It has been a common practice among women in Kerala State to crush the tender leaves into a paste and rub it in the palms which get dyed a light reddish shade. These leaves have also been used in indigenous medicine.

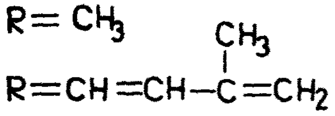
We had occasion to collect teak leaves from different parts of India at different times of the year. They seem to vary in quality and some of them did not yield any colouring matter. But the major study was made on mature leaves collected in 1958 from the teak garden in the Forest Research Institute, Dehra Dun. The main extraction procedure was as follows: The dry leaves were extracted with cold acetone and the waxes and chlorophyll removed from the extractives through digestion with petroleum ether. The dark red solid thus obtained was a complex mixture of a number of quinonoid pigments of apparently similar properties and was difficult to separate by paper chromatography.

The crude pigment was fractionated by extraction with petroleum ether, cyclohexane, benzene, chloroform and acetone in succession. The benzene-soluble portion was in major quantity and was further fractionated by column chromatography on silica gel. The column was eluted successively with benzene, ether, ethyl acetate and acetone and regular fractions were collected and separately examined. Most of them were found to be mixtures. One of the benzene fractions afforded a small quantity of a dark red crystalline compound, now named Tectoleafquinone whose constitution has first been studied.

This new compound has a molecular formula $C_{19}H_{14}O_6$. On distillation with zinc dust it affords a hydrocarbon whose UV absorption is similar to that of an alkylanthracene. It is decolorised by alkaline dithionite, but the colour is restored on aeration. The compound should therefore be an anthraquinone derivative. Acetylation with acetic anhydride and sulphuric acid gives a tetra-acetate. On the basis of the broad and low carbonyl frequency in the infrared spectrum (2) and the colour reactions with methanolic magnesium acetate (purple) (see ref. 3 for the colour reaction) and with concentrated sulphuric acid (blue) (4), the compound has been considered to be a 1,4,5,8-tetrahydroxyanthraquinone. The insolubility of the compound in aqueous sodium carbonate rules out the presence of any β-hydroxyl group in the molecule. The remaining atoms of carbon and hydrogen (C_5H_7) have been placed in a side chain. Kuhn-Roth estimation shows the presence of a C-methyl. In hydrogenation 6 hydrogen atoms are absorbed; but the product undergoes aerial oxidation to yield tetrahydrotectoleafquinone. This product has UV absorption maximum very close to that of cynodontin (I). The original quinone itself has absorption maximum at a higher wavelength showing that the double bonds in the side chain are conjugated with the main quinone structure. This is confirmed ozonolysis (chloroform solution) which yields formaldehyde and pyruvic aldehyde and by IR frequencies 885 cm^{-1} corresponding to an end methylene group attached to a tertiary carbon atom and 718 cm^{-1} corresponding to a *cis* -CH=CH- group. The constitution of the new quinone is therefore considered to be 1,4,5,8-tetrahydroxy-2-isopentadienylanthraquinone (II).



I $R=CH_3$

II 

$$R=CH=CH-\overset{\overset{\displaystyle CH_3}{|}}{C}=CH_2$$

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