Phytochemistry, 1970, Vol. 9, pp. 1355 to 1357. Pergamon Press. Printed in England.

VOLATILE COMPONENTS OF *FEIJOA* FRUITS

P. J. HARDY and B. J. MICHAEL

C.S.I.R.O. Division of Horticultural Research, Private Bag 1, Glen Osmond, South Australia 5064, Australia

(*Received* 6 *November* 1969)

Abstract—Methyl benzoate and ethyl benzoate together made up over 90 per cent of the total volatile oil of *Feijoa* fruits. Other compounds identified were 3-octanone, ethyl butanoate, ethyl cinnamate, ethyl acetate, hexenyl acetate, 2-hexenal, 2-heptanone, 2-nonanone, 2-undecanone, methyl *p*-anisate, and ethyl *p*-anisate. Hexenyl propionate and hexenyl benzoate were tentatively identified. A predominant role in the aroma of *Feijoa* fruits is ascribed to methyl and ethyl benzoate.

INTRODUCTION

Feijoa sellowiana Berg (Myrtaceae) is a shrub native to South America and is a close relative of the guava (*Psidium guajava* L.). It is grown in tropical or sub-tropical countries for its fruit, which is consumed either fresh or processed. The present study was undertaken to identify the factors responsible for the strong and distinctive aroma of the fruit.

RESULTS AND DISCUSSION

When the *Feijoa* fruit volatiles were examined by smelling at the outlet of the gas chromatography column, it was noticed that a strong *Feijoa*-like aroma was associated with the two major peaks in the chromatogram (Fig. 1: peaks 14, 15), which were identified as methyl benzoate and ethyl benzoate. Both esters have a similar odour, although that of the methyl ester is somewhat stronger, and it is concluded that these two compounds have a predominant role in the aroma of *Feijoa* fruits. Most of the minor components also had strong fruity or floral odours, which probably add to the effect of the benzoate esters.

Although benzoate esters have been detected in other fruits, the *Feijoa* is the only fruit so far examined in which benzoate esters are the major aroma compounds. Ethyl benzoate has been reported as a minor component of peaches[1] and Muscat grapes,[2] and both methyl and ethyl benzoates occur as traces in black currants.[3,4] Ethyl benzoate occurs in the essential oil of *Nepeta leucophylla*[5] and methyl benzoate in heartwood extracts of *Pinus banksiana* Lamb[6] and in the essential oil of *Cananga odorata*.[7] The *Feijoa* fruits contained several other esters of aromatic acids which have not been reported previously in fruits. Mass spectra of methyl *p*-anisate (peak 21) and ethyl *p*-anisate (23) are shown in Fig. 2. Methyl *p*-anisate has been found in a phenolic acid fraction from slash pine bark.[8] Ethyl cinnamate (peak 24), ethyl acetate (2), ethyl butanoate (3) and other benzoate esters were also observed in the *Feijoa* extract.

[1] M. R. SEVENANTS and W. G. JENNINGS, *J. Food. Sci.* **31**, 81 (1966).
[2] K. L. STEVENS, J. BOMBEN, A. LEE and W. H. MCFADDEN, *J. Agr. Food. Chem.* **14**, 249 (1966).
[3] J. ANDERSON and E. VON SYDOW, *Acta Chem. Scand.* **18**, 1105 (1964).
[4] H. E. NURSTEN and A. A. WILLIAMS, *J. Sci. Food. Agr.* **20**, 91 (1969).
[5] G. N. GUPTA, *Soap Perfumery Cosmetics* **37**, 45 (1964).
[6] E. RUDLOFF and A. SATO, *Can. J. Chem.* **41**, 2165 (1963).
[7] Y. R. NAVES and P. ARDIZIO, *Helv. Chim. Acta* **47**, 111 (1964).
[8] W. F. ERMAN and W. I. LYNESS, *Tappi* **48**, 249 (1965).

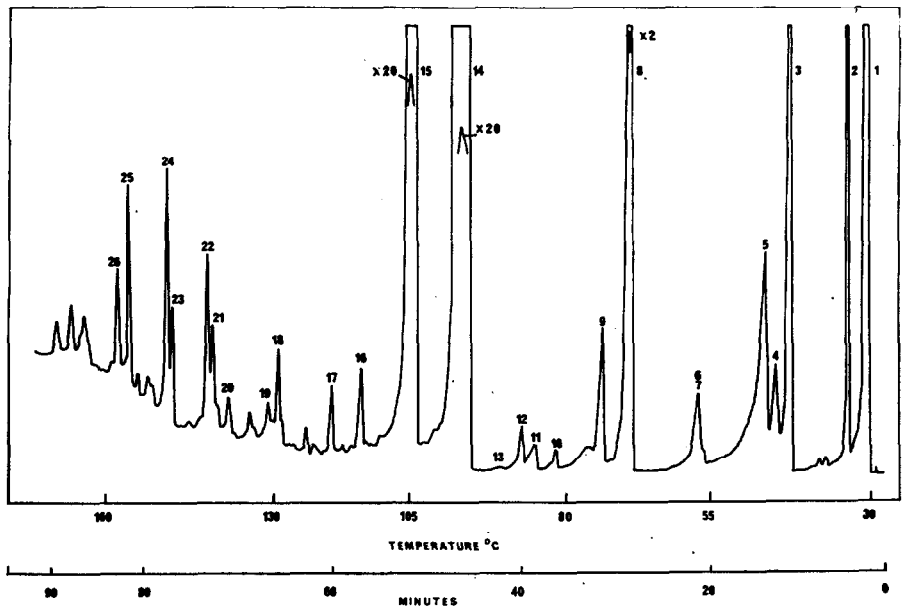

FIG. 1. CHROMATOGRAM OF VOLATILES FROM *Feijoa* FRUITS. FOR IDENTITIES OF COMPONENTS SEE TABLE 1.

TABLE 1. IDENTITIES OF *Feijoa* VOLATILES (SEE FIG. 1)

Peak number	Identity or mass spectral data
1	Solvent
2	Ethyl acetate
3	Ethyl butanoate
4	Unknown: major peaks at *m/e* 29, 45, 31, 91, 27
5	Hexenal
6	2-Hexenal
7	2-Heptanone
8	3-Octanone
9	Hexenyl acetate
10	Hexenyl propionate (tentative)
11	2-Nonanone
12	Unknown: 55, 111, 93, 81, 174 (P)
13	Unknown: base peak 68
14	Methyl benzoate
15	Ethyl benzoate
16	2-Undecanone
17	Unknown: 69, 41, 114, 123, 82, 182 (P)
18	Unknown: 104, 91, 105, 107, 178 (P)
19	105, 161, 119, 204 (P), 134 probably a sesquiterpene hydrocarbon
20	Similar to peak 19
21	Methyl *p*-anisate
22	Major peaks 205, 220 (P), possibly di t-butyl methyl phenol
23	Ethyl *p*-anisate
24	Ethyl cinnamate
25	Hexenyl benzoate (tentative)
26	Similar to peak 22

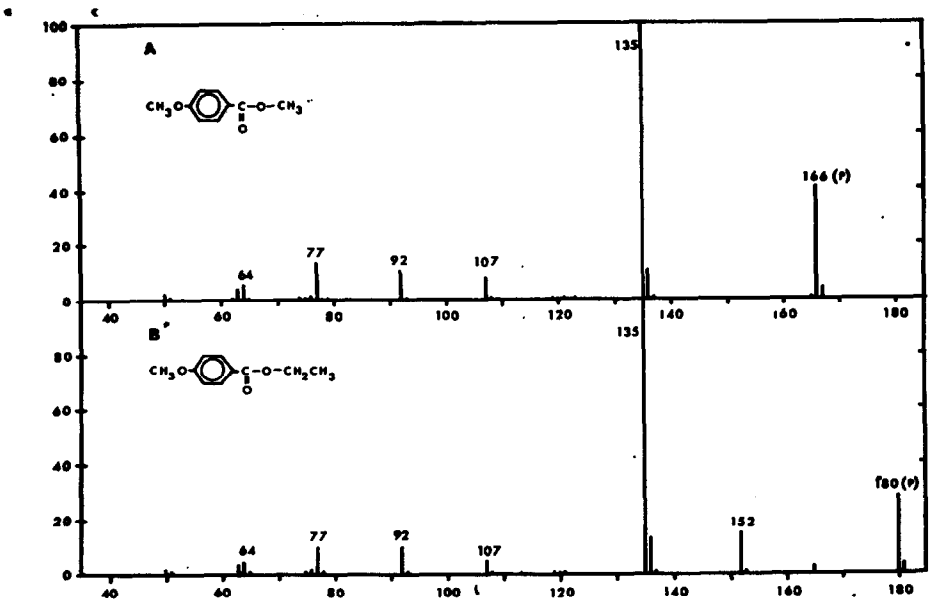

FIG. 2A. MASS SPECTRUM OF METHYL *p*-ANISATE (PERKIN–ELMER–HITACHI MODEL RMU 6D DOUBLE FOCUSING MASS SPECTROMETER).

Prominent metastable peaks occur at *m/e* 84·8 (135 → 107); 109·7 (166 → 135); 55·5 (107 → 77).

FIG. 2B. MASS SPECTRUM OF ETHYL *p*-ANISATE.

Prominent metastable peaks at 84·8; 128·5 (180 → 152); 55·5.

Several carbonyl compounds were identified, the major ketone being 3-octanone which represented about 5 per cent of the total volatile oil. Also present were 2-heptanone, 2-nonanone, 2-undecanone and 2-hexenal. According to Pattabhiraman, Rao and Sastry[9] the aroma of guava may be attributed mainly to carbonyl compounds. Mass spectra of some of the unidentified substances in *Feijoa* indicated the presence of sesquiterpene hydrocarbons (peaks 19, 20) and other cyclic structures (peaks 22, 26).

EXPERIMENTAL

Three *Feijoa* fruits (100 g) were homogenized with 150 ml distilled water in a Waring Blendor for 2 min at full speed. The homogenate was distilled *in vacuo* using a rotary evaporator at 40° until distillation ceased. The receiving vessel and condenser were cooled with water at 0–1°. The distillate (150 ml) was shaken in a separatory funnel with 3 × 30 ml portions of once-redistilled trichlorofluoromethane,[10] and the combined extracts concentrated[10] until no further solvent could be removed.

A 1·5 μl aliquot of the concentrate was analysed using a combined gas chromatography–mass spectrometry apparatus[11] using a Perkin–Elmer support-coated open tubular column (Ucon Oil LB-550-X stationary phase) with operating conditions as previously described.[12] Compounds were identified by comparison of the mass spectra with published data where available[13–15], and by co-chromatography with authentic specimens.

Acknowledgements—Help from Dr. E. M. Emery, Dr. J. H. Bowie and Mr. A. G. Thornton is gratefully acknowledged.

[9] T. R. PATTABHIRAMAN, P. RAO and L. V. L. SASTRY, *Perfumery Essent. Oil Record* **58**, 733 (1968).
[10] P. J. HARDY, *J. Agr. Food Chem.* **17**, 656 (1969).
[11] W. STARK, J. F. SMITH and D. A. FORSS, *J. Dairy Res.* **34**, 123 (1967).
[12] P. J. HARDY, *Phytochem.* **9**, 709 (1970).
[13] A. CORNU and R. MASSOT, *Compilation of Mass Spectral Data*, (1958), Heyden and Son Ltd., London.
[14] E. M. EMERY, *Anal. Chem.* **32**, 1495 (1960).
[15] A. G. SHARKEY, JR., J. L. SCHULTZ and R. A. FRIEDEL, *Anal. Chem.* **28**, 934 (1956).