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Short Communication

Evaluation of some *Triticum turgidum* var. *polonicum* accessions and their derivatives for high kernel weight and resistance to leaf rust (*Puccinia recondita*)

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There is considerable genetic variation in tetraploid wheats for the desirable agronomic traits such as resistance to leaf rust, drought tolerance [1] and thousand kernel weight (TKW). Twelve accessions of *Triticum turgidum* var. *polonicum* (2n = 4x = 28, genome AABB) were screened for leaf rust (*Puccinia recondita*) resistance in seedling and in adult plant stage and for TKW. One accession, *T. polonicum*-7 possessed high thousand kernel weight. Researchers [1, 2] have emphasized on increase of both grain weight and grain density as a suitable criteria for enhancing yield in chickpea and wheat. The weight and density of grains are considered as important for the improvement of wheat with respect to yield and quality. However, the information on genetic improvement, particularly for test weight in bread wheat utilizing emmer wheat, *T. polonicum* (Polish wheat) is scanty. Therefore, an investigation was carried out to explore the possibility of utilizing *T. polonicum* to improve TKW and test weight in bread wheat through limited backcrossing approach of breeding.

Twelve accessions of *Triticum turgidum* var. *polonicum* and three *T. aestivum* lines *viz.*, Sonalika, HD 2687 and HW 2041 were used in the present study. The accessions of *T. polonicum* were screened for resistance to leaf rust pathotypes, 77-5 (121-R63-1) and 77-7 (121R127) in seedling stage under controlled conditions in greenhouse at 25±2°C and adult plants stage in the field in 1996-97. The rust data on seedlings as well as adult plant were recorded by following standard procedure. The data on adult plant resistance to stem rust and stripe rust were also recorded.

T. polonicum-7 is of winter growth habit but produces high thousand kernel weight (>70 g). Extra light was provided for 35 days to bring the donor in flowering stage for attempting crosses with *T. aestivum* cv Sonalika. The chromosome count was made in pentaploid F_1 hybrid. The F_1 was backcrossed to bread wheat cvs. HW 2041 and HD 2687. Selections in subsequent generations (BC_1F_1, F_2 and F_3) were made based on adult plant response to rust infection, spike fertility and seed size. Derivatives from BC_1 F_4 generation were evaluated for 1000-kernel weight (TKW) and test weight. The derivatives were also screened for adult plant resistance to leaf rust. Volume of the grains was determined by measuring the quantity of hexane displaced by the grains in the test tube.

Eight accessions of *T. polonicum* exhibited susceptible infection type (IT) 3c to 33+ to leaf rust pathotype 77-7, while six of them showed IT 0; –1 to 2c to pathotype 77-5 (Table 1). Only one accession EC 143792 showed seedling resistance to both the pathotypes. Two accessions *viz.*, *T. polonicum* - 31 and 44 showed susceptibility at adult plant stage. The remaining ten accessions were found resistant in adult stage, when inoculated with 77-5 and 77-7 pathotypes. The range of infection recorded was 20MRMS to 60XS, which indicated that the acccessions *T. polonicum* var. *nigrobarbatum*, var. *vestitum*, EC 143793 and *T. polonicum*-7 possess genes for adult plant resistance. Most of the accessions exhibited susceptibility to stem rust and stripe rust. The gene *Lr23*, originating from emmer wheats, is ineffective to Indian leaf rust pathotypes 77-5 and 77-7 [3], it is presumed, that the resistance identified in the accession of *T. polonicum* is due to some other gene(s) and may be useful in wheat breeding.

The pentaploid F_1 hybrid showed a maximum of 14 bivalents as expected. However, the variation in total number of bivalents ranged from 12 to 14 with an average of 12.98. High frequency of trivalents (0.19 per cell) was also noticed which indicated closer homoeology between wheat genomes. Selections were made on the basis of spike fertility, its morphology and adult plant resistance to leaf rust. The chromosome number were determined in BC_1 aneuploids ranged from 2n = 38 to 2n = 42. Genotypes having high TKW were retained during the screening of seed in the

Table 1. Seedling and adult plant response of *T. polonicum* accessions to 77-5 and 77-7 pathotypes of *Puccinia recondita*

Accessions	Seedling reactions to Pts.		Adult plant response to rusts		
	77-5 (121R-63-1)	77-7 121R-127	Stem	Leaf	Stripe
T. p.-31	3+	33+	70S	90S	70S
T. p.-38	0:-1c	-	50S	50XS	70S
T. p.-44	3+	33+	10S	60S	40S
T. p. var. *nigrobarbatum*	2c	3+	40S	30MR. MS	30S
T. p. var. *vestitum*	3c	3	60S	70MR, MS	40S
T. p. G586	3c	-	60S	40MR, MS	40S
T. p. EC143792	0:-1c	2+	40S	20MR, MS	F
T. p. EC143793	0:-1c	33+	20S	20MR, MS	10S
T. p. EC 143794	3+	33+	15MS	60MS	20MS
T. p. EC 119483	3+	33+	90S	60XS	40S
T. p. EC 119484	0:-1c	-	40S	40XS	50S
T. p.-7	0:-1c	33+	40S	20MR, MS	30MS
Agra local	4	33+	80S	90S	60S

T.p. = T. polonicum

laboratory. With careful monitoring and proper selection in segregating generations, it was possible to select recombinants possessing high TKW and resistance to leaf rust in F_5 generation.

Most of the derivatives involving HW 2041 as one of the parents exhibited complete resistance to leaf rust, due to presence of *Lr19* in HW 2041. The selections from Sonalika/*T. polonicum*//HD2687 also showed moderate resistance to leaf rust in adult plant stage, which is due to resistance transferred from *T. polonicum*. Cultivar HD 2687 is a derivative involving Veery and is likely to carry 1BL.1RS translocation having *Lr26*, which is ineffetive to both 77-5 and 77-7 pathotypes of leaf rust. The interspecific derivatives appear to be promising and diverse for test weight (Fig. 1), TKW and for leaf rust resistance, which can be utilized further in wheat improvement programme. *T. polonicum* has been earliar utilized to improve durum wheat and a variety MACS 9, which has lustrous bold grains (46 g TKW) with identifiable *T. polonicum* hump and good protein content (> 13%) and moderate degree of resistance to black rust.

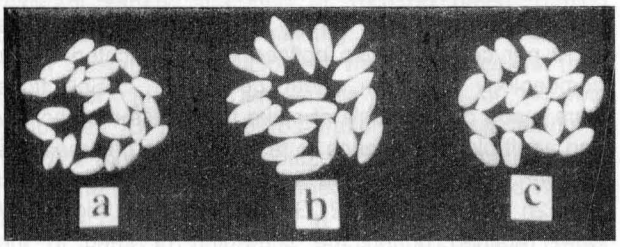

Fig. 1. Kernels of (a) HD2687, (b) T. polonicum and (c) BM Sel 749-2.

Table 2. Test weight and 1000-kernel weight of interspecific derivatives in F_5 generation

Cross/Selections	Adult plant reactions to leaf rust pathotypes 77-5 and 77-7	1000-kernel weight (g)	Test weight (vol.)
Sonalika/*T. polonicum*//HW 2041			
BM Sel. 741	TR	50.0	138.9
BM Sel. 741	TMR	49.2	136.7
BM Sel. 743-2	TR	59.4	135.0
BM Sel. 744-1	TR	51.8	136.3
BM Sel. 744-2	F	52.2	137.4
BM Sel. 757-2	TR	42.0	140.0
BM Sel. 757-3	TR	54.4	133.3
BM Sel. 758-1	20MR, MS	50.8	133.4
Sonalika	60S	45.6	134.2
HW 2041	TR	46.8	138.1
Sonalika/*T. polonicum*//HW 2687			
BM Sel. 747-2	20MR, MS	40.6	135.3
BM Sel. 747-3	30MX	43.4	135.6
BM Sel. 747-5	20MR. MS	38.2	136.4
BM Sel. 748-1	30MX	37.4	138.4
BM Sel. 749-1	20MR. MS	41.4	133.5
BM Sel. 749-2	30S	44.0	137.5
BM Sel. 755-1	40MR, MS	38.8	133.8
BM Sel. 764-1	20S	36.0	138.5
BM Sel. 769-2	20MS	46.1	135.8
BM Sel. 770-1	40MR, MS	35.2	140.8
HD 2687	50S	27.6	131.4
T. polonicum-7	20MR, MS	66.7	129.5

It has been emphasized earlier that grain density is an important indicator for post anthesis source sink relationship determining the grain weight as an important component of yield and that grain density could be increased with simultaneous increase in grain weight and yield even under abiotic stress. Present results indicated that limited backcrossing has been very useful breeding method with greater selection response for improving seed density in bread wheat through interspecific hybridization (Table 2). Single backcross of pentaploid F_1 with hexaploid wheat were found to enhances the frequency of hexaploid and near hexaploid segregants as compared to F_2 population and thus increased the selection response. Density of seed depends on the matrix of protein with starch granuals in the endosperm. The ratio of bran to flour is changed by the change in the flour knitting of protein with starch.

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