# CHANGE OF TRIGLYCERIDE COMPOSITION OF CUCURBITACEAE AND *Taraxacum officinale* SEED OIL DURING RIPENING

**V. I. Deineka,[1] A. N. Maslov,[1] O. N. Borzenko,[1] A. A. Sirotin,[1] and L. A. Deineka[2]**

UDC 543.54:665.35

*The change of triglyceride composition in seeds of certain plants of the Cucurbitaceae family and* Taraxacum officinale *during ripening was studied by HPLC. A small decrease in the content of palmitic derivatives in Cucurbitaceae seed oil and a questionable change of the triglyceride composition of* T. officinale *seed oil were found. Data for the triglyceride composition were compared with calculations performed assuming an equally probable statistical distribution of fatty-acid radicals.*

**Key words:** HPLC, triglycerides, fatty acids, Cucurbitaceae, *Taraxacum officinale.*

Oils from plants of the Cucurbitaceae (gourd) family are interesting because of their high biological activity and the nascent industrial production (pumpkin, watermelon, and cantaloupe oils). It has been shown [1, 2] that the fatty-acid (FA) composition of most plants of this family is practically the same. However, seed oils of squash and certain pumpkin species differ in the oleic-acid content. On the other hand, the FA content of oils from several plants varies (at times substantially) depending on the duration of ripening and growing conditions [3-6].

This article presents data from investigations of the FA composition of seed oil during ripening using as examples plants from the Cucurbitaceae family: cucumber (*Cucumis sativus* L.), squash (*Cucurbita pepo* L. var. *giraumons* Duch.), pumpkin (*Cucurbita pepo* L.); and dandelion (*Taraxacum officinale* Web. subsp.) under conditions of Belgorod district. Seed oil of dandelion was selected as a sample that varies widely morphologically and genetically.

It has been found that the triglyceride (TAG) composition of squash seed oil 25 days after fruit setting differs insignificantly from 30- and 40-day specimens (Table 1). The same was true for the seed-oil composition of pumpkin and cucumber. The content of linoleic acid increases with ripening whereas that of oleic and saturated (palmitic and stearic) acids decreases (Table 2) although a decrease of unsaturation with ripening has been reported [3-6].

The situation is different for dandelion. Investigation of more than 40 samples of seeds in various stages of ripening found that the TAG and FA compositions of ripe and unripe seeds from a single population differed by 5-7 mol %. The unsaturation decreased in some instances and increased in others. No dependence on the humidity or lighting of the growth habitat was observed. The small quantity (from 1.6 to 3.5 mol %) of octadecatrienoic acids consisted of two isomers. A doubled signal (1:2 ratio) was observed in the range of linolenic—dilinoleic ($LnLe_2$) retention. The first signal corresponded to $\alpha$-linolenic; the second, $\gamma$-linolenic acid.

Direct determination of TAG by the method used with subsequent calculation of the FA composition enabled a reverse calculation of the TAG composition with a theoretical equally probable distribution (Table 3). The uncertainty of the double calculation (2-3% for $Le_3$) could not be accurately defined because of problems obtaining data using mixtures with a known ratio of pure TAG. However, it is obvious that the model of equally probable distribution is viable. In fact, the experimentally calculated content of trilinoleate is slightly less (by 0.9-3.0 rel. %) than theoretical. The theoretical values for dilinoleate—palmitate are slightly greater (by 20-30 rel. %) with a striking agreement of the linoleate—dipalmitate content in both versions of the calculations.

---

1) Belgorod State University, Belgorod, ul. Pobedy, 85; 2) Belgorod State Agricultural Academy, Belgorod Dist., Belgorod Region, Maiskii, ul. Vavilova, 1.

TABLE 1. Triglyceride Composition of Plant Seed Oils

| Triglyceride | Content, mol % (±0.1÷0.5) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Cucurbita pepo* L. var. *giraumons* Duch. | | | *Cucurbita pepo* | | *Cucumis sativus* L. | | *Taraxacum officinale* Web. subsp. |
| | Days from ovary | | | | | | | |
| | 25 | 30 | 40 | 25 | 40 | 20 | 30 | |
| $LnLe_2$ | 0.4 | 0.9 | 0.9 | 0.4 | 1.2 | 1.4 | 1.2 | *3.7-9.5 |
| $Le_3$+LnLeOl | 15.5 | 23.3 | 21.8 | 14.6 | 16.4 | 28.7 | 32.6 | *31.9-48.2 |
| LnLePa | 0.4 | 0.9 | 0.9 | 0.8 | 0.8 | 2.2 | 1.8 | *0.5-5.5 |
| $Le_2Ol$ | 15.5 | 19.5 | 19.7 | 18.6 | 19 | 9.0 | 11.3 | 15.7-23.4 |
| $Le_2Pa$ | 20.8 | 20.1 | 19.1 | 19.8 | 18.8 | 35.6 | 29.7 | 11.0-16.5 |
| $LeOl_2$ | 7.8 | 5.7 | 5.8 | 6.4 | 9.1 | 1.5 | 2.4 | 1.8-7.1 |
| $Le_2St$+LeOlPa | 18.2 | 15.9 | 15.8 | 22.3 | 18.7 | 9.8 | 13.1 | 6.6-11.0 |
| $LePa_2$ | 6.9 | 3.9 | 3.9 | 7.0 | 5.2 | 5.8 | 4.1 | 0.2-2.2 |
| $Ol_3$ | 1.7 | 0.9 | 0.5 | 2.5 | 1.0 | 1.1 | 0.3 | 0.1-3.3 |
| LeOlSt+$Ol_2Pa$ | 6.8 | 3.1 | 5.3 | 3.7 | 5.8 | 2.2 | 0.9 | 0.1-0.8 |
| LePaSt+$OlPa_2$ | 4.7 | 3.7 | 4.4 | 1.8 | 3.5 | 0.4 | 0.4 | 0.1-0.4 |
| $Ol_2St$ | 0.4 | 2.0 | 1.0 | 0.3 | 0.3 | 0.2 | 0.2 | 0.1-0.3 |

Acid radicals: Ln, $\alpha$-linolenic; Le, linoleic; Ol, oleic; Pa, palmitic; St, stearic.
*Total octadecatrienic acids.

TABLE 2. Fatty-Acid Composition of Plant Seed Oils

| Acid | Content, mol % (±0.5÷2.5) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Cucurbita pepo* L. var. *giraumons* Duch. | | | *Cucurbita pepo* | | *Cucumis sativus* L. | | *Taraxacum officinale* Web. Subsp. |
| | Days from ovary | | | | | | | |
| | 25 | 30 | 40 | 25 | 40 | 20 | 30 | |
| Linolenic | 0.4 | 0.9 | 0.8 | 0.3 | 0.9 | 1.9 | 1.6 | *1.4-5.0 |
| Linoleic | 55.3 | 62.5 | 61.3 | 56.4 | 57.9 | 68.1 | 70.8 | 67.2-79.4 |
| Oleic | 20.0 | 16.9 | 17.1 | 19.8 | 19.8 | 8.2 | 8.3 | 9.7-22.8 |
| Palmitic | 18.5 | 14.2 | 14.6 | 18.1 | 15.6 | 18.8 | 15.7 | 6.0-9.9 |
| Stearic | 5.8 | 5.6 | 6.1 | 5.1 | 5.7 | 2.2 | 2.8 | 1.1-2.8 |

*Total octadecatrienic acids.

TABLE 3. Comparison of Experimental and Calculated Compositions of Principal Triglycerides

| Triglyceride | Content, mol % | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Cucurbita pepo* L. var. *giraumons* Duch. | | *Cucurbita pepo* | | *Cucumis sativus* L. | | *T. officinale* | |
| | exp. | calc. | exp. | calc. | exp. | calc. | exp. | calc. |
| $Le_3$ | 21.8 | 22.7 | 16.4 | 19.4 | 32.6 | 35.5 | 44.7 | 46.4 |
| $Le_2Ol$ | 19.7 | 19.1 | 19.0 | 19.9 | 11.3 | 12.5 | 18.9 | 22.6 |
| $Le_2Pa$ | 19.1 | 16.3 | 18.8 | 15.7 | 29.7 | 23.6 | 13.0 | 10.8 |
| $LeOl_2$ | 5.8 | 5.4 | 7.2 | 6.8 | 2.4 | 1.5 | 4.1 | 3.7 |
| $Le_2St$+LeOlPa | 15.8 | 17.2 | 17.3 | 17.4 | 13.1 | 10.9 | 6.8 | 6.2 |
| $LePa_2$ | 3.9 | 3.9 | 4.2 | 4.2 | 4.1 | 4.1 | 0.8 | 0.8 |

## EXPERIMENTAL

Seeds from gourds were collected for analysis 5-10 days after appearance of ovaries; dandelion seeds (Belgorod Dist., summer 2002), from populations in different geographical regions (up to 60 km) and growth conditions (humidity, illumination).

The triglyceride composition of oils obtained by acetone extraction was studied. The triglycerides were abbreviated and FA compositions were calculated as before [2].

## REFERENCES


1. L. A. Deineka, N. G. Gabruk, V. I. Deineka, L. A. Manokhina, G. M. Fofanov, and A. N. Maslov, *Proceedings of the VIth International Scientific-Industrial Conference*, March 26-28, 2002, BSAA, 119 (2002).
2. V. I. Deineka, G. M. Fofanov, V. A. Khlebnikov, and L. N. Balyatinskaya, *Khranenie Pererab. Sel'khozsyr'ya*, No. 11, 20 (2002).
3. G. Griffiths and J. L. Narwood, *Biochem. Soc. Trans.*, **17**, No. 4, 688 (1989); *Ref. Zh. Biokhim.*, 6G1197 (1990).
4. S. G. Yunusova, G. A. Preobrazhenskaya, A. I. Glushenkova, and A. L. Markman, *Khim. Prir. Soedin.*, 424 (1973).
5. T. V. Khomova, S. D. Gusakova, Yu. M. Murdakhaev, and A. U. Umarov, *Khim. Prir. Soedin.*, 30 (1984).
6. G. A. Stepanenko, A. U. Umarov, and A. L. Markman, *Khim. Prir. Soedin.*, 513 (1974).