Collection and Characterization of Wheat Germplasm from North-West Himalaya

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One hundred and fifty five germplasm accessions of wheat collected from North-Western Himalaya were characterized for qualitative and quantitative traits. The germplasm have shown wide range of variability for all the characters studied. Maximum accessions were found to possess spreading type of growth, late maturity, white ear, awned, amber, semi- hard oblong bold grain, grain size (38-50 g) and medium brush hair length. Results for quantitative traits also reveal a wide range for ear length (6.0-13.8 cm) and thousand grain weight (25-66 g). Seven genotypes were found to possess seedling resistance against 21R55 pathotype of leaf rust whereas only two genotypes have shown resistant reaction against 121R63-1 pathotypes of leaf rust. The data on yield contributing traits reveals the potential of some of the germplasm accessions *viz*., WLG43, WLG44 and WLG171 for their utilization in wheat improvement programme.

Key Words: Wheat, Germplasm, Variability, Characterization

Among high yielding varieties of wheat (*Triticum aestivum*), the most popular present day varieties have been derived only from six broad groups (Rao, 1988). This narrow genetic base largely due to development and adoption of High Yielding Varieties (HYVs) points towards collection, evaluation and conservation of wheat germplasm. The North-Western hills of the country are one of the rich repositories of germplasm of winter wheat and rye (Partap *et al*., 2001). However, these genetic resources have considerably eroded from the traditional wheat growing areas but still some of the landraces/ farmers' varieties are in cultivation in high hills and tribal areas of Jammu & Kashmir and Himachal Pradesh. Locally, the wheat in this region is known by various vernacular names such as *Kanak, Gehun, Ghoon, Gandham, Tor* and *Toe*. Although, such varieties and landraces have low yielding capacity besides disease susceptibility but they do possess yield stability, which is important for subsistence farming in the tribal areas.

Moreover, they are good sources of genes for traits such as drought tolerance (as most of them are grown in rainfed conditions) and for nutrition and dough quality (selected by the farmers with very long experience and local preferences) by virtue of which they are still existing and or competing with their superior counterparts. The impact of high yielding varieties (HYVs) is clearly visible in this region also, but it is more in irrigated valley areas than rain fed, remote and tribal areas. About 55% loss of wheat genetic resources has been recorded in this region over the last 30 years (Rana *et al*., 2000). In view of above, a systematic germplasm collection programme was initiated in the genetic diversity rich areas especially the *changar* and *kandi* areas (highly rainfed) and tribal belt of North-Western Himalaya for strengthening our wheat germplasm programme. The objectives of the present study are to (i) collect local germplasm of wheat, (ii) locate out the sites having maximum genetic variability and (iii) characterize the germplasm to identify trait specific promising genetic stocks.

Materials and Methods

The study area was confined to the two states as mentioned above. Three explorations specific to wheat were undertaken from 2000 to 2003. Wheat accessions were collected while conducting multi-crop explorations. Germplasm explorations were conducted in April to May for main season crop and in August-September for off-season crop (cold arid region). In all about 40 sites spreading over 16 districts located at different elevations ranging from 800-2600 msl were explored and 155 germplasm accessions were collected. Since the collections were constituted of random samples, the single ear selection was performed during *rabi* 2003-2004 at Tutikandi reseach farm of Indian Agricultural Research Institute, Regional Station, Shimla to purify the germplasm. Single ear head progenies of 155 accessions were evaluated in detail for various morpho-physiological traits during the year 2004-05. The observations were recorded on Growth class, Coleoptile pigmentation,

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Maturity class, Ear colour, Ear length, Awn type, Grain colour, Grain texture, Grain shape, Grain size and Brush hair length. Another set of germplasm accessions along with susceptible check *Agra local* was planted in glass house for recording their response against predominant pathotypes of brown rust according to the method described by Stakman *et al.* (1962).

Results and Discussion

Characteristic features of the sites visited and landraces collected

The agro-climatic conditions of the areas chosen for field study were highly varied for rainfall (500-2000 mm), topography (valleys, sub-mountainous to mountainous) and mean monthly temperature (–0.10-35°C). Wheat is sown in October-November in warm areas (subtropical) and from March-May (once the snow melting starts) in cold arid region of Pangi, Spiti, Upper Kinnaur and Ladakh. However, winter wheat in this region is sown in November-December (before the snowfall). Improved varieties of wheat are occupying 90-95% in plains and valleys of Jammu, Kangra, Mandi, Sirmour and Una, whereas it was 40-50% in rain-fed hilly terrains (Rana *et al.*, 2000; Sharma and Rana, 2005). While undertaking explorations the sites having maximum genetic variability for traits of economic importance and those sites which have high number of known landraces were considered as areas with rich genetic diversity (Fig. 1). The important traits for which genetic variability was observed were drought tolerance, cold tolerance, growth habit and adaptability to poor environments.

In general, there was not much variability within a landrace but while critically examining the fields; mechanical mixture was found to be very common. About

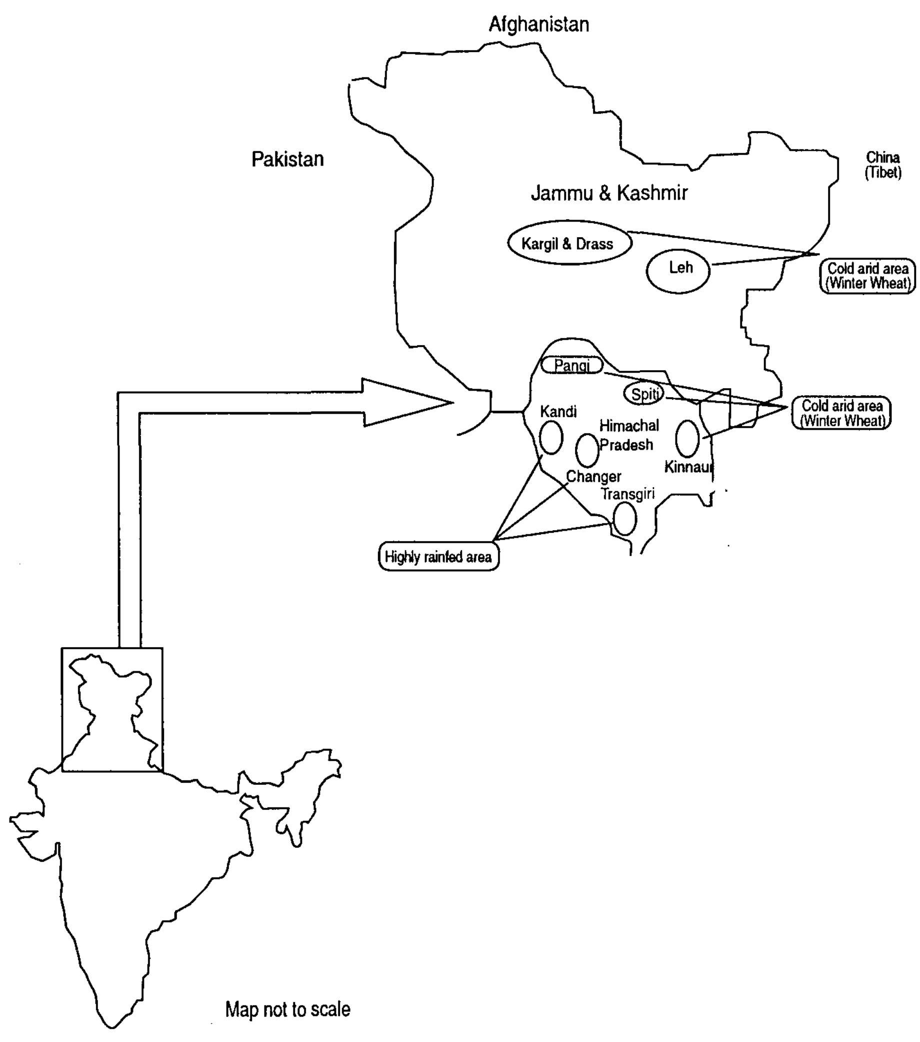

Fig. 1: Areas rich in wheat genetic variability

70% of the local wheat growing in the hills has named varieties and 30% were found without local names and generally called "*desi kanak*". The sites, where maximum variability was observed were located in Chamba, Sirmour, Kangra, Mandi, Hamirpur, Kullu, Lahaul & Spiti districts of Himachal Pradesh and Kargil, Drass, Leh, Poonch, Rajouri of Jammu & Kashmir. One hundred and fifty five germplasm accessions collected represent different agro-climatic areas *viz.*, Chamba (20), Sirmour (14), Kangra (15), Mandi (14), Hamirpur (9), Lahaul & Spiti (9) and others (16) in Himachal Pradesh and Kargil (16), Drass (23), Leh (12), Poonch (4) and others (3) in Jammu and Kashmir.

Genetic variability including farmers' varieties/ landraces was observed more in remote. It was observed that folk varieties/landraces have been named by the farmers based on characteristics they possess. For instances, *brad kanak* which means spreading type and have more number of tillers; *lalpuri* – red grains; *Misri* – sweet, soft and white, suitable for making bread. Adopting the same pattern about 35 named landraces *viz., Bhangru, Bharadoo, Chawera, Cheeuni, Chiti Kanak, Daru, Darmori, Daron, Desi Mundal, Gazaria, Jael, Joth, Jhuladi, Kasieun, Kothek, Kothi, Kankoo, Kiawali, Lal kanak, Lalpuri, Latar, Kalee bauri, Mundra, Mandaleu, Marodum, Misri, Mundu, Paluwa, Ralieun, Rigaliya, Rundan, Shruin, Trimudi,* were observed in Himachal Pradesh only. The characteristic features of some important landraces as described by the farmers given in Table 1. As it is mentioned that wheat genetic resources are depleting at very fast rate as compared to other crops, thus concerted efforts are required to capture this gene pool. Although enough germplasm has been preserved under *ex situ* conditions but there are hardly any efforts to conserve the germplasm on farm which is perhaps very important for sustaining the wheat breeding programmes in the long run.

Characterization of the Germplasm at the Experimental Farm

The data recorded has been on one hundred and fifty five local wheat germplasm accessions for qualitative and quantitative traits. Considerable phenotypic variability was observed for coleoptile colour (green, light purple, purple, dark purple), growth habit (spreading, semi-spreading, semi-erect, erect), awn type (awned, scur, awnless), ear colour (brown, white), grain texture (hard, semi-hard, soft), grain colour (medium red, light red, amber, amber-white, white), grain shape (elliptical, oblong, ovate, round), grain size (bold, medium, small), brush hair length (long, medium, small). Results for quantitative traits also reveal a wide range for ear length (6.0-13.8 cm) and thousand grain weight (25-66 g) in the germplasm.

Maximum accessions were found to possess spreading type of growth, late maturity, white ear, medium spike length (9-12 cm), awned, amber grain colour, semi-hard grain, oblong grain shape, bold grain size (43-50 g) and medium brush hair length (Table 2). Germplasm accessions (Table 3), WLG41, WLG72, WLG73, WLG75, WLG76,WLG77, WLG89, WLG96, WLG101, WLG171 were found to possess long ear (>12cm) and

Table 1. Characteristic features of the landraces as described by farmers

Name of the landrace	Characteristic feature
Rundal	Awnless, tall, thin stem, makes good bread, good yield
Jhuldi	Awned, long ears, bold grain size
Sirohun	Awned, gives good yield in rotation with paddy but less with maize
Kathuan	Pink pigmentation in the ear, poor yielder, very good quality
Kishal	Awned, good bread making quality, average yielder
Kankoo	Good plant vigour, awnless, tall, average yield, non-shattering, bread tasty and does not dry quickly, flour white
Dharmouri	Red grained, high tillering ability, drought tolerant
Desi mundal	Awnless, bread tasty, disease resistant, non-shattering type
Brad kanak	Awned, more straw, drought resistant, flour brown but bread tasty, very high tillering, shattering type, lodging resistant
Bharadoo	Late maturing, more tillers, good dough quality
Ralieun	Easy threshable, flour white, high yield, bread tasty
Mundu, Misri	Cold tolerant, amber colour, soft bread
Shruin	Awnless, tall, small grain, good dough quality

Table 2. Frequency distribution of 155 local germplasm for morphological characters

Characteristic feature	Frequency distribution for different descriptors
Growth class	Spreading (64); Semi-spreading (23); Semi-erect (49); Erect (15); $ (04)
Coleoptile pigmentation	Green (102); Light purple (12); Purple (26); Dark purple (9); $ (6)
Ear colour	White (115); Brown (37); $ (3)
Ear length	Short <9.0 cm (60); Medium 9-12 cm (82); Long >12.0 cm (11); $ (02)
Awn type	Awned (124); Scurs (02); Awnless (23); $ (6)
Maturity class	Medium early (29); Medium late (53); Late (64); Very late (05); $(04)
Grain colour	Red (01; Medium Red (20); Light Red (57); Amber (67); Amber - White (09); $ (01)
Grain texure	Soft (65); Semi-Hard (82); Hard (07); $ (01)
Grain shape	Elliptical (39); Oblong (96); Ovate (18); Round (01); $ (01)
Grain size	Small < 32g (27); Medium 32–42g (47); Bold 43- 50g (54; Extra Bold>50g (27)
Brush hair length	Short or lacking (01); Medium (132); Long (22)

$ Not recorded

Table 3. Promising accessions of local wheat germplasm for yield contributing traits and seedling leaf rust resistance

Grain yield component/leaf rust pathotype	Promising accessions
Ear length (>12 cm)	WLG41, WLG72, WLG73, WLG75, WLG76, WLG77, WLG89, WLG96, WLG101, WLG171
1000-Grain weight (e"60g)	WLG43, WLG44, WLG54, WLG119, WLG122, WLG132, WLG135, WLG137, WLG163, WLG167, WLG169, WLG171, WLG174
Pathotype 21R55	WLG14, WLG17, WLG23, WLG32, WLG36, WLG70, WLG71
Pathotype 121R63-1	WLG23, WLG88

WLG43, WLG44, WLG54, WLG119, WLG122, WLG132, WLG135, WLG137, WLG163, WLG167, WLG169, WLG171, WLG174 had extra bold grains (e"60 g thousand grain weight). The data on yield contributing traits reveals the potential of some of the germplasm accessions *viz.*, WLG43, WLG44 and WLG171 for their utilization in wheat improvement programme. Seven genotypes were found to possess resistance against 21R55 whereas only two genotypes had shown resistant reaction against 121R63-1 pathotypes of leaf rust at seedling stage (Table 3). However, there may be chances of disease escape; therefore more confirmation of resistant lines at adult plant stage is required for validating them as gene sources against above pathotypes of brown rust.

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