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STUDIES ON THE SEED OIL OF ABRUS PRECATORIUS LINN

Part I.—Composition of Total Fatty Acids

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Oils of seven varieties of locally available *Abrus precatorius* seeds were examined and the fatty acid composition was determined qualitatively and quantitatively by GLC. As many as seventeen fatty acids have been identified in the oils of these seeds. IR spectra show no unusual features (conjugation, *trans* or α, β-unsaturation). Although the pattern of fatty acids was found to be quite similar in all the seven varieties, the amounts of some constituent fatty acids differed slightly, especially in three principal varieties, namely white, black and scarlet.

Abrus precatorius Linn (Jequirity), locally known as *ratti* or *ghungchi*, is a plant of the natural order *Leguminoseae* and suborder *Papillionaceae*. The plant is a perennial twiner with numerous stems and is a natural inhabitant of Indo-Pakistan subcontinent and other tropical countries.

The leaves, roots and seeds of *Abrus precatorius* are described as of medicinal value, an account of which has been given by Dymock.[1] The seeds have been used externally against granular conjunctivitis and various forms of skin diseases, ulcers and affections of the hair, but the most interesting and important property of the seeds is that, when taken internally by women, they disturb the uterine functions and prevent conception.

The seeds of *Abrus precatorius* have attracted much attention on account of their toxic and agglutinating properties,[2,3,4] and although the seed oil is reported to possess the antifertility activity,[5] very little work has been carried out on the fatty acid composition of the oil.[6] We have therefore, undertaken detailed gas chromatographic studies of the fatty acid composition of the oil of seven varieties of *Abrus precatorius* seeds available in the local market, and report their fatty acid composition in the present communication.

Materials and Methods

Seven varieties of *Abrus precatorius* seeds were obtained from the local market and graded as: (i) white seeds with no eye; (ii) yellowish seeds with brown eye; (iii) black seeds with no eye; (iv) dark brown seeds with black eye; (v) light brown seeds with black eye; (vi) scarlet seeds with black eye and (vii) vermilion shining scarlet seeds with black eye.

The seed coat was removed by coarse grinding and the kernel was ground into fine powder. The oil was extracted at room temperature with a mixture of chloroform–methanol (2:1 v/v), until all the oil was extracted. The solvent was distilled off, last traces being removed under vacuum.

Gas Liquid Chromatography.—Transesterification, of the glycerides to their methyl esters, was carried out according to the procedure of Nelson.[7] The esters were extracted with petroleum ether (b.p. 40°–60°C) and stored in screw-capped sample tubes in a refrigerator until analysed. The methyl esters were found to be suitable for chromatography without further purification.

The methyl esters were chromatographed on a Varian Aerograph model-600 gas chromatograph with a flame ionization detector. A stainless steel coiled column 5 ft 10 in long and 0.8 in outer diameter, containing 80 to 100 mesh Chromosorb W, coated with 20% DEGS (diethylene glycol succinate), was used for the regular packed column GLC. Nitrogen was used as carrier gas.

For all GLC determinations the gas flow was 25 ml/min; column temperature was 187°C; flash heater 250°C; and hydrogen flow rate 20 ml/min. The operating conditions were maintained constant throughout the analysis.

The identities of the individual fatty acids were achieved by co-chromatography with standard reference compounds; where standards were not available, the peaks were tentatively identified by comparing their relative retention times with known values,[8] or otherwise by plotting a log retention time curve against carbon number.[9]

Infrared Studies.—The thin film IR spectra of all these oils were taken on Beckman IR instrument. The spectra were more or less identical in having the usual absorptions at about 1725 cm^{-1} for the carbonyl and at 1150 cm^{-1}. There was a very slight indication of hydroxyl group in the region of 3300–3500 cm^{-1}. The oils did not show any absorption around 970 cm^{-1} indicating the absence of trans fatty acids.

Results and Discussions

Roxburgh has described three principal varieties of *Abrus precatorius*, namely white, black and scarlet. Apart from these varieties there are seeds of intermittent colours and if the colour of the seed coat be considered sufficient to constitute a variety there would be more than ten varieties of *Abrus precatorius* Linn.[10] In this investigation studies have been confined only to seven varieties of Abrus seeds available in the local market. In order to account for the differences in the age and the source of the seeds, three samples of each variety were collected from different stores and the results reported in the present paper are averages of three independent analyses.

Table 1 represents the various varieties of Abrus seeds and average percentages of their total oil on kernel basis. It may be seen that the level of fat was practically the same in all the varieties. Even the general pattern of the individual fatty acids is very much similar, as is evident from Table 2. In all, seventeen fatty acids have been observed. Difficulties were encountered in the resolution of arachidic acid and eicosenoic acid because of their close retention time. The data in Table 2 therefore, give combined percentage of these two acids.

The identities of these acids were confirmed by bromination[9] and potassium permanganate oxidation studies.[11] The peaks were almost completely eliminated following bromination and oxidative degradation, suggesting the presence of smaller proportions of arachidic acid as compared

TABLE 1.—SEED OILS FROM VARIOUS VARIETIES OF *Abrus precatorius* LINN.

No.	Variety and description		% Oil
1	White	without eye	1.5
2	Yellow	with brown eye	1.6
3	Black	without eye	1.3
4	Dark brown	with black eye	1.9
5	Light brown	with black eye	1.8
6	Scarlet	with black eye	1.7
7	Vermillion	with black eye	1.4

TABLE 2.—FATTY ACID COMPOSITION OF SEED OILS OF SEVEN VARIETIES OF *Abrus precatorius* LINN.

(Weight Percentage of Total Fatty Acids)

Name of variety	$C_{14:0}$	$C_{15:0}$	$C_{16:0}$	$C_{18:0}$	$C_{20:0}$	$C_{22:0}$	$C_{24:0}$	$C_{16:1}$	$C_{18:1}$	unknown	$C_{18:2}$	$C_{18:3}$	$C_{20:0}$ $C_{20:1}$	unknown	$C_{20:2}$	$C_{20:3}$	$C_{22:1}$	$C_{22:2}$
White	tr	tr	9.8	1.4		6.5	1.0	1.0	47.4	1.3	5.6	1.0	20.6	1.2	x	2.9	0.3	x
Yellow	tr	tr	9.3	1.9		5.0	0.7	0.6	56.3	0.8	3.5	1.1	18.7	0.8	tr	0.4	0.3	0.5
Black	tr	tr	6.6	3.6		7.4	4.0	1.0	47.8	2.1	4.7	2.5	16.9	0.8	0.7	0.6	x	1.3
Brown (dark)	tr	tr	10.2	2.6		5.6	0.3	0.5	59.2	1.1	2.2	1.4	15.7	0.3	x	x	0.9	x
Brown (light)	tr	tr	8.3	2.7		5.8	tr	1.1	58.7	1.4	3.1	2.0	15.0	0.4	0.5	0.5	0.5	x
Scarlet	tr	tr	7.3	3.7		5.9	1.4	0.6	49.2	0.8	3.6	2.6	18.3	1.6	x	1.4	1.8	1.8
Vermillion	tr	tr	7.0	2.9		4.8	tr	1.0	54.2	0.8	3.8	4.4	18.8	0.9	x	0.5	0.9	tr
Scarlet from India Mandiratta and Dutt[6]	x	x	1.07	4.65	5.09	4.42	2.53	x	46.02	x	12.64	18.49	x	x	x	x	x	x

*tr = present in traces; x = not detectable

to the eicosenoic acid. Studies done by Lefar *et al.*[13] on the seed lipids of *Abrus precatorius* also indicated a small amount of arachidic acid (0.6%) in the hexane fraction and its absence in the ether fraction of the lipid extracts.

The percentage of saturated fatty acids varied from 14.7 to 21.7 and those of the unsaturated acids from 78.4 to 85.3 (Table 2). Amongst the most prominent saturated acids, palmitic ranges from 6.6 to 12.2% and behenic from 4.8 to 7.4%. Oleic, linoleic and eicosenoic acids ranging from 47.4 to 59.2; 2.2 to 5.6 and 15.1 to 20.6% respectively are prominent unsaturated acids. Although in small amounts, linolenic acid is also present in all the seven varieties of *Abrus precatorius*.

The effect of environmental conditions on the fatty acid composition of *Abrus precatorius* becomes quite evident when the oils of scarlet variety from Pakistan and India are compared (Table 2). With the exception of stearic, behenic, lignoceric and oleic acids, the values of other fatty acids differ markedly. Mandiratta and Dutt[6] reported much lower values for palmitic and eicosenoic acids and correspondingly higher values for linoleic and linolenic acids. A similar observation has been made by Baker *et al.*[13] on *Phaseolus mungo* from Manchuria and West Pakistan. It is, however, interesting to note that as against the eight fatty acids observed by Mandiratta and Dutt in the scarlet variety, more than seventeen fatty acids were observed in the present study. This is probably due to the greater resolution power of gas chromatography than the techniques used by them. The composition of fatty acids reported by Lefar *et al.*[12] was limited to one variety only, and on account of the use of different solvents for extraction of the lipids of Abrus seeds, our data could not be compared with the data obtained by these workers.

Apart from the three principal varieties white, black and scarlet—the other four varieties studied, seem to be intermediary between three principal varieties on comparison of their component fatty acids. Such variations have also been observed in the other seeds. Earle *et al.*[14] found that eight species of genus *Crepis* fall into three groups differing in chemical composition and that within each group the oils were similar chemically. Collins *et al.*[15,16] demonstrated that oleic, linoleic and linolenic acid contents of soya bean oil varied from one variety to another. The same is undoubtedly true of the seven varieties of abrus seeds, where the percentage of different fatty acids vary from one variety to another.

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