Website : www.asthafoundation.in
Frontiers in Crop Improvement
Vol 9 (2) : 178-181 (July-2021) Print ISSN : 2393-8234 Online ISSN : 2454-6011
Astha Foundation, Meerut (U.P.) India

Rapeseed-Mustard Improvement : Uttarakhand Perspective

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Abstract

Rapeseed-mustard is an important oilseed crop at national level with soybean and groundnut and India rank fourth among the rapeseed-mustard growing country. Inspite of having high yielding varieties, improved technologies for cultivation there is a large gap between demand and supply. India is the second largest importer of edible oil after China. Uttarakhand hills are the rich reservoir of genetic resources with unique traits and have significantly contributed towards rapeseed-mustard improvement programme at national level. The extra early maturing germplasm of toria PT-141, Pant Pili Sarson, are selection from local material from Uttarakhand. PAB 9511 a tolerant source against Alternaria blight was also developed by crossing with a selection from Uttarakhand hills. Recently one line of Indian mustard PWR-13-8 has been identified that show immune reaction against white rust under field as well as laboratory condition. B. rugosa, variant of Indian mustard, suitable for culinary purpose was collection from the higher hills and screened for its biochemical and nutritional properties. Some lines are found to be high in micronutrients like Fe, Mn, Zn and -carotene content. These lines also show uniqueness in their biochemical profile. One unique germplasm i.e., B. pekinensis suitable for salad purpose has also been collected from district Pithoragarh and is been maintained at Pantnagar. Unique B. nigra germplasm has also been collected and found fairly high in oil content.

Key words : *Germplasm, unique traits, Brassica, varieties, Uttarakhand*

Introduction

India is world's fourth largest edible oil economy after the U.S., China and Brazil. Globally, it contributes almost 6% of global vegetable oil production; 14 % of vegetable oil imports and 10 % of edible oils. The total market size of the Indian oilseed sector is about Rs 600 billion. In the context of national agricultural system, oilseeds occupy 13 % of the country's gross cropped area and 3% to gross national products and 10% value of all agricultural products. Groundnut, soybean and rapeseed-mustard are the major oilseeds and contribute approximately 80 % of production. The average contribution of rapeseed-mustard to the total oilseed production in India was 35% to primary sources and almost one-fourth to total domestic edible oil production of 11.0 mt, although it is second in normal acreage (6.13 mha) after soybean (11.25 mha). Though, rapeseed-mustard is placed 2nd in terms of production, after soybean, it ranks 1st in terms of oil yield among all oilseed crops. Rapeseed mustard groups of crops includes *Brassica rapa* var. toria, *Brassica rapa* var. brown sarson, *Brassica rapa* var. yellow sarson, *Brassica juncea*, *Brassica nigra*, *Brassica napus* and *Brassica carinata*. *B. juncea* predominates and accounts for about 90% area under rapeseed-mustard crops. These crops are grown in diverse agro-climatic conditions varying from north-eastern/north-western hills to down south under irrigated/rainfed, timely/late sown and sole/mixed cropping. In India Rajasthan, Haryana, Madhya Pradesh, Gujarat and Uttar Pradesh are major rapeseed-mustard producing states. The estimated area, production and yield of rapeseed-mustard in the world was 36.68 million hectares (mha), 72.42 million tonnes (mt) and 1974 kg / ha, respectively, during 2017-18. Globally, India account for 19.8 % and 9.8% of the total acreage and production. During the last seven years, there has been a considerable increase in productivity from 1840 kg/ha in 2010-11 to 1974 kg/ha in 2017-18 and production has also increased from 61.64 mt in 2010-11 to 72.42 mt in 2017-18. Indian mustard accounts for about 75-80 % of the 6.07 m ha under these crops in the country during 2016-17 crop seasons. India is the second largest importer of edible oilseeds after China. Country needs to spend over 60,000 crores annually to augment domestic supplies. Thus, attaining self-sufficiency in edible oil sector is critical for reducing current account deficit and also edible oil security of a burgeoning population. This necessitates a comprehensive road map to meet the challenge of bridging the widening gap of demand and production of edible oil and Rapeseed-mustard is expected to play a major role. Inspite of having high yielding varieties, improved technologies for cultivation there is a large gap between demand and supply. Major constraints are susceptibility of crop to biotic and abiotic stresses, low level of heterosis, un-utilization of non-traditional areas and changing climatic condition. To combat the situation the enrichment of genetic wealth

Received : June-2020; Revised : June-2020; Accepted : July-2021

Table-1 : Details of collected unique germplasm collected from hills of Uttarakhand.

S. No.	Name of variety/ germplasm	ID	Feature	Pedigree
1.	Pant Pili Sarson-1	SO.211(E) Dt: 29.01.10	Pendent bearing	Selection from local material
2.	PAB-9511	06041 (2006)	Tolerant to *Alternaria* blight	[(RC 78 × Krishna) × (PHR-1 × Poorbiraya)]
3.	Kiran	SO.401(E) Dt: 15.05.98	Suitable for rainfed and having compound resistance	Selection from HC-1
4.	PT-141	INGR-17018 (2017)	Earliness for maturity and flowering	Collection from Chamba (Tehri Garhwal)
5.	PWR-13-8	-	Resistance against white rust	GP-11-222 Collected from Dewal (Chamoli)
6.	Elephant Ear collection	-	High nutritive value. Suitable for vegetable purpose	Collection from Ranikhet (Almora)
7.	*B. pekinensis*	-	Suitable for salad	Collected from Pithoragarh

followed by pre-breeding should be taken as priority activity.

Uttarakhand hills are the rich reservoir of genetic resources with unique traits which can be effectively utilized for significant improvement rapeseed-mustard at national level. In Uttarakhand, rapeseed-mustard is the most important oilseed crop accounting for 77.05% of the total oilseeds area and 79.66% of oilseeds production (excluding soybean). Total acreage in Uttarakhand can be grouped into hills and plain regions (1). In the hills mostly either toria (gharia) or brown sarson is grown whereas in plains yellow sarson and mustard is the predominant crop. In hills, irrespective of growing situations, rapeseed-mustard share 72.31% of total oilseeds area and 81.54% of total oilseeds production whereas, rapeseed-mustard has a share of 80.08% in total area and 78.91% in total production under plain condition. Of the total rapeseed-mustard area in the state, 51.52% is in plains and 48.48% in hills. Due to low productivity of the crop in hills, the share in total Rapeseed-Mustard production is much higher in plains (61.70%) than in hills (38.30%). Inspite of having low productivity the unexplored hilly regions are great reservoir of germplasm with unique traits. Collection maintenance of germplasm is pre requisite for any crop improvement programme as it carries unique traits. Most of the area of higher hills is still unexplored therefore exploration visits need to be made in order to collect the unique germplasm for further use in improvement of crop.

Materials and Methods

Uttarakhand is location in the Northern part of country and is the hub of great genetic wealth. There are two distinct crop growing situations in the state viz. plains and hills. Furthermore, cropping situations in hills comprise of valleys, slopes, low hills (600-1200m), mid hills (1200-1700m), high hills (1700-2500m) and very high hills (>2500m). The unique germplasm is available in the form of land races with the farmers. Some of the germplasm is also found as wild and weedy relatives. Pantnagar is located 29°N latitude and 79.30°E longitude and at an altitude of 243.84m from mean sea level. It falls in humid and subtropical zone and situated in foot hills of Shivalik range of Himalaya. Exploration trips were made in collaboration with Pantnagar Center of Plant Genetic Resources (PCPGR), Pantnagar and germplasm were collected, characterized and maintained using appropriate breeding methodology. Their evaluation of germplasm for unique trait was also done.

Results and Discussion

As a result of exploration, characterization and evaluation of germplasm some unique germplasms were identified and were released as variety or registered with the NBPGR for their uniqueness (Table-1 and Fig.-1).

A very popular variety of yellow sarson namely Pant Pili Sarson-1 (PPS-1), among the farmers has been released by SVRC, is a selection from local material from Uttarakhand. It has yellow flower and unique feature i.e., pendent bearing (droopy) which make it distinct from other variety and become an identification mark for seed producers and growers. It matures in 100-110 days and seed contains 44% oil. Its seed yield ranges from 15-19 q/hac.

Alternaria blight is a serious problem of Rapeseed mustard crop. It was characterized by formation of brown spot with concentric rings. In acute condition due to merger of spots the complete drying of leaves take place which caused defoliation of leaf and ultimately affect the photosynthesis and seed yield. PHR-1 and PHR-2 were identified as resistance sources of *Alternaria* blight and were collections from the hills of Uttarakhand. Later on, PAB 9511, a tolerant source against *Alternaria* blight, has been registered with NBPGR, was developed by crossing with one of the germplasms i.e., PHR-1 collected from Uttarakhand hills.

Fig.-1 : Unique germplasm collected from Uttarakhand.

Kiran, an improved variety of *Brassica carinata* (Ethiopian mustard) was released from Pantnagar and remain as national check in all the *B. carinata* trials at national level. It was selected from a local material HC-1. Kiran was also found tolerant in rainfed condition and was also reported to have compound resistance against *Alternaria* blight, white rust and downy mildew. Its dried stem is also used as fuel for household works.

In recent years the extra early maturing germplasm of toria PT-141 has been registered with NBPGR for earliest known maturity duration of 58-60 days till time. It flowers 18-20 days after sowing if sown in September. It also bears a short stature (~30.0 cm) and long siliqua size (5.40 cm). This unique germplasm has been collected from Chamba district of Tehri Garhwal. Though productivity of line is quite low however, it can serve as a great donor for earliness and shot height as it showed good general combining ability with other germplasm having high seed yield potential. Besides improvement of its seed yield potential through recurrent selection programme has been initiated (2,3).

White rust is another biotic stress which affects the mustard crop in tarai region. It is characterized by white chalky blisters on the lower side of the leaves. In its acute condition hypertrophy and hyperplasia is reported which causes formation of stage head and complete loss to crop due to malformation in floral parts. Recently among the germplasms collected from hills, one line of *B. juncea* i.e., PWR-13-8 has been identified that show immune reaction against white rust under field as well as laboratory condition. This material has been collected from village-Van, block-Dewal of district Chamoli and being used in the breeding programmes designed for resistance against white rust. (4,5). *B nigra* commonly called as Banarasi rai, commonly used for the spices in pickle and curries. It has very small size and low oil content. One of the *B. nigra* collection from the Uttarakhand also showed high oil content (~40%) and boldness in seed size.

A leafy variant of *Brassica juncea*, viz; *Brassica rugosa* is prevalent in the almost all the kitchen gardens of hills were found highly nutritious for consumption as green vegetable. Germplasm was grown and lines were evaluated. These selections from the local material have shown high amount of iron, zinc, manganese, phosphorous and â-carotene. These selections emerged as valuable sources for phenol and also showed high anti-oxidative properties. The leafy green possesses second largest amount of flavonoids with anti-cancerous property. Regular consumption of mustard green in diet is known to prevent iron deficiency osteoporosis and offer an excellent protection against cardiovascular diseases, colon and prostate cancer so the green mustard leaves can serve as a healthy alternative to the most of the winter season leafy vegetables. One unique germplasm i.e., *B. pekinensis* has also been collected from district Pithoragarh and is been maintained at Pantnagar. It is suitable for salad purpose as raw and after blanching.

Therefore, it has been reflected from the above review that hills of Uttarakhand are great source of natural variability and germplasm with unique traits. To enrich the total gene pool of rapeseed mustard exploration, collection and further characterization of germplasm and

their identification is need of time. Such identified unique germplasm can serve as donors for the strategic and target oriented improvement programmes of crops.

References

1. Pant U., Bhajan R., Jeena A.S. and Singh A.K. (2021). PYSCA-1: A mutant line for apetalous flower in yellow sarson (*Brassica rapa* var. Yellow sarson), *Frontiers in Crop Improvement,* 9(1): 50-52.
2. Bhajan Ram, Pant Usha, Khulbe R.K. and Singh A.K. (2013). New sources of variability for restructuring *Brassica rapa*. *J. of Oilseed Brassica,* 4(1): 53-56.
3. Bhajan R., Pant U., Khulbe R.K., Singh A.K. (2018). PT-141 (IC0621691; INGR17018), a Toria (*Brassica rapa* var. toria) Germplasm with Earliness of Maturity; Earliness of Flowering. *Indian Journal of Plant Genetic Resources,* 31(3): 347-348
4. Pant Usha, Bhajan Ram, Tewari A.K., Singh A.K. and Chaturvedi Sameer (2017). Development of new white rust resistant line of Indian Mustard. *In 3rd National Brassica Conference "Enhancing Oilseed Brassica Production Through Climate–Smart Technologies* Vashudev S., Yadava D.K., Yadav S., Singh N., Saini N., Dhillon M., Rathor S.S., Yashpal, Kumar V. and Meena P.D. (eds) Pp 231.
5. Gairola Kalpana, Tewari A.K., Bhajan Ram and Pant Usha (2017). Source of resistance in *Brassica juncea* lines against *Albugo candida*. *J. of Hill Agriculture.* 8(4): 436-441.