



Safflower genetic resources in India - an overview

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Abstract

The National Active Germplasm Site for safflower (*Carthamus tinctorius* L.) in India is located at the Directorate of Oilseeds Research, Hyderabad, India. The germplasm collection includes indigenous as well as exotic accessions representing most of the safflower growing regions of the world. For maintenance and multiplication, 2000 accessions out of the total holdings of over 6000 accessions are sown annually during the first fortnight of October. Safflower researchers from all over the country are invited to review the material and select lines useful for their breeding programs. The collection is being characterized and evaluated for 30 to 59 descriptors and wide variability has been recorded for some of the important traits viz. days to 50% flowering, plant height, number of primary branches and capitula, capitula size, seed weight and oil content. Multilocation testing and evaluation for different cropping situations is in progress. These include early sowing, late sowing in rice fallows, minimal irrigation and salt affected areas. Accessions possessing resistance/tolerance to important biotic stresses viz. aphids, *Alternaria* leaf spot, *Fusarium* wilt have been identified. The collection is being submitted for conservation in the Long Term Storage Facility (-20°C) at the National Gene Bank, National Bureau of Plant Genetic Resources, New Delhi, India in a phased manner.

Key words: Safflower – genetic resources – maintenance – characterization – evaluation

Introduction

Genetic resources form the basic inputs for crop improvement activities in any crop species. In India, the establishment of the Germplasm Management Unit (GMU) for Safflower (*Carthamus tinctorius* L.) in 1983 gave momentum to the organised and systematic collection, maintenance, evaluation, documentation and cataloguing of the rich genetic diversity of safflower. Initially set up at the headquarters of the Coordinating Unit of All India Coordinated Research Project on Safflower at Solapur (Maharashtra) India, this unit was shifted to the Directorate of Oilseeds Research (DOR), Hyderabad, India in 2001.

The Germplasm Management Unit at DOR is the major repository for safflower germplasm in India and has also been designated as the National Active Germplasm Site for safflower by the National Bureau of Plant Genetic Resources (NBPGR), New Delhi, India. The total holdings amount to over 6000 accessions, including indigenous accessions collected through exploration programmes and exotic accessions received through the National Bureau of Plant Genetic Resources.

Materials and Methods

Collection

Major efforts in the initial phases of germplasm management were centered around collection of all the exotic and indigenous accessions available with various centres working on safflower. Many exotic and indigenous collections maintained at National Bureau of Plant Genetic Resources (NBPGR) including the World Collection from USDA were also added to the collection. Explorations have been undertaken in collaboration with NBPGR since 1994 and landraces have been collected from different states of India.

Characterisation and evaluation

Systematic efforts were made by the Germplasm Management Unit to multiply, characterize and evaluate all the germplasm accessions. Extensive characterization and evaluation was carried out at Solapur (17° 14'N ; 75° 56'E) and subsequently at Hyderabad (17° 19'N ; 78° 24'E). Data



for each accession was recorded for 30 to 59 morphological descriptors and agronomic parameters.

Maintenance and conservation

About 2000 accessions are rejuvenated every year to maintain the viability of the accessions. To avoid loss of germplasm due to unforeseen climatic conditions, the activity of large-scale multiplication of these accessions and their deposition in the National Gene Bank at NBPGR has been started from 1998. More than half the collection has already been deposited in the National Gene Bank for long term storage.

Results

Among the accessions characterized, 88 per cent were spiny while the remaining were sparsely/non spiny. Considerable variability has been recorded for most of the quantitative traits evaluated (Table 1).

Table 1. Variability recorded for 7 quantitative traits in safflower germplasm collection

Important traits	Range	Variability for different traits	
		Range	Frequency of occurrence (%)
Days to 50% flowering	40-108	<50	0.01
		50-100	98.54
		>100	1.45
Plant height (cm)	16-144	<50	10.23
		50-100	87.31
		>100	2.46
Average number of primary branches	2-65	<20	98.54
		20-40	1.43
		>40	0.03
Average number of effective capitula	2-158	<10	6.21
		10-30	71.57
		31-50	16.59
		51-70	3.52
		71-90	1.49
		91-110	0.37
>110	0.25		
Diameter of main capitula at maturity (cm)	1-4.1	<2	27.59
		2-3.5	72.34
		>3.5	0.07
100 seed weight (g)	0.5-15.3	<4	32.20
		4-6	57.57
		6.1-8	9.14
		8.1-10	1.05
		>10	0.04
Oil content (%)	14.8-43.7	<25	21.07
		25.1-30	53.67
		>30	25.26

The accessions have also been screened for major insect pests and disease reactions and the resistant/tolerant lines have been identified. The collection includes 65 aphid tolerant lines, 118 *Alternaria* leaf spot tolerant accessions and more than 150 accessions exhibiting resistance to *Fusarium* wilt.



Since 1986, every year 150 germplasm accessions have been evaluated under different situations like normal *rabi* (October sowing), early *rabi* (sowing immediately after receipt of first soaking rains in September), late sowing (November) in rice fallows, minimal irrigation and salt affected conditions and a number of promising accessions have been identified (Table 2.).

Table 2. Promising accessions identified for various cropping situations

Situation	Number of accessions tested	Number of promising accessions identified
Normal <i>rabi</i>	2390	286
Early <i>rabi</i>	2312	292
Late sowing in rice fallows	2102	153
Minimal irrigation in black soils	2312	343
Salt affected area	1952	134

The characterization and evaluation data has been documented in 9 different catalogues. In addition, one more catalogue was brought out after evaluating 1,200 germplasm accessions, of interest to breeders for 13 different agronomically important attributes. Database for characterization and evaluation data has been created using MS Access for easy retrieval of information. A consolidated catalogue including information on all accessions characterized is under preparation.

Discussion

The characterization and evaluation of safflower germplasm has resulted in the identification of many promising accessions for different traits. These have been used by breeders for the development of new varieties which have been released for cultivation in India (Hedge *et al.*, 2004). Recently, information has been generated on the use of molecular markers for genotyping safflower cultivars (Sehgal and Raina, 2005) as well as for characterization of safflower germplasm (Johnson *et. al.* 2007). Future activities of the Germplasm Management Unit include the incorporation of these advanced tools to develop more efficient germplasm management and utilization systems.

References

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