

of cells and the formation of a complex of small cells, gradually developing into an heart-shaped embryo. When these grow bigger in size, they detach themselves and are found free floating in the liquid medium as shown in the figure. Although, it was assumed by Steward *et al.*<sup>11</sup>, that embryoids come from single cells in carrot, later, it was shown experimentally by several workers that Steward's hypothesis cannot be generalized,<sup>12-14</sup> and embryos are formed from multicellular aggregates.

Regeneration in the form of embryo or plantlet has been reported for other trees. In almost all the cases the frequencies are very low and of no commercial interest yet. Among conifers, the most common material used for propagation studies was seed embryo or seedling explants, which quickly give good results. Except for limited use, the seed cloning offers very little to the tree breeder who wishes to propagate elite trees and not their progeny. Only recently several labs have switched onto propagation studies using 4-5 years old material, old enough to be classified elite. In the present investigation callus is initiated from shoot pieces collected from mature sandal trees of about 20-25 years age and this callus is used to initiate suspension cultures. This is the first time for any tree species to develop complete plantlets from suspension cultures.

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#### CHEMICAL CONSTITUENTS OF THE BARK OF *SANTALUM ALBUM* LINN.

THE chemical constituents of the sandal bark have not been so far subjected to a systematic chemical examination. The present communication gives a brief account of the chemical constituents of the benzene extract of sandal bark. The sandal bark was also found to contain 14% of tannins.

The air-dried powdered bark was subjected to sequential extraction with petroleum ether (60-80°), benzene, chloroform, acetone and methanol.

While the petroleum ether extract gave a waxy material from which no pure compound could be isolated, the benzene extract (2-3% of yield) gave on repeated chromatography of its petroleum ether elute over basic alumina, a crystalline solid (0.1-0.3% of yield) m.p. 115-116° (EtOAc),  $[\alpha]_D^{24} + 20^\circ$  (CHCl<sub>3</sub>) identified (IR, NMR and MS) as urs-12en-3β yl palmitate<sup>1</sup>, which was found to exhibit a phenomenal insect growth inhibition and chemosterilant activities<sup>2</sup>. Topical application of this compound in microdoses on freshly formed pupae of some forest insects (*viz.*, *Atteva fabriciella*, *Eligma narcissus*, *Eupterote geminata*, etc.) produced morphologically defective adults with crumpled wings and shorter abdomen; these did not successfully mate and lay eggs. Such compounds, of late, are becoming popular as "third generation pesticides"<sup>3</sup> in controlling forest pests without the bad side effects of the common organic pesticides.

The benzene elute furnished a viscous yellow liquid ester, which on saponification and purification of the alcoholic product gave a crystalline solid m.p. 131° (MeOH),  $[\alpha]_D^{25} - 41^\circ$  (CHCl<sub>3</sub>) in a yield, of 0.1%, responds positive to Liebermann-Burchard test for sterol (pink → violet → green), characterised as β-sitosterol by m.p., Co-TLC., Co-IR and it had

comparable NMR spectrum and MS with the reported  $\beta$ -sitosterol<sup>4</sup>.

The acetic acid elute was found to contain a mixture of acids (3500–3,000, 1720 cm<sup>-1</sup>). On methylation and purification, of the methyl esters on 40% argentized silicagel, with benzene : petroleum ether (20 : 80 v/v) mixture as eluant, two fractions—a semi-solid (0.1% yield) and a liquid (0.2% yield)—were obtained. These fractions were analysed by GLC (EGSS—'X' 15% on chromosorb W, 200°C, N<sub>2</sub>, FID) and the composition of the fatty acids given as below :

Semi-solid fraction : C<sub>14</sub> 2.5%, C<sub>16</sub> 81.6%, C<sub>18</sub> 13.4%.

Liquid fraction : C<sub>18:1</sub> (Oleic) 86.9%, C<sub>16</sub> 12.9%.

The sandal bark was also estimated for its tannin content using the standard procedure<sup>5</sup> and it was found to contain 14% of tannins, tannin : non-tannin ratio 2 : 1.

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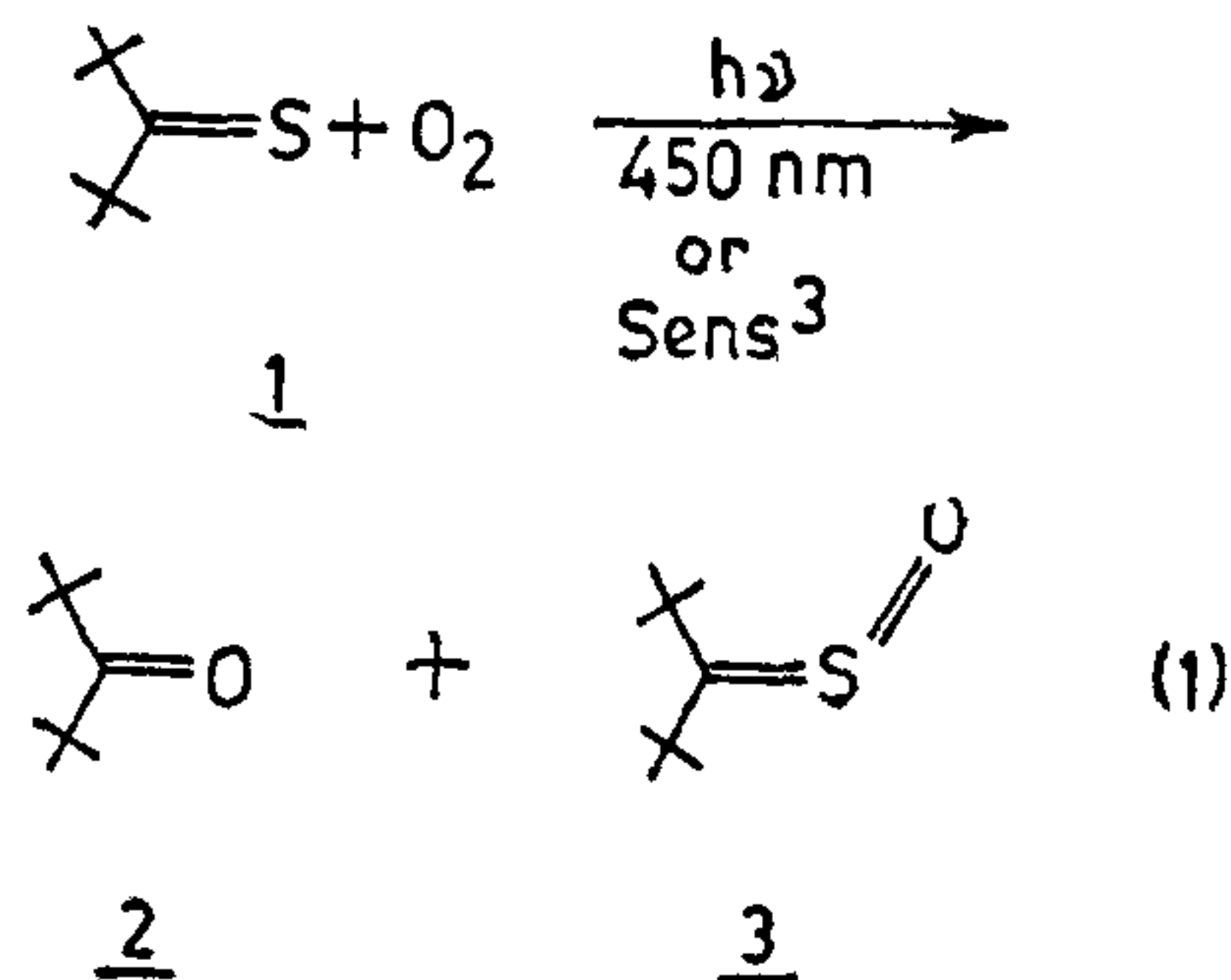
### PHOTOOXIDATION OF DI-T-BUTYLTHIOKETONE

RECENTLY we had reported that thioketones are converted into the corresponding ketones by singlet and triplet oxygen<sup>1</sup>. As an exception, we have now found that di-*t*-butylthioketone(1)<sup>2</sup> is converted by triplet oxygen in the presence of light to an unexpected product -sulfine (3)- along with the expected di-*t*-butylketone (2). Irradiation of 1 (0.1 M) using a medium pressure mercury lamp and corning glass filters (> 450 nm) in cyclohexane dioxane, tetrahydrofuran,

diethylether, diglyme and methanol in an atmosphere of oxygen resulted in rapid decolorisation. Purification of the product by column chromatography (silicagel-benzene) gave di-*t*-butyl ketone and a nice crystalline material (mp 47-48°C) having the following spectral properties:

IR (CCl <sub>4</sub> )	1380, 1280, 1260, 1180, 1080, 1020 cm <sup>-1</sup>
PMR (CDCl <sub>3</sub> )	1.536 (s); 1.369 (s).
CMR (CDCl <sub>3</sub> )	216.49 (s); 43.525 (s); 40.425 (s); 30.691 (q); 29.543 (q).
Mass Spec	m/e 174, 158, 131, 118, 112, 111, 101, 91, 84, 69, 57.
Analysis	Found C: 61.06%; H: 10.50% Calculated C: 62.04% for C <sub>9</sub> H <sub>18</sub> SO H: 10.41%

Based on the above spectral data the product is identified as di-*t*-butyl sulfine. The product ratio in various solvents as obtained from PMR spectra is shown in eq. 1.



Solvent	% of 2	% of 3
Tetrahydrofuran*	81.5	18.5
Dioxane	70.0	30.0
Cyclohexane	54.0	46.0
Diglyme	53.3	46.7
Benzene	46.0	54.0
Acetonitrile	33.3	66.7
Methanol*	10%	90%
Ethanol*	10%	90%

\* accompanied by polymer.

The formation of 3 is novel, considering the fact that thiobenzophenone is converted to the corresponding sulfine in the absence of light in oxygen atmosphere<sup>3,4</sup>. As the formation of 2 and 3 is sensitised by triplet sensitizers such as 4,4'-dibromobiphenyl and 1,4-dibromonaphthalene and quenched by triplet quenchers such as anthracene and allcocaine, the