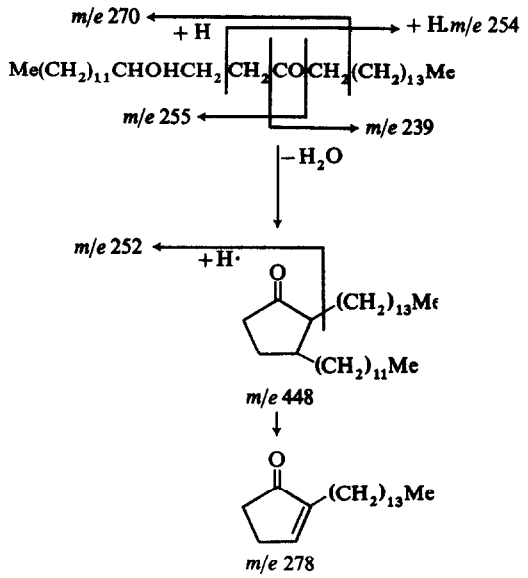

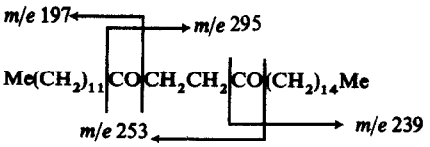

Oxidation of (1) with Jones reagent afforded a diketone (2); mp 85°, $C_{31}H_{60}O_2$ [*m/e* 464 (M^+)], no OH in IR. MS shows expected fragmentation for assignment as hentriacontone-13,16-dione.

The MS of (1) is complex and we cannot interprete it fully, but from a distinct peak at *m/e* 239, we concluded that the compound is 13-hydroxyhentriacontan-15-one. This conclusion is supported by some other peaks, as shown in the following scheme, along with a peak at *m/e* 58 (characteristic of dialkyl ketones).

REFERENCE

1. Hayashi, N. (1969) *J. Sci. Hiroshima Univ., Ser.* A-11 **33**, 107.

Phytochemistry, 1977, Vol. 16, pp. 1043–1044. Pergamon Press. Printed in England.

TRANS-2,*CIS*-6-NONADIENAL AND *TRANS*-2-NONENAL IN CUCUMBER FRUITS

J. SEKIYA, T. KAJIWARA and A. HATANAKA
Department of Agricultural Chemistry, Yamaguchi University, Yamaguchi 753, Japan

(*Received* 14 *January* 1977)

Key Word Index—*Cucumis sativus*; Cucurbitaceae; cucumber fruit; ripening stage; *trans*-2,*cis*-6-nonadienal; *trans*-2-nonenal.

In previous work [1, 2] were reported the biosynthesis of *trans*-2,*cis*-6-nonadienal (1) and *trans*-2-nonenal (2) via *cis*-3,*cis*-6-nonadienal and *cis*-3-nonenal from linolenic and linoleic acids, respectively, using cucumber fruits. The present paper reports the formation of (1) and (2) by homogenates prepared from cucumber fruits at different ripening stages.

As shown in Fig. 1, mid-ripening fruits (300–400 g), which were the harvesting size, produced 1.0–1.6 mg/kg of 1 and *ca* 0.2 mg of 2, while small growing-fruits, less than 250 g in weight, produced only 0.5 mg/kg of 1 and less than 0.1 mg of 2. Thus, the activity of C-9 aldehyde formation was closely related to the ripening stage of the fruits, though the amounts of 1 and 2 were not parallel to ripening stages (fr. wt and fruits length). The amounts of C-6 aldehyde (*trans*-2-hexenal and *n*-hexanal) were less than 10% of C-9 aldehyde in each case.

Substrate specificity for C-9 aldehyde formation is shown in Table 1. Linolenic, linoleic and γ-linolenic acids were converted to the corresponding C-9 aldehydes (1 or 2), but methyl esters of linolenic and linoleic acids were converted to less than 10% of 1 or 2 from free fatty acids. No C-9 aldehydes were produced from triglycerides of linolenic and linoleic acids, oleic, stearic

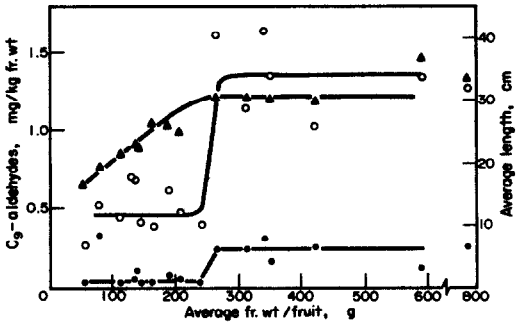

Fig. 1. Formation of *trans*-2,*cis*-6-nonadienal and *trans*-2-nonenal by homogenates of cucumber fruits prepared at different ripening stages. —○—; *trans*-2,*cis*-6-nonadienal (1), —●—; *trans*-2-nonenal (2), —▲—; average length of fruit.

Table 1. Substrate specificity for C-9 aldehyde formation by a homogenate of cucumber fruits

Substrate	Relative activities* *trans*-2,*cis*-6-Nonadienal (1)	*trans*-2-Nonenal (2)
Linoleic acid	0	100
γ-Linolenic acid	0	30
Linoelaidic acid	0	0
Methyl linoleate	0	4
Trilinolein	0	0
Linolenic acid	100	0
Methyl linolenate	6	0
Trilinolenin	0	0

* Activities are expressed relative to the amounts of 1 and 2 produced from linolenic and linoleic acids, respectively.

or palmitic acid by the homogenate. It is concluded that compounds with a *cis*-1,*cis*-4-pentadiene system and a free carboxyl group act as substrate [2–4].

EXPERIMENTAL

Plant material. Cucumber (*Cucumis sativus* L. cv Kurumechojitsuochiai) fruits grown in a greenhouse were used from April to May, 1976.

Preparation of essential oil and quantitative analysis of C 9 aldehydes. About 300 g of fr. cucumber fruits were used. The procedures were the same as described previously [2]. For substrate specificity, mid-ripening fruits were blended with substrate and then C-9 aldehydes were extracted and analysed by the same methods [2]. Homogenate without substrate was used as control. The *C-9* aldehyde producing activity was obtained from the amounts of 1 and 2 formed with substrate minus the amounts in a control.

REFERENCES

1. Kajiwara, T., Odake, Y. and Hatanaka, A. (1975) *Agr. Biol. Chem.* **39**, 1617.
2. Hatanaka, A., Kajiwara, T. and Harada, T. (1975) *Phytochemistry* **14**, 2589.
3. Galliard, T. and Phillips, D. R. (1976) *Biochim. Biophys. Acta* **431**, 278.
4. Galliard, T., Phillips, D. R. and Reynolds, J. (1976) *Biochim. Biophys. Acta*, **441**, 18.

Phytochemistry, 1977, Vol. 16, pp. 1044–1046. Pergamon Press. Printed in England.

FATTY ACID COMPOSITION OF FERN SPORE LIPIDS

ARMIN R. GEMMRICH
Abt. Allgemeine Botanik (Biol. II), Universität Ulm, Oberer Eselsberg, D-7900 Ulm (Donau), BRD

(*Received* 11 *February* 1977)

Key Word Index—Lycopodiaceae; Filicales; spores; fatty acids; chemotaxonomy.

Abstract—Fatty acid composition of lipids isolated from spores of different fern groups show differences between the families whereas species variations within the families are smaller. As in seed fats, the spore lipids are mainly triglycerides, with the exception of *Osmunda* where free fatty acids accumulate. The spore lipids contain as major components oleic, linoleic, and palmitic acid although those of the sporophylls contain C-20 polyunsaturated acids.

INTRODUCTION

Fern spores are haploid cells which are produced in large numbers during the diploid phase of the life cycle. They are, with the exception of the rare occurrence of adventitious bodies, the only organs of propagation in ferns. In this respect they are analogous to the seeds of higher plants. Like seeds they are equipped with a protective cover, the exine, to overcome periods of unfavourable conditions and contain storage material as energy source for germination and early development. In fern spores, reserve substances are mainly lipids [1–7] or proteins [8]. There is no report on carbohydrates as storage material. Although the lipid composition of fern sporophytes is well documented [9–15], only few data are available concerning the lipids of spores [3, 4, 7]. The fatty acid composition of some lipid storing fern spores were therefore examined so that comparisons could be made with the fatty acids of the sporophytes.

RESULTS AND DISCUSSION

The total amount of lipids and their fatty acid composition in spores of 17 fern species and one species of the Lycopodiales are shown in Table 1. The amount of lipids differs considerably, i.e. constituting 4% of the weight in *Ceratopteris thalictroides* and up to 79% in *Polypodium meyenianum*. A relatively high content is characteristic of spores of the two *Polypodium* species and for those of the Schizaeaceae. The small quantity in spores of *Ceratopteris* and *Osmunda* suggests that in these spores other sub-