internal evidence of a derivation from simple leaves. One exception, the Quiinaceae, has already been commented on. The only other major exception is the Leguminosae in which the evidence is consistent with the persistence of compound leaves since the glossopterid phase of evolution.

The fourth example, *Sagenopteris* from the Caytoniales, is of a leaflet from a compound digitate leaf with a venation pattern representing an evolutionary stage between that of *Gangamopteris* and *Glossopteris*. The midrib is poorly developed, being a loose aggregation of parallel veins, and the principal vein islets are of the hydroid type which in the evolutionary sequence is one of the first to appear in *Gangamopteris*. Moreover, these vein islets run almost parallel with the midrib, whereas in the more advanced species of *Glossopteris* the principal vein islands along the midrib are of arcuate, angular or deltoid types and they make angles of about 70°–80° with a compact well formed midrib. The latter three types of vein island are the most advanced elements in the glossopterid syndrome. They must carry considerable weight in assessing probable angiosperm affinities with the Glossopteridae, for they occur in several angiosperm families in a similar relationship to the midrib of a simple (not a compound) leaf. Unless it can be shown that the more advanced types of vein island occur in the same kind of relationship in the other four orders of gymnosperms, the claim of Alvin and Chaloner that "on venation pattern alone there is no closer similarity between *Glossopteris*-like angiosperms and *Glossopteris*" than between these and the other major taxa cannot be maintained.

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1 Melville, R., *Nature*, **188**, 14 (1960).
2 Plumstead, E. P., *Trans. Geol. Soc. South Africa*, **59**, 211 (1956).
3 Plumstead, E. P., *Trans. Geol. Soc. South Africa*, **55**, 281 (1952).

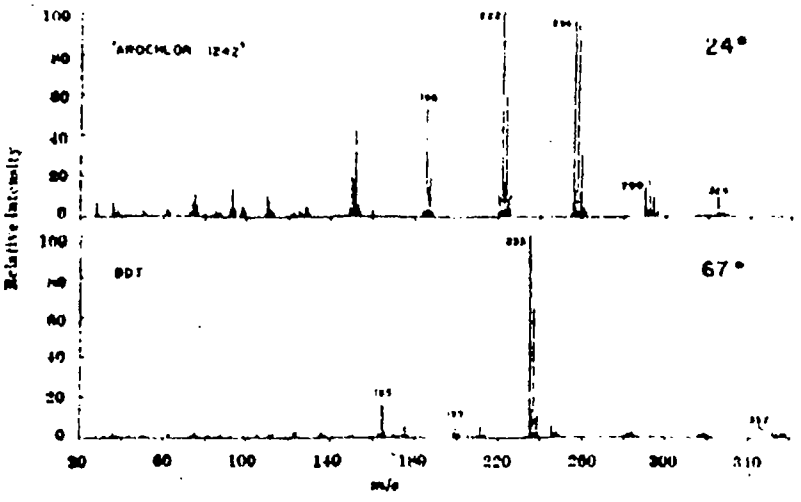

Fig. 1. 70 eV mass spectra (C.E.C. 21-110B instrument) of a 1 : 1 mixture of 'Arochlor 1242' and DDT at different sample temperatures. Isotope clusters at *m/e* 222, 256, 290 and 324 result from individual components of 'Arochlor'; the group of peaks at *m/e* 198 are mainly fragment ions from this substance.

Identification of Polychlorinated Biphenyls and DDT in Mixtures by Mass Spectrometry

Recently it was recognized that certain chlorinated aromatic compounds, particularly polychlorinated biphenyls (PCBs), are found in natural samples as pollutants[1-3]. PCBs interfere with the analysis for chlorinated pesticides because some of the PCB components from the technical mixture have identical retention times and response to the electron capture detector[3-5].

Although combined gas chromatography–mass spectrometry for detection of PCBs from natural samples has been described[6], the use of mass spectrometry, particularly high resolution techniques, for the unambiguous identification of PCBs in the presence of chlorinated pesticides without previous separation[6] has not been reported.

We have recorded the mass spectra of a commercial sample of PCB ('Arochlor 1242') in different conditions and obtained high resolution measurements to confirm the molecular formulae of major components. The peaks arising from the individual major components of the mixture were as follows. $C_{12}H_7Cl_3$: found, 222·0000; calc., 222·0000. $C_{12}H_6Cl_4$: found, 225·9614; calc., 255·9610. $C_{12}H_5Cl_5$: found, 289·9220; calc., 289·9220. $C_{12}H_4Cl_6$: found, 323·8829; calc., 323·8830. (The experimental error is within ± 2 p.p.m. in all cases.) These can easily be distinguished from major peaks found in the most common chlorinated insecticides (Fig. 1 and refs. 6–13) by their position, peak pattern arising from the chlorine isotopes and particularly high resolution measurements. Furthermore, a useful spectrum of 'Arochlor 1242' can be obtained at low temperatures by direct introduction with the aid of a temperature controlled probe[14], and fractional sublimation from many chlorinated pesticides directly in the ion source seems possible (see Fig. 1).

Techniques for identification of trace quantities of PCBs and chlorinated insecticides in crude natural samples and their semiquantitative determination by mass spectrometry as well as the chemical characterization of major constituents of PCBs are being developed.

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1 Jensen, S., Johnels, A. G., Olsson, M., and Otterlind, G., *Nature*, **224**, 247 (1969).
2 Risebrough, R. W., Riecke, P., Peakall, D. B., Herman, S. G., and Kirven, M. N., *Nature*, **220**, 1098 (1968).
3 Reynolds, L. M., *Bull. Environ. Contam. Toxicol.*, **4**, 128 (1969).
4 Risebrough, R. W., Riecke, P., and Olcott, H. S., *Bull. Environ. Contam. Toxicol.*, **4**, 192 (1969).
5 Widmark, G., *J. AOAC*, **50**, 1009 (1967).
6 Lovins, R. E., *J. Agric. Food Chem.*, **17**, 443 (1969).
7 Mumma, R. O., and Kantner, T. R., *J. Econ. Entomol.*, **60**, 401 (1966).
8 Kantner, T. R., and Mumma, R. O., *Residue Rev.*, **16**, 128 (1966).
9 Jöns, J., Spitteler-Friedmann, M., and Spitteler, G., *Pflanzenschutzberichte*, Sonderheft 157 (1967).
10 Damico, J. N., Barron, R. P., and Ruth, J. M., *Org. Mass Spectrom.*, **1**, 331 (1968).
11 Damico, J. N., Barron, R. P., and Spiro, J. A., *J. Mass Spectrom. Ion Phys.*, **2**, 161 (1969).
12 Mumma, R. O., *Abst. 157th Meeting Amer. Chem. Soc., Div. Agric. Food Chem.*, **22** (1969).
13 Spiro, J. A., and Damico, J. N., *Org. Mass Spectrom.*, **3**, 51 (1970).
14 Jamieson, W. D., and Mason, P. G., *Rev. Sci. Instrum.* (in the press).

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