GENETIC RESOURCES OF OILSEED BRASSICEAE IN INDIA

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Gene Centre

India is the centre of diversity of oilseed Brassiceae. Brassica campestris vars. Toria and Sarson, Brassica juncea and Eruca vesicaria considered as Indian Gene Centre, are distributed in eight phyto-geographical/agro-ecological zones of the country (Table 1). These types exhibit preponderance of variable forms/ land races. Much of the diversity is concentrated in the Indo-Genetic Plain and Sub-Montane Himalayas. Uttar Pradesh, Rajasthan, Madhya Pradesh, Gujarat, Haryana, West Bengal, Assam, Punjab, Orissa, Bihar, Himachal Pradesh and Jammu and Kashmir are the important states where oilseed Brassiceae are widely prevalent.

Early Work

Systematic studies on economic plants and floristic wealth started in India in later part of 19th century. This resulted in publication of Flora of British India (Hooker, 1872-97) and dictionary of economic plants of India (Watt, 1889-93). Subsequently, the work on collection of land races and study of crop plant diversity was taken up in oilseed Brassiceae alongwith other crops in Pusa (Bihar). Though the awareness on genetic resources vis-a-vis the research for resource genes in crop improvement was realized in 40s, the genetic resources activity on oilseed Brassiceae was systematically taken up in mid seventies by ~~the~~ then Plant Introduction Division of the Indian Agricultural Research Institute, New Delhi.

Current Status

With the creation of the National Bureau of Plant Genetic Resources/ICAR/,New Delhi in 1976 subsequently establishment of Germplasm Management Research Centre in the ICAR Project Coordinating Unit (Rapeseed-Mustard) at Hisar, the activities on plant genetic resources of oilseed Brassicaceae got required emphasis and impetus. While the Bureau is the nodal agency for the entire national programme on plant genetic resources, the Germplasm Management Centre (Rapeseed-Mustard) has the following crop specific objectives.

Assembly of land races including wild types from all possible sources, maintenance, evaluation, characterization, utilization, documentation and distribution of germplasm.

The present paper briefly highlights the results of researches carried out on genetic resources of oilseed Brassicaceae in India.

Exploration and Collection

During the last 30 years, more than 23 explorations have been organised which have resulted in collection of 2022 germplasm lines of oilseed Brassicaceae (Table 2). The regions explored range from the plains to high Himalayan hills (1500-3000 meters). The important types of oilseed Brassicaceae collected include *Brassica juncea*, *Brassica campestris* vars. Brown Sarson, Yellow Sarson and Toria, *Eruca sativa*, *Eruca vesicaria* and *Brassica nigra*. Besides, a number of semi-wild and wild species were also collected. The important amongst them were *Brassica tournefortii*, *Sisymbrium officinale*, *Erysimum hieracifolium* and *Nasturtium montanum*.

Maintenance

Oilseed Brassicaceae have mating systems ranging from total cross pollination to total self pollination. Therefore the techniques

employed for maintenance of different types are different. For evaluation of germplasm of self pollinating species germplasm lines were grown in augmented design in paired rows. To maintain the lines representative plants of individual cultures were bagged prior to initiation of flowering.

In out-crossed species, individual lines were grown in the field in a similar fashion as indicated for self-pollinating species. They were, however, maintained by sibmating. At population level, insect-proof cages were utilized for the maintenance of germplasm of cross pollinating species. In case of out-crossed Brassica campestris var. Brown Sarson, an isolation distance of 400 m was found to be quite adequate for maintenance of breeder seed (Kumar and Singh, 1978).

The country has at present 14576 accessions in the germplasm (Kumar, 1987) as against 42919 lines available in the world (Table-3). A number of accessions are likely to be duplicates or even quadruplicates.

Evaluation and Characterization

Due to the lack of standard descriptors, most of the collections do not include characterization. A descriptor for Brassica juncea has recently been prepared (Kumar, 1987). The germplasm received from various sources are evaluated for various qualitative and quantitative characters and characterised on the basis of the descriptor.

More than 4000 lines of oilseed Brassiceae have so far been evaluated during 1983-86. Data in respect to various agro-morphological and a number of diagnostic traits were recorded, both under rainfed as well as irrigated conditions. Under rainfed conditions the line RH-7839 matured earliest while two lines RLM-319 and RLM-785 recorded maximum primary (10.8) and secondary (25.8) branches, respectively. A line RIK-78-4 possessed maximum seed yield per plant /23.18g/.

Under irrigated conditions, lines B-137 and B-169 matured earliest (121 days). Lines B-199, RC-199, and CSR-164 recorded maximum primary branches, 11.4,8.8 and 20.5, respectively, while lines B-284, RC-199 and CSR-498 had maximum secondary branches, 28.8, 21.5, 46.0, respectively. Lines B-199, B-380 and RC-1277 recorded the highest seed yield per plant.

Indian mustard germplasm lines were also evaluated for a number of diagnostic traits. It was observed that 50 per cent of the total lines had hair on leaves. Most of the lines possessed dark green leaves except for a few with light yellow green leaves. Purple splash on leaf appeared in only two lines and purple splash on internode and siliqua was present in almost all the lines. 53 lines possessed appressed siliqua. In general, the beak of siliqua was long (more than 5 mm), however, 21 lines had short beak. Siliqua surface was beaded in only 9 lines.

Of Brown Sarson germplasm evaluated, lines NC-63636 NC-63639, NC-36642, BS-42, HJA-98028 and NC-60783 were identified as promising for days to maturity (early), siliqua on main raceme, primary and secondary branches, respectively. The line NC-60789 possessed the highest seed yield per plant (26.0 g). The promising lines of Yellow Sarson were B-9 (earliest flowering), BAYS-53 (earliest maturing), YST-5 (maximum pods on main shoot) and YSP-5 (bold seeded and highest yielder). Among Taramira cultures the lines RTM-439 recorded minimum days for maturity while the exotic lines EC-159505 and EC-159506 were latest to mature. These two lines were also highest yielders. Lines RTM-51 and RTM-327 possessed maximum primary branches (15.8 and 18.8, respectively). Lines RTM-92, RTM-31 and RTM-327 possessed maximum secondary branches. The lines RTM-78 and RTM-252 were identified as the highest yielders (22.3 g and 18.0 g, respectively).

Besides evaluating the germplasm for quantitative and qualtative characters, cultures were also evaluated for biotic and

abiotic stresses. The sources for tolerance/resistance were identified /Kumar, 1987/.

Utilization

The germplasm assembled/collected from various sources, after evaluation are either introduced directly or utilized in hybridization programme. Amongst the exotic collections, Midas and Tower of Brassica napus, Candle, Span and Torch varieties of Brassica campestris have been found to be promising. The Spain variety, possessing low erucic acid, has also been found to be tolerant to frost injury. The sources for frost resistance, RJ-175 and DBS-1 identified in Brassica juncea and Brassica campestris, respectively, from the available germplasm, are being used in hybridization programme. Likewise, the sources for resistance to Alternaria blight and white rust diseases, RC-781, and YRT-3 and aphid resistance T-6342 and Cream white flower glossy stem identified from the genetic stock of Brassica juncea are being extensively used in hybridization programme (Kumar, 1987)

Major Thrust

Realizing the need for intensifying the research on genetic resources of oilseed Brassiceae in India, the following priority areas of research havebeen identified (Kumar, 1987).

1. Plant exploration and germplasm collection from border areas of Bihar-West Bengal facing Nepal and Bihar-west Bengal-Assam facing Bangladesh, Jammu-Kashmir and Uttar Pradesh hills, Karnatka-Andhra Pradesh and Orissa.
2. Characterization, Evaluation and Documentation.
3. Elimination of duplicates.
4. Synthesis of germplasm complexes in allogamous species
5. Development of low cost system for maintenance of allogamous species and
6. Determination of optimum seed sample in case of auto- and allogamous oilseed Brassiceae for medium and long term storage conditions.

References

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Table 1. Oilseed brassicas in different agro-ecological regions of India

S.No.	Region	State
1.	Humid Eastern-Himalayan Region	Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura
2.	Humid Bengal-Assam Region	West Bengal and Assam
3.	Sub-Humid to Humid Eastern and South Eastern Uoland	Orissa, East Madhya Pradesh and Andhera Pradesh
4.	Humid to Semi-Arid Western Ghats and Plateau	Karnataka and Tamilnadu
5.	Semi-Arid Lava Plateau and Central Uolands	Maharashtra and Rest of Madhya Pradesh
6.	Arid Western Plains	Gujarat, Rajasthan and Haryana
7.	Sub-Humid Sutlej Ganga Alluvial Plains	Bihar, Uttar Pradesh and Punjab
8.	Humid Western Himalayan Region	Part of Uttar Pradesh, Himachal Pradesh, Jammu and Kashmir.

Table 2. Germplasm collection of oilseed Brassiceae in India during 1966 to 1986

Species	No. of collections	Regions explored
Brassica juncea	739	Assam, Bihar, U.P., M.P., H.P., Maharashtra
Brassica campestris var. Toria	398	Assam, U.P., Haryana, Punjab
Brassica campestris var. Brown Sarson	116	Sikkim, Orisa, Maharashtra, Haryana, H.P., J & K.
Brassica campestris var. Yellow Sarson	119	Assam, Sikkim, Bihar, U.P., H.P., Punjab
Species of tribe Brassiceae	550	North Western and Central India, Saurashtra, Kutch, Gujarat, U.P., M.P., Jammu and Ludhiana regions.
Eruca sativa	100	Haryana, Jammu, M.P., Punjab, Maharashtra, Rajasthan and Haryana.

Table 3. Germplasm of oilseed Brassiceae available in the world.

Species	No. of lines
Brassica campestris	14631
Brassica juncea	11705
Brassica napus	6147
Brassica nigra	1047
Brassica species	759
Brassica carinata	735
Sinapis alba	353
Eruca sativa	339
Crambe spp.	78
Brassica tournefortii	23
Camelina sativa	17
Grand total	42919

Source: Directory of Germplasm collections; 4. Vegetables by J. Toli and D.H. van solten, IBPGR Publication, August 1982.