STUDIES IN INDIAN ESSENTIAL OILS.

VII. ESSENTIAL OIL FROM THE FLOWER-HEADS AND STALKS OF *CYMBOPOGON POLYNEUROS*, STAPF.

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The *Cymbopogon* grasses (N.O. *Gramineæ*) are characterised by the essential oils contained in their leaves, efflorescence or roots and several of these oils are products of commercial importance. The oil from *C. polyneuros*, Stapf., which occurs in the Western Ghats, especially in the Nilgiris, does not appear to have been examined and a genuine sample of grass having been obtained through the courtesy of the Forest Department, Madras, the opportunity was availed of, to examine the constituents of the oil. It is also stated to grow in Ceylon and in the island of Delft and appears to form excellent fodder for horses. According to Parry (*The Chemistry of Essential Oils and Artificial Perfumes*, 1921, 1, 63), the odour of the rubbed leaves is reminiscent of fennel or anise and the grass yields a volatile oil in 0.25 per cent. yield.

EXPERIMENTAL.

The grass was cut 6 inches above ground and included inflorescence and stalk (moisture, 27.0 per cent.); 174 lbs. yielded 218 g. oil or 0.38 per cent. on the dry grass, on distillation in steam. The oil was thoroughly dried over anhydrous magnesium sulphate and was reddish brown in colour, having a peculiar sweet odour, allied to that of ginger-grass oil. Table I gives analytical constants for the oil along with the values for four samples examined at the Imperial Institute (*Bull. Imp. Inst.*, 1912, 10, 30), the scanty data available indicating the samples to be similar.

TABLE I.

	Bangalore	Imperial Institute			
		1	2	3	4
Yield	0·38	0·20	0·34	—	0·32
d_{30}^{30}	0·9329	d_{15}^{15} 0·942	0·951	0·936	0·943
n_D^{30}	1·4922				
$(\alpha)_D^{30}$	+49·3°		+50·7	+55·2	+30·9
Acid value	4·8				
Ester value	58·5				
Acetyl value	124·9				
Alcohols as $C_{10}H_{18}O$	37·9	44·0	44·0	38·7	51·8
Absorption with 5 per cent. NaOH	Nil				

The oil (177 g.) was saponified with alcoholic potash washed free of alkali and dried over anhydrous magnesium sulphate. The saponified oil (165 g.), distilled under diminished pressure (4 mm.) using a four-pear Young's column, yielded the following fractions:—

TABLE II.

No.	B.P.	d_{30}^{30}	n_D^{30}	α_D^{30}	Weight in grams	Yield per cent.
1	45–53°	0·8579	1·4749	+100·1	15·5	9·5
2	53–63°	0·8731	1·4789	+ 88·4	15·5	9·5
3	63–80°	0·9223	1·4870	+ 61·4	19·0	11·5
4	80–88°	0·9460	1·4902	+ 40·1	19·5	11·8
5	88–90°	0·9496	1·4926	+ 40·9	31·5	19·2
6	90–95°	0·9525	1·4943	+ 24·2	16·8	10·2
7	100–140°	0·9762	1·5040	+ 20·8	16·0	9·9

In Fig. 1, physical constants are plotted against the percentage yield of the oil.

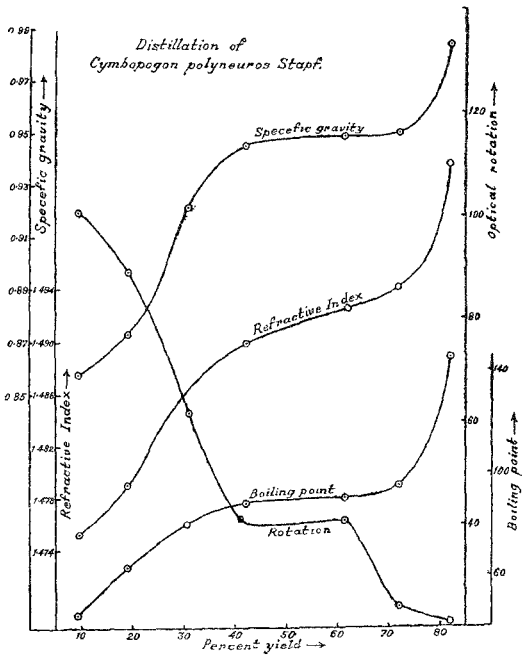

Fig. 1.

The first two fractions contained the greater part of the terpenes and were distilled at 32 mm. pressure over sodium with the following results:—

	B.P.	d_{30}^{30}	n_D^{30}	$(\alpha)_D^{30}$
a	79°	0·8458	1·4716	+108·4°
b	79–81°	0·8482	1·4727	+103·6°

d-Limonene tetrabromide.—The presence of *d*-limonene was confirmed by the preparation of its tetrabromide. Fraction *a* (2.5 g.)

was dissolved in glacial acetic acid (10 c.c.) and to the well-cooled solution an acetic acid solution of bromine (7 g.) was gradually added. The solid that separated was filtered off and recrystallised from ethyl acetate. It melted at 104° and had $[\alpha]_D^{\circ}$, +72·4°, in chloroform (c, 5·0); Br, 70.7 per cent.; $C_{10}H_{16}Br_4$ requires 70.2 per cent. The mixed melting point with an authentic specimen of *d*-limonene tetrabromide was identical. No other terpenes were identified.

d-*Perillic alcohol.*—Fractions 3–6 were mixed together and heated with phthalic anhydride at 130° for 3 hours. The alcohol (26 g.) liberated from the acid phthalic ester in the usual manner formed 15 per cent. of the oil and had the constants given under *c*:—

c	88–92°/3	0·9460	1·4940	+52·4°
d	94–96°/4·5	d_{20}^{20}0·964	n_D^{20}1·4996	—68·5°

d gives the constants for perillic alcohol from perillaldehyde (Simonsen, *The Terpenes*, 1931, 1, 263). The alcohol which failed to react with phthalic anhydride has not been identified.

d-*Perilla aldehyde.*—The presence of the alcohol was confirmed by oxidation to the corresponding aldehyde in the following manner:—To a well-cooled solution of the Beckmann's chromic acid mixture (15 c.c.), the alcohol (4.5 c.c.) was gradually added under stirring. The oxidation was completed by heating on a boiling water-bath for 30 minutes. It was extracted with ether and distilled at 10 mm. pressure, the following fractions being obtained:—

98–100°	0·9576	1·4950	
100–104°	0·9784	1·4990	+22·3°

Both the fractions reduced ammoniacal silver nitrate and yielded an identical semicarbazone m.p. 199° (*d*-perillaldehyde semicarbazone, m.p. 198–199°; Simonsen, *loc. cit.*): N, 19.7; $C_{11}H_{17}ON_3$ requires N, 20.3.

Sesquiterpene alcohol.—The higher boiling fraction from the portion which did not react with phthalic anhydride and fraction 7, Table II, were mixed and refractionated and a constant boiling fraction having the following properties was isolated; b.p. 148–153/9 mm.; d_{30}^{30}, 0.9571; n_D^{30}, 1.5170; C, 82.9; H, 10.0; $C_{15}H_{24}O$ requires C, 81.8; H, 10.9. It is not a pure sesquiterpene alcohol but appears to be still mixed up with a hydrocarbon. It failed to react with phthalic anhydride showing that the alcohol is tertiary. The product obtained on heating the alcohol with selenium had d_{30}^{30}, 0·9371; n_D^{30}, 1.4995 and contained neither cadalin nor eudalin.

SUMMARY.

The volatile oil from the grass, *Cymbopogon polyneuros*, Stapf., has been obtained in a yield of 0.38 per cent. and its analytical constants determined. *d*-Limonene and *d*-perillic alcohol have been found to be present in the oil.