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ESSENTIAL OIL FROM THE LEAVES OF *FERONIA ELEPHANTUM*, CORR.

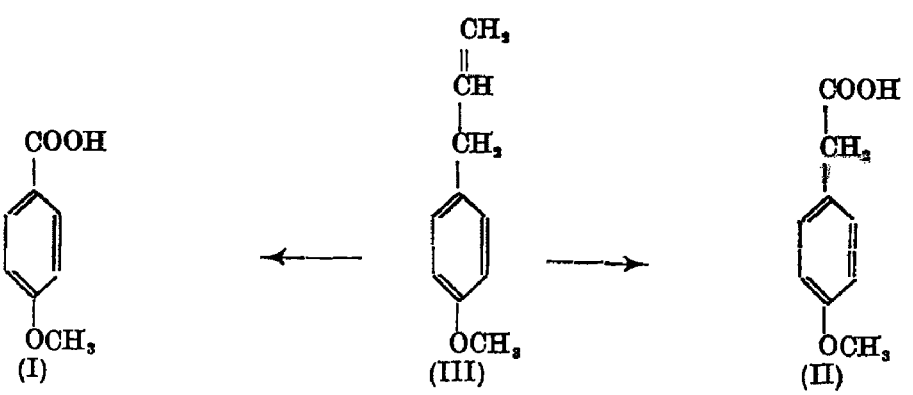
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The chief component of the essential oil from the leaves of Kavit (*F. elephantum*) is estragol which constitutes about 90% of the oil.

The tree is indigenous to S. India and Ceylon. Its leaves contain an essential oil which is said to be similar to that of the leaves from *Bel* (*Aegle marmelos*, Corr) ("Nadkarni, "Indian Materia Medica", p. 358), another member of the Rutaceae family. In continuation of our studies on the essential oil of Bel leaves (this *Journal*, 1939, **26**, 231) the examination of the essential oil from wood apple or Elephant apple (Kavit in Hindi) leaves was thought to be of interest.

The leaves yield 0.73% oil, on steam distillation, of the following properties: boiling range, 209° to 211° (at atmospheric pressure); $d_{25}°$, 0.9668; $n_D^{28°}$, 1.5195; $[\alpha]_D$, 0°; saponification value, 11.0 It does not reduce Fehling's solution nor does it give any reaction characteristic of a carbonyl compound. The boiling range, optical inactivity and non-reducing properties indicate the absence of phellandrene (the chief component of the essential oil from *Bel* leaves) and the absence of aldehydes like crital or citronellal.

On refractionation, about 90% of the oil passes over between 210° and 212°. As repeated distillations do not alter the boiling range, this fraction has been taken to consist mostly of one individual compound. It has the molecular formula $C_{10}H_{12}O$ and contains a methoxy group. It is unsaturated as is shown by the absorption of bromine in chloroform solution. On oxidation with hot neutral 4% potassium permanganate, anisic acid (I) is formed indicating the existence of a side chain in *para* position to the methoxy group and the double bond in the side chain. On milder oxidation with ice-cold 1% permanganate, *p*-methoxyphenylacetic acid (II) is produced. These properties indicate that the substance might be estragol (III)



(I) (III) (II)

The identity has been confirmed by preparing the nitrosite derivative by treatment

with amyl nitrite and hydrochloric acid and comparing with an authentic sample. These and other properties of our compound along with those of estragol are recored below.

TABLE I

	The compound.	Estragol.
B. p.	210° to 212°	214° (Klages, *Ber.*, 1899, 32, 1439) 212° (Dupont & Guerlain, *Compt. rend.*,1897, 124, 300)
Density	0.9665 at 20°	0.9645 at 21°
n_D	1.5235	1.5236
$[\alpha]_D$	0°	0°
M.p. of nitrosite	146°	147° (Rimini, *Gazzetta*, 1904, 34, 284)
Oxidation with cold 1% $KMnO_4$	*p*-Methoxyphenyl-acetic acid	*p*-Methoxyphenylacetic acid (Eijkman, *Ber.*, 1889, 22, 2744)

EXPERIMENTAL

The leaves (4 kilos) were distilled in steam in a copper still provided with a spiral copper condenser. The oil (14c.c.) floating over the aqueous distillate was collected and from the aqueous layer 16 c.c more were obtained by extraction with carbon tetrachloride. The total yield of the oil (14+16=30 c.c., 29 g.) was thus 0.73% of the weight of the leaves.

On repeated fractionation of the oil under atmospheric pressure the boiling range remained steady between 210° and 212°. The compound without further purification was analysed. [Found : C, 78.8 ; H, 8.1% ; Me, 17.4 ; M.W., 142 (freezing point depression method in benzene solution). $C_{10}H_{12}O$ requires C, 81.0 ; H, 8.0 ; Me, 20.90% ; M.W., 148].

Oxidation with 4% *Permanganate.*—To the compound (3 g.) 4% neutral $KMnO_4$ solution was added, first at room temperature and then at water-bath temperature until pink colour persisted. About 15 g. of permanganate were used up. On filtering, concentrating the filtrate and acidifying, a crystalline acid separated which crystallised from hot water in needles, m.p.183°. The equivalent weight was determined by titration with 0.025*M* alkali. [Found : Equiv., 152.8. $CH_3O.C_6H_4.COOH$ (m.p. 184°) requires equiv., 152].

Oxidation with ice-cold 1% *Permanganate.*—The compound was treated as described except that the temperature was kept throughout at 0°. An acid was obtained which crystallised from hot water in shining plates melting at 85-87°. [Found : Equiv., 166.9. $CH_3O.C_6H_4.CH_2.COOH$ (m.p. 85-87°) requires equiv., 166].

The Nitrosite.—The usual method of preparing a nitrosite by the action of sodium nitrite, acetic acid and hydrochloric acid on an unsaturated compound gave a poor yield in the present case. After a number of trials the following method was found to give a satisfactory yield.

The liquid compound (2 c.c.) was dissolved in petroleum ether (4 c.c.) and the solution was cooled to ice temperature. Amyl nitrite (5c.c.) and glacial acetic acid (6c.c.) were then added and finally 10 drops of strong hydrochloric acid were added, the whole being maintained

at 0°. The mixture was then allowed to remain at room temperature for two days. The nitrosite, which separated as almost a colorless crystalline mass, was filtered at the pump and weighed (0.35 g.). The crude nitrosite melted at 134° but on repeated washing with dry ether the melting point rose to 146° and could not rise further. It was then analysed. (Found : C, 53.2 ; H, 5.4 ; N, 13.3. $C_{10}H_{12}N_2O_4$ requires C, 53.5 ; N, 5.35 ; N, 12 5 per cent).

Conclusion

Although Bel and Kavit both belong to Rutaceæ family the essential oils from their leaves differ completely from one another regarding their chemical composition. The chief component of the latter oil is estragol (methyl chavicol) which constitutes about 90% of the oil. Estragol occurs in small proportion in Russian aniseed oil and its best source so far has been estragon oil in which it occurs to the extent of 60% to 75%, the yield of the oil itself being 0.3% on the weight of the entire branches (Grimaux, *Bull. soc. chim.*, 1894, *iii*, **11**, 34). The leaves of Kavit is now the richest source for the compound.

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