



# Evaluation of a Worldwide Collection of Safflower for Morphological Diversity and Fatty Acid Composition

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## Introduction

*Carthamus tinctorius*, family Compositae  
One of the important underutilized oilseed crops  
Self-pollination with less than 10% out-crossing  
Plant height varies from 30–90 cm  
Root depth is up to 300 cm  
120 frost-free days growing season  
Alternaria blight leaf spotting disease, Sclerotinia head rot, rusts

## Importance

Oilseed crop: Safflower oil contains two major fatty acids i.e. oleic acid and linoleic acid  
Dying purpose: Produces water-soluble yellow dye carthamidin, and a water-insoluble red dye carthamin

## Methodology Used

- Comprehensive germplasm collection
- Agro-morphological evaluation at Reinsdorf Goettingen
- Analysis of fatty acid composition
- Calculation of averages, correlation and analysis of variance
- Grouping of accessions into geographical provenances.
- Cluster analysis



Safflower (*Carthamus tinctorius*)

## Hypotheses

- Accessions from a specific region have a specific seed quality
- A large diversity is present in worldwide collection of safflower

## Objectives

- To assess diversity of agro-morphological traits and fatty acids
- To study the relationships between agro-morphological traits, fatty acids and geographical provenance

## Agro-morphology studied

Days to flowering      Head size  
Plant height          Branching pattern  
Spininess              Disease susceptibility  
Flower colour

## Fatty acids studied

Palmitic acid          Oleic acid  
Stearic acid          Linoleic acid

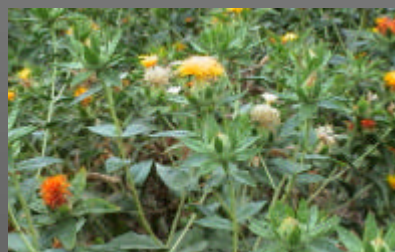
Dendrogram for 193 accessions produced by Cluster analysis based on agro-morphological traits and fatty acid composition (Euclidean distance as dissimilarity measure)

## Mean values and ranges of traits

Variables	Minimum	Maximum	Mean
Days to flowering	194	233	211
Plant height (cm)	50	130	90
Palmitic acid (%)	1.8	12.8	6.3
Stearic acid (%)	0.31	5.8	1.8
Oleic acid (%)	7.8	29.4	13.6
Linoleic acid (%)	61.2	83.5	76

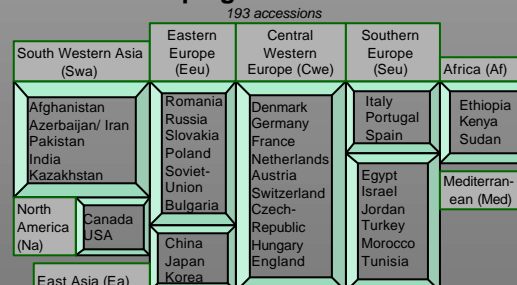
## Correlation between traits

Variables	Days to flowering	Plant height	Palmitic acid	Stearic acid	Oleic acid
Plant height	0.660**				
Palmitic acid	-0.003	-0.069			
Stearic acid	-0.171*	0.216**	0.230**		
Oleic acid	0.059	-0.036	0.298**	-0.103	
Linoleic acid	-0.081	0.019	-0.524**	-0.110	0.928**



Accessions with yellow, orange and white flowers

## Grouping of Accessions



## Analysis of variance

Source of variance	df	Variance components					
		Days to flowering	Plant height	Palmitic acid	Stearic acid	Oleic acid	Linoleic acid
Accessions	168	19.21**	121.5**	0.47**	0.13**	8.09**	13.94**
Between groups	7	6.14**	28.46**	0.08**	0.03**	1.42**	2.38**
Within groups	161	15.26**	101.6**	0.42**	0.11**	7.18**	12.44**
Ea	12	30.42**	86.54	0.42*	0.10	16.7**	22.06**
Swa	33	21.60**	116.8**	0.49**	0.15**	8.27**	17.80**
Eeu	13	30.40**	243.1**	0.79*	0.06	6.81**	14.53**
Cwe	41	5.24**	90.71**	0.26**	0.04	0.72*	3.21**
Seu	14	11.26**	136.9**	0.43**	-0.003	3.32*	12.41**
Med	21	7.81**	18.30	0.30**	0.09*	5.06**	9.76**
Af	8	34.10**	192.20*	0.56**	0.40**	13.4**	21.08**
Na	19	10.31**	31.58	0.50	0.16	16.6**	14.68**

\*, \*\*, + means significant at p<0.01, 0.05 and 0.10 respectively (F-test of corresponding mean squares)

## Main findings/conclusions

- Large variation in agro-morphological characteristics and fatty acid composition is available in germplasm evaluated
- The trait expressions were within the known range
- Variance was larger within geographical groups than between them
- There is no clear relationship between diversity pattern and geographical groups
- No clear patterns of plant types were detected by cluster analysis

## Prospects

Biodiversity in safflower germplasm points out that there is a large potential for the improvement of safflower for both agronomic and quality traits

## Acknowledgements

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