

SUNFLOWER (*Helianthus annuus*) (2n=34)

It is an important oil seed crop. Oil content ranges from 46-52 per cent and is of high quality having non-cholesterol properties.

Origin: America

Distribution: USSR, Romania, Canada, USA In India this crop is introduced in 1969 from USSR. In India it is cultivated in Tamil Nadu Karnataka, Maharashtra and Andhra Pradesh, Punjab and Haryana

Progenitors: *Helianthus petiolaris*
H. giganteus

Wild species: *H. hirsutus*
H. rigidus

The genus *Helianthus* comprises of 67 species. Two species *H. annuus* and *H. tuberosus* are cultivated as food plants genus has basic chromosome number of 17 and diploid, tetraploid and hexaploid species are found.

Cultivars of sunflower:

Giant types: 6 - 14 feet tall. Late maturing, Large heads 12 - 30" in diameter, seeds large, white or grey or with black stripes. Oil content is very low.

E.g. Mammoth Russian.

Semi dwarf varieties :

Medium tall - 4 ½ to 6 feet, Early maturing. Heads 7 - 9" in diameter. Seeds smaller, black, grey or striped. High oil content 35%. E.g. Jupiter, Pole star.

Dwarf types

2 to 4½ feet tall. Early maturing. Head size 5½ - 6½ " diameter. Small seeds, high oil content 37%.

E.g. Sunrise, Morden, Co1, Co2

Breeding objectives

To develop short duration varieties suitable for dry land and irrigated conditions .

Dryland successful in black soils only. In red soil under rainfed it is not successful.

Breeding varieties with high oil content :

Ranges 38 to 48%. Complex character yield and oil content are negatively correlated. To increase oil content the shell must be thin.

Breeding for self fertile lines.

Protoandry and self incompatibility mechanism operates in sunflower. Hence hand pollination is necessary. To avoid this self fertile lines can be evolved.

Breeding for disease resistance.

Maharashtra hybrid susceptible to powdery mildew. Hence ban is there.
Powdery mildew, rust, charcoal rot, *Alternaria*. Wild species like *H.hirsuta* are moderately resistance to *Alternaria*.

Resistant to pest : Heliothis , Grass hopper Jassids.

Breeding Methods

Introduction : Morden from Canada.

Mass selection: Ec 68414 from Russia. Co1 mass selection from Morden.

Useful for characters which are highly heritable.

E.g. Plant height, disease resistance.

Hybridization and selection a) Intervarietal :

b) **Interspecific :**

Wild species of North American origin and best Soviet varieties were crossed and number of varieties were evolved

Mutation

Co3 (Mutant from Co2 thro' gamma rays)

Head to row and remnant seed method

Developed by **Pustovoit** in Russia. By this method oil content is increased.

In this method the following are the steps:

From open pollinated type a large no (10,000 to 12,000) plants are selected based on Head size. The selected lines are analysed for oil content and high oil content lines are isolated (1000 plants). Part of the seed reserved and the part is sown in progeny rows along with check to estimate yield.

Second season testing is also done. The best lines are identified.

The remnant seed of elite plants which give high yield were raised in isolation and multiplied for crossing *interse* next season. The multiplied lines also tested for oil content and high yielding high oil content lines were raised in isolation and crossed *interse*.

Population improvement

By mass selection, recurrent selection and use of male sterile lines population can be improved and utilised for breeding.

Heterosis breeding :

Development of inbred lines and crossing them to harness heterosis was first done as early as 1920 in Russia. During 1970 cytoplasmic genic male sterility was identified in wild types and obsolete cultivars. Now this system is being extensively used for production of hybrid.

First hybrid : BSH 1, APSH – 11

A number of CGMS lines were bred by Government as well as private seed growers and are utilised now. Male sterility can also be induced by GA 100 ppm.

Steps

Development of inbreds.

Evaluation of inbreds for combining ability.

Conversion of inbreds into CGMS lines and R lines.

Production of hybrids.

Breeding centre:

Directorate of oil seed Research (DOR) Hyderabad.

All India coordinated sunflower improvement project (Bangalore)

Practical achievements

Varieties EC 68414, EC 68415, Mordern, Co-1, surya Hybrids BSH-1, KBSH-1, LSH-1, APSH-1 LDMRSH -1, 3



MUSTARD (*Brassica nigra*) (2n=16, 18, 20, 22, 36)

Important oil seed crop grown in cool season sub tropics, higher elevations and winter

crops. Seeds contain 40 – 45 per cent oil and 38-41 per cent protein.

Origin: India

Distribution:

China, Canada, India, Europe, Pakistan, collectively contribute 90 per cent of the global

production. In India Uttar Pradesh, Rajasthan, Punjab, Assam, Bihar and West Bengal.

Progenitor: Exact progenitor is not known.

The genus *Brassica* contains more than 3000 species of which 40 are of economic importance.

Cultivated *Brassica* can be broadly divided in to two distinct types viz.

Vegetable type : cabbage, cauliflower, turnip

Oil seed type - rape seed and mustard.

Taxonomy :

Harberd (1972) examined 85 species of *Brassica* and grouped species of the genus into cytodemes. These cytodemes are composed of different species with the same chromosome number and which are cross fertile and other having species with different chromosome number and cross infertile. According to him most important agricultural species are four diploids, three allopolyploids, each belong to a separate cytodeme. **Four**

Diploids are :

B.nigra - Black mustard

B.oleracea - Cabbage

B.campestris - Rape seed.

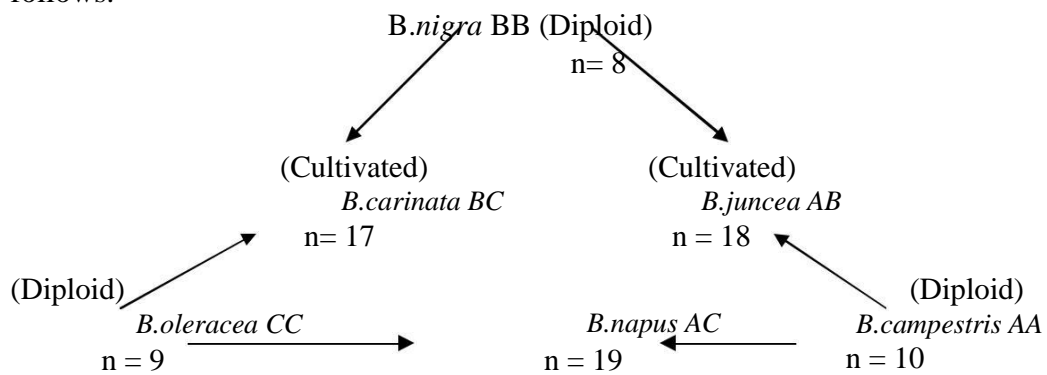
B.tourne froitii - Wild turnip

B.napus - Rape seed of Europe

B.juncea - Indian mustard

B.carinata - sthipplam mustard (veg / oil seed)

The genetical relationship between the oilseed brassicas are diagrammatically represented as follows.



Mustard



Rapeseed

B.napus will cross readily with *B.campestris* but with extreme difficulty in case of *B.oleracea*.

Botanical name	2n	<i>Economic characters</i>
Rape seed	20	Indian Rape Seed. Self sterile in nature.
1. <i>Brassica campestris</i>		Important oil seed crop of North India. 3 Cultivated types. <i>B.campestris</i> var. Brown sarson <i>B.campestris</i> var. Yellow sarson <i>B.campestris</i> var. toria
2. <i>B.napus</i>	38	European Rape Seed. Self fertile.
Mustard		
1. <i>B.nigra</i>	16	Black mustard : Native of Eurasia. 28% fixed oil. Used as medicine pungent due to glucoside sinigrin.
2. <i>B.alba</i>	24	White mustard : Young seedling used as Salad, yellowish seed 30 % oil.
3. <i>B.juncea</i>	36	Indian mustard. RAI 35% oil. Leaves used as herb contains sinigrin.

Breeding objectives :

1. **Seed yield** : Yield is the end product of many biological processes which are under control of

complex polygenic systems. An ideal plant type is having increased branch number, pods per

plant, seeds per pod and seed size. Further yield increase could result from increase in biomass

and harvest index. Increased biomass can result from reduced photo respiration and increased

light saturated rate of photosynthesis.

2 **Early maturity** : For use in various multiple cropping sequence.

Resistance to abiotic factors

Frost resistance is needed to prevent yield losses. Winter hardiness is very important.

Resistance to biotic stress

Powdery mildew

Black leg

Sclerotinia rot, alternaria blight

mustard aphid - so far no resistance source identified.

Herbicide resistance :
Shattering resistant:(Atrazine,simabine) A few sources of resistance is available.

B.napus - highly shattering

B. juncea - tolerant. Introgressive breeding done.

Increased oil content and quality

High oil content 45% yellow seed varieties > oil.

For industrial purpose > Erucic acid.

Development of low erucic acid cultivars for edible purpose.

Reduced linolenic acid content is also desirable.

Meal quality

Meal having less Glucosinolate content.

Breeding methods :

Introduction - Regina from Sweden

Simple selection

Hybridization and selection

Intervarietal

Bulk method

Pedigree method

single seed descent

Inter specific

Back cross method

Population improvement

Recurrent Selection, mass selection

Heterosis breeding

CMS lines

Mutation breeding

Tissue culture technique for production of homozygous diploids

Saline resistance screening. Induction of mutation in haploids.

Embryo rescue technique for inter specific crosses.

Breeding centres:

National Research Centre for Mustard (NRCM) – Bharatpur (Rajasthan)

Coordinated project at Bharathpur.

Practical Achievements: Varieties Kranti, RLM 198, Krishna, Varun, Pusa Kalyani etc.