



## Fatty acid composition in *Carthamus* species

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### Abstract

Fatty acid composition of seven *Carthamus* species viz., *C. oxyacantha*, *C. tinctorius*, *C. palaestinus*, *C. glaucus*, *C. creticus*, *C. lanatus* and *C. turkestanicus* were assayed. Each species had undergone more than seven generations of self-pollination and was grown in Vertisols under dry conditions from October to May. Seeds were collected from plant-progenies of each species. Among the species, palmitic acid ranged from 5.7% and 9.7%, stearic acid was between 1.6% and 6.3% and oleic acid ranged from 11% to 68% while linoleic ranged from 61% to 82%. Considerable variation was observed within each species for these fatty acids. Linoleic acid was 72% in *C. creticus* while it varied from 61.4% to 68% in *C. glaucus*, 68.9% to 76.6% in *C. turkestanicus*, 64.4% to 76.8% in *C. lanatus*, 71.1% to 81.1% in *C. palaestinus*, 74.3% to 79.6% in *C. oxyacantha* and 34.4% to 82% in *C. tinctorius*. Among the wild species, highest content of oleic acid was recorded in *C. glaucus* (21.6%-23.4%). It was between 11.1% and 15.8% in *C. oxyacantha*, 11.3 % and 20.6% in *C. palaestinus*, 15.2% and 20.1% in *C. turkestanicus* and 15.1 % and 23.2% in *C. lanatus*. The indigenous accession of *C. lanatus* collected from Kashmir Valley, India possessed high contents of oleic acid (23.2%) and palmitic acid (9.7%). The exotic accession EC573367 of *C. tinctorius* recorded medium levels of oleic acid (48.4%-68.2%) and linoleic acid (36.4-44.8%). *C. glaucus* recorded the highest content of stearic acid (6.3%) with a range of 3.3% to 6.3%.

**Key words:** *Carthamus* species - fatty acid composition

### Introduction

The genus *Carthamus* is a member of the tribe Cynareae, sub-family Tubuliflorae and family Compositae and it contains about 25 species. These species are distributed from Spain and North Africa across the Middle East to Northern India and China (Harvey and Knowles 1965). Safflower (*Carthamus tinctorius* L.) is the only species from this genus that is commercially cultivated in over 20 countries (Esendal 2001). The reserve of oil and fatty acid composition in oilseeds is of particular interest to man and *Carthamus* species are a suitable example. Evaluation of the constituent fatty acids from these species can be found in limited reports (Demir *et al.* 1978, Khan *et al.* 1985, Carapetian and Zarei 2005). Hence, an attempt was made to study the variation in fatty acid composition in *Carthamus* species which have undergone more than seven generations of self-pollination.

### Materials and Methods

Seven *Carthamus* species viz., *C. oxyacantha*, *C. tinctorius*, *C. palaestinus*, *C. glaucus*, *C. creticus*, *C. lanatus* and *C. turkestanicus* were grown in Vertisols under dry conditions from October to May 2006 at ICRISAT-DOR farm. Each species had undergone more than seven generations of self-pollination. Seeds were collected from plant-progenies of each species at maturity. Fatty acids of these species were determined by gas chromatography after the preparation of their methyl esters. Safflower seed of individual species was crushed in a mortar and pestle and placed in a test tube and 4 ml of 0.5% sodium methoxide in methanol and 2ml hexane were added. After shaking, the test tubes were covered and left for 5 min at room temperature. The samples were then heated at 60 to 65°C for 20 min in a water bath to form methyl esters. These fatty acid methyl esters (FAMES) were subjected to gas chromatography analysis. A Thermo Focus GC fitted with a DB225 polar column (30m, 0.322mm, 0.25 $\mu$ ) and FID was used for the analysis of fatty acid composition. The temperature of oven, injectors and detector blocks were maintained at 210, 230 and 250°C respectively. Nitrogen was used as the



carrier gas. Peaks were identified by comparison with relative retention times of the standard FAMES. Concentration of each fatty acid was recorded by normalization of peak areas using GC post run analysis software, manual integration and reported as % of the particular fatty acid.

## Results and Discussion

### *Fatty acid composition of wild species*

Fatty acid composition of seven *Carthamus* species viz., *C. oxyacantha*, *C. tinctorius*, *C. palaestiuns*, *C. glaucus*, *C. creticus*, *C. lanatus* and *C. turkestanicus* were presented in the table 1. Among these species, palmitic acid ranged from 5.7% and 9.7%, stearic acid was between 1.6% and 6.3% and oleic acid ranged from 11% to 68% while linoleic ranged from 61% to 82%.

Table 1. Mean fatty acid composition in *Carthamus* wild species

Wild species	Fatty acid composition (%)			
	Palmitic	Stearic	Oleic	Linoleic
<i>C. oxyacantha</i>	7.61	2.31	13.84	76.23
<i>C. glaucus</i> (43/76)	7.10	3.28	21.61	68.01
<i>C. glaucus</i> (45/95)	8.86	6.33	23.40	61.41
<i>C. creticus</i>	8.84	3.03	16.04	72.09
<i>C. turkestanicus</i> (66/76)	6.31	1.92	15.18	76.60
<i>C. turkestanicus</i> (63/79)	8.45	2.52	20.09	68.94
<i>C. lanatus</i> (J & K)	9.72	2.74	23.17	64.37
<i>C. lanatus</i> (65/76)	5.94	2.11	15.12	76.83
<i>C. palaestinus</i> (EC521142)	6.03	2.26	20.57	71.14
<i>C. palaestinus</i> (PI235663-2)	6.02	1.68	11.25	81.06

Considerable variation was observed within each species for these fatty acids. Similar results were reported by Carapetian and Zarei 2005 in three wild species of *Cathamus*. Among the wild species, highest content of oleic acid was recorded in *C. glaucus* (21.6%-23.4%). The indigenous accession of *C. lanatus* collected from Kashmir Valley, India possessed high contents of oleic acid (23.2%) and palmitic acid (9.7%). *C. glaucus* recorded the highest content of stearic acid (6.3%). The exotic accession EC573367 of *C. tinctorius* recorded medium levels of oleic acid (48.4%-68.2%) and linoleic acid (36.4-44.8%).

Diversity analysis classified 30 accessions of *C. oxyacantha* collected from northwestern India (Anjani *et al.* 1999) into 9 distinct groups based on fatty acid composition (Fig.1.). The accession IP

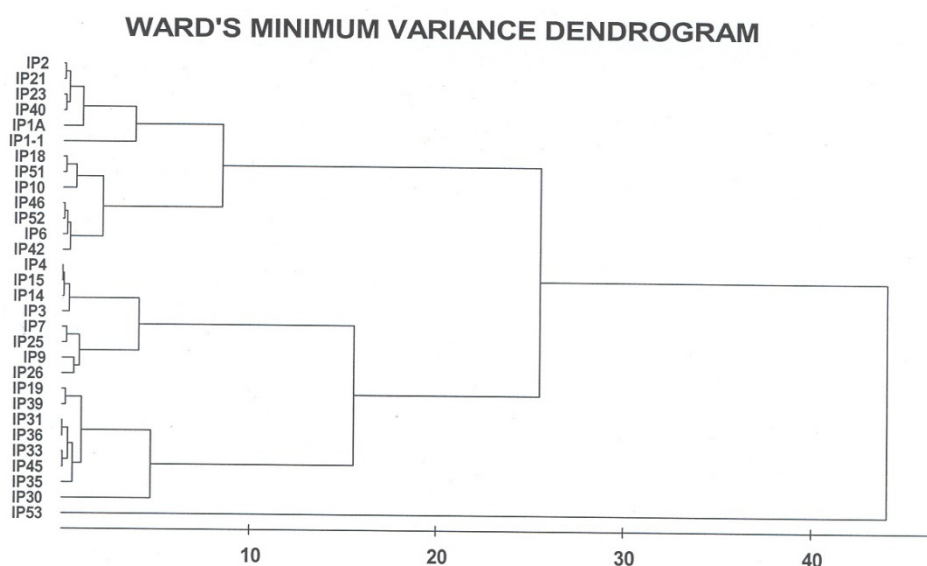


Fig. 1. Diversity in *C. oxyacantha* accessions for fatty acid composition

9 possessed highest linoleic content (81%) while IP 53, which alone formed a group, had the lowest linoleic content (60%) and highest oleic content (29.27%).

Thus, the present study reveals the existence of wide variability in the fatty acid composition of wild species of *Carthamus* and the indigenous accession of *C. lanatus* collected from Kashmir Valley, India possessed high contents of oleic acid (23.2%) and palmitic acid (9.7%).

### References

- Anjani, K., Yadav, W.S. and Duhoon, S.S. 1999. Safflower germplasm collecting in northwestern India. IPGRI Newsletter for Asia, The Pacific and Oceania 28: 8-9.
- Demir, I., Aydem, N. and Marquard, R. 1978. The fatty acid pattern and tocopherol content as differential characteristics of *Carthamus* species found in Turkey. *Angew Bot.*, 52:313-319.
- Esendal, E. 2001. Global adaptability and future potential of safflower. Proceedings of 5<sup>th</sup> International Safflower Conference. Williston, ND, USA, July 23-27, pp: 9-12.
- Harvey, B.L. and Knowles, P.F. 1965. Natural and artificial allopolyploids with 22 pairs of chromosomes in the genus *Carthamus* (Compositae). *Ca J. Genet. Cytol.* 7: 126-139.
- Carapetian, J and Zarei, G. 2005. Variation in Protein, Oil and Fatty Acid Contents in Three Wild Species of Safflower (*Carthamus*) from West Azerbaijan, Iran. *International Journal of Botany.* 1(2):133-137.
- Khan, S.A., Khan, K.H., Zaka, S., Waheed, I., Raie, M.Y. and Bhatti, M.K. 1985. Fatty acids from indigenous resources for possible industrial applications. Part VIII, Investigations of some species of Compositae family. *Pak. J. Sci. Ind. Res.*, 28: 400-402.