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Genetic evaluation of interspecific derivatives of wheat

S. M. Palve[1] and P. Raghavaiah

Division of Genetics, Indian Agricultural Research institute New Delhi 110 012

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Abstract

A set of 46 homozygous durum derivatives (*Triticum durum* Desf.) along with three standard cultivars were grown under irrigated and high fertility conditions using 7 × 7 quadruple lattice design. The objective of the experiment was to evaluate these homozygous durum derivatives which were evolved through interspecific hybridization using back-cross breeding programme for yield and quality traits. The significant differences were observed among the genotypes for all the traits under study. Mean values of the derivatives for each character were higher than the checks. Comparison of variability generated through different donor species revealed maximum variation for grain yield/plot (7.42, 10.31%), number of productive tillers/m^2 (7.89, 7.07%), weight of main spike (7.98, 12.29%) and sedimentation value (10.76, 8.46%). The pattern of variability observed in these derivatives indicated that variability was distinct for each group for specific traits only. This indicated that the genes from different donor species helped in creating additional variability in durum wheat. *T. turgidum* × *T. durum* derivatives showed improvement for protein content, grain yield and spike length while in *T. timopheevi* × *T. durum* derivatives for early maturity and sedimentation values. *T. aestivum* × *T. durum* derivatives had exhibited short stature of plant, early flowering, increased number of spikelets/spike and number of grains/spike.

Key words: Wheat, interspecific derivatives, grain quality, introgression, sedimentation value, protein content

Introduction

The most important species of cultivated wheat are bread wheat and durum wheat. With the introduction of semi-dwarf and thermo-insensitive characters into agronomically desirable spring wheats and adoption of an accompaying package of production practices, major increase in yield have been accomplished. Unlike common or bread wheat, durum wheat is predominantly spring or semi-winter (facultative) in growth habit. The adaptation of durum wheat largely overlaps that of bread wheat but is less widely grown because of its unsuitability to proper chapati and bread-making [1]. However, durum wheat is an important crop used for pasta production because of its amber colour and superior cooking quality.

For improvement of durum wheat which has a narrow genetic base it is essential to tap varied genepools of other *Triticum* species. Earlier studies have also used. *T. timopheevi* as source of alien genes [2-5]. The common wheat genotypes chuanmai#18 and Darf were used as donor parents in improving Indian durums [6]. Ceoloni *et al.* [7] reported the transfer of common wheat chromosome ID storage protein genes into durum wheat. Rajaram *et al.* [8] emphasized on transfer of genes through interspecific and intergeneric hybridization for the improvement of durum wheat. *Triticum turgidum* used for obtaining useful high-yeilding lines with long ears containing many spikelets and long grains [9]. Taurin and Aidrov [10] and Rao *et al.* [11] obtained lines with introgression of useful characters and yield involving *T. turgidum* in crosses with durum wheat.

The objective of this study was to investigate the agronomic and quality characteristics of homozygous interspecific durum derivatives which were evolved through back-cross breeding programme using *T. turgidum, T. timopheevi* and *T. aestivum* as donor species.

Materials and methods

The experimental materials consisted of 49 genotypes of which 46 were homozygous durum derivatives and three durum cultivars — Raj1555, PBW 34 and PDW 233. Durum derivatives comprised of 15 elite selection each from *T. turgidum* × *T. durum* derivatives and from *T. timopheevi* × *T. durum* derivatives and 16 from *T. estivum* × *T. durum* derivatives. These durum derivatives were evolved at the Division of Genetics, Indian Agricultural Research Institute, New Delhi through back-cross breeding [12] programme with an objective of introgressing genes of the donor tetraploid and hexaploid species.

[1] *Present address* : Division of Crop Improvement, Central Research Institute for Jute and Allied Fibres, Barrackpore 743 101.

Experiment was conducted at the Division of Genetics, Indian Agricultural Research Institute, New Delhi in 1996-97 and 1997-98. The experimental materials were evaluated in a 7 × 7 quadruple lattice design with four replications. Each entry was sown in 6 rows in a plot measuring 5.5m length and 0.23m apart by using seed drill. Fertilizers were applied at the rate of 120 kg/ha N, 60 kg/ha P, and 40 kg/ha K. A net plot of size 5.00m × 0.92m were harvested at physiological maturity for yield and recording of the observations.

Data were recorded on the following characters *viz*., grain yield per plot (kg), number of productive tillers per square metre, plant height (cm), length of spike (cm), number of spikelets per spike, weight of main spike (g), 1000-grain weight (g), days to flowering, days to maturity, gluten strength (sedimentation value) and protein content (%). The gluten strength was determined by the method modified by Preston *et al.* [13]. The protein content was estimated by using Technicon N Autoanalyser.

Analysis of variance was computed according to Cochran and Cox [14] and homogeneity of error variance was tested using 'F' test as per Gomez and Gomez [15]. For number of spikelets per spike, thousand grain weight and sedimentation value no adjustments were made as pooled mean square for block was less than mean square for error.

Results and discussion

The analysis of variance showed highly significant differences among the genotypes for all the characters under study (Table 1). The data could not be pooled over years as the 'F' test of error variance over years was significant for most of the characters. No adjustments were made of treatment means for number of spikelets per spike, thousand grain weight and sedimentation value as pooled mean square for block was less than pooled mean square for error. The quantitative variation shown as means, ranges and coefficient of variation among derivatives and checks are presented in Table 2 and Table 3 for yield and agronomic traits. The durum derivatives were classified into three groups based on the types of the species used as donor (Group 1: *T. turgidum* × *T. durum* derivatives, Group II: *T. timopheevi* × *T. durum* derivatives and Group III: *T. aestivum* × *T. durum* derivatives).

Results presented (Table 2, 3) showed that the coefficient of variation was high for grain yield per plot (7.42%, 10.31%), productive tillers/m^2 (7.89%, 7.07%), weight of main spike (7.98%, 12.29%), sedimentation value (10.76%, 8.46%) and minimum for days to flowering (0.97%, 1.91 %) and days to maturity (1.09%, 1.14%). It is evident from data that a wide range of variation exists among the derivatives for various characters than observed for standard cultivars.

Based on the mean values Group I derivatives showed a greater range for grain yield/plot (2.214-3.489 kg; 1.597-1.917 kg), length of spike (7.03-9.28 cm; 7.02-9.67cm) and days to flowering (99.22-107.44; 85.90-95.82). Group II derivatives had shown a wide range for 1000-grain weight (36.88-57.10 g; 34.58-54.93 g) and sedimentation values (15.66-40.14 ml; 14.75-36.50 ml) and Group III derivatives for plant height (77.49-97.06 cm - 69.34-93.82 cm), number of productive tillers/m2 (255.53-338.08; 269.66-328.82) and protein content (11.59-13.27%; 11.03-13.30 %). This variability provided an opportunity for selecting derivatives with high yield and protein content than the popular cultivars presently grown.

Table 1. Analysis of variance of (7x7 quadruple lattice design) of eleven characters of 49 genotypes

Source of variation	d. f.	Year	Grain yield/ plot (kg)	No. of productive tillers/m^2	Plant height (cm)	Length of spike (cm)	No. of spikelets /spike	Weight of spike (g)	Days to flowering	Days to maturity	1000 grain weight (g)	Sedimentation value (ml)	Protein content (%)
Replications	3	1996-97	0.661	11151.31	59.14	2.17	6.21	0.18	4.22	15.31	1.65	49.65	3.05
		1997-98	1.446	4618.33	62.06	1.71	9.31	0.57	62.41	104.00	79.94	37.69	1.66
Blocks Within Replication (adjusted)	24	1996-97	0.159	1433.36	25.60	0.27	0.56	0.08	2.41	5.63	1.53	8.62	1.06
		1997-98	0.101	727.85	18.07	0.33	2.19	0.13	10.56	9.85	13.57	3.14	0.60
Treatments Unadjusted	48	1996-97	0.346	1384.89	85.00	1.12	6.35	0.38	27.41	17.73	110.14	170.91	1.09
		1997-97	0.063	900.80	93.67	1.15	11.51	0.34	29.94	19.38	89.23	152.39	1.66
Adjusted	48	1996-97	0.335**	1114.81**	83.63**	1.12**	-	0.37**	26.79*	16.90*	-	171.29**	0.96**
		1997-98	0.059*	840.06**	92.15**	1. 19**	11.98**	0.35**	29.43**	17.16**	90.10*	-	1.66*
Error (Effective)	120	1996-97	0.046	561.67	5.10	0.17	0.68	0.44	1.03	2.42	2.41	6.25	0.46
		1997-98	0.033	427.61	8.33	0.21	1.36	0.09	3.03	2.07	10.19	4.00	0.43
Total	195												

*, **Significant at 5% and 1% levels of probability, respectively.

Table 2. Adjusted mean for 49 genotypes evaluated in 1996-97 for eleven characters

Sl. No.	Geno-types	Grain yield/ plot (kg)	No. of productive tillers/m^2	Plant height (cm)	Length of spike (cm)	No. of spikelets/ spike	Weight of spike (g)	1000-grain weight	Days to flowering	Days to maturity	Sedimentation value (ml)	Protein content (%)
T. turgidum × *T. durum* derivatives												
1	B01	2.214	287.2	92.14	8.70	16.63	2.58	47.03	101.9	142.3	19.75	12.71
2	B09	2.815	287.1	91.80	7.94	17.30	2.54	45.16	101.6	143.6	23.98	13.24
3	B06	3.010	268.4	96.38	8.14	17.08	3.28	55.32	103.3	144.5	27.17	13.27
4	B313	2.920	297.7	86.22	7.23	16.07	2.43	49.78	98.3	139.3	27.13	12.01
5	B314	2.933	310.0	87.88	7.03	15.66	2.45	54.04	102.2	142.0	32.45	12.43
6	B623	2.719	286.4	95.92	7.12	16.15	2.19	55.92	99.2	141.8	28.33	12.18
7	B730	2.614	294.8	99.17	9.28	16.95	2.48	56.18	99.7	140.7	21.68	12.14
8	B530	3.232	327.7	83.76	8.79	18.44	2.94	46.40	104.3	145.9	25.99	12.62
9	B536	2.524	306.9	75.01	8.20	18.48	2.38	59.79	102.8	141.4	27.22	12.14
10	B1452	3.427	318.9	87.21	7.25	18.10	2.58	42.09	107.4	145.7	18.71	12.74
11	B 1162	3.246	307.0	87.21	7.48	18.83	2.59	46.13	103.9	144.1	19.87	12.27
12	B 1164	3.342	326.8	88.48	7.77	18.40	2.83	47.93	107.1	146.8	21.44	13.23
13	B1455	3.489	300.7	93.46	7.45	17.98	2.89	48.16	106.7	146.1	18.57	11.51
14	B1176	3.281	303.4	86.40	7.72	16.68	2.72	35.88	104.1	143.7	13.93	12.04
15	B759	3.358	313.7	87.54	7.72	18.54	2.17	37.16	106.5	146.3	21.21	11.81
T. timopheevi × *T. durum* derivatives												
16	B188	3.076	325.1	84.86	7.26	14.98	2.11	47.96	103.2	143.6	25.69	11.89
17	B599	2.795	304.6	93.20	8.10	15.50	2.23	42.85	95.9	141.2	34.69	12.35
18	B125	2.914	320.2	89.54	7.81	15.70	2.35	48.27	101.4	140.6	28.35	11.28
19	B220	2.095	314.3	86.03	8.17	15.85	1.99	57.10	100.9	138.2	37.66	12.28
20	B230	2.665	301.4	88.96	8.26	16.50	2.56	47.53	102.3	141.5	40.14	11.74
21	B441	3.076	309.6	88.64	7.24	16.78	2.45	36.88	104.5	144.2	16.66	11.83
22	B271	2.744	301.7	90.14	8.47	18.60	2.66	48.61	102.1	144.5	20.70	12.10
23	B275	2.628	303.9	91.38	8.08	16.86	2.59	45.04	104.6	143.0	18.43	11.74
24	B286	2.806	311.6	85.25	7.57	16.10	2.43	46.89	101.5	141.6	15.66	12.87
25	B287	2.741	311.5	87.11	7.53	16.75	2.32	48.05	103.7	143.4	16.58	11.72
26	B302	3.079	317.8	89.04	7.24	17.05	2.25	42.04	102.2	142.9	28.16	11.53
27	B308	3.101	326.5	95.99	7.36	19.25	2.52	39.77	106.6	145.4	23.63	11.55
28	B829	2.877	296.0	86.55	8.20	16.58	2.54	44.84	100.6	138.9	24.13	10.99
29	B858	3.054	314.4	96.27	7.75	18.13	2.78	42.68	100.7	142.0	25.29	11.83
30	B627	2.797	296.8	88.55	7.39	17.70	2.84	48.94	100.2	139.3	26.27	12.01
T. aestivum × *T. durum derivatives*												
31	B485	2.766	280.6	77.49	6.84	19.75	2.59	42.40	107.4	145.9	14.51	12.67
32	B487	2.876	266.6	87.16	8.44	18.73	2.86	38.85	104.4	144.5	15.68	12.26
33	B490	2.656	309.5	92.00	7.91	18.59	2.67	44.88	105.3	144.4	15.74	11.59
34	B494	2.727	278.6	86.19	8.07	19.36	2.44	39.98	105.8	144.2	15.47	12.27
35	B514	2.679	255.5	87.53	7.63	17.50	2.65	44.09	105.0	143.1	14.98	12.34
36	B860	2.749	270.0	85.98	8.77	17.98	2.82	39.48	104.1	144.3	14.85	12.54
37	B520	2.993	279.7	90.05	8.32	17.53	2.80	47.12	103.1	142.3	32.33	12.52
38	B119	2.913	287.5	97.06	8.08	18.68	2.88	42.66	103.0	143.6	19.57	13.06
39	B780	2.756	300.0	90.45	7.95	19.90	2.96	49.12	102.7	142.7	23.23	12.52
40	B782	2.843	279.3	93.68	8.05	18.50	3.23	42.93	100.9	142.9	20.55	12.52
41	B783	3.215	264.7	91.05	7.97	19.50	3.41	43.43	103.2	144.7	17.79	12.38
42	B744	2.841	309.8	92.56	8.78	17.92	2.77	41.00	105.1	144.1	32.29	13.27
43	B792	2.696	296.9	86.92	8.28	18.89	2.68	39.49	102.4	141.4	22.07	12.36
44	B795	2.838	338.1	86.89	7.89	26.20	2.49	43.43	101.6	142.2	23.04	11.80
45	B871	2.991	286.1	85.89	7.80	18.24	3.11	47.44	107.8	143.8	24.53	12.38
46	B872	3.460	305.4	86.71	7.78	17.83	3.08	49.16	106.3	143.6	20.20	12.63
Check												
47	Raj1555	2.506	297.5	93.54	7.21	15.35	2.17	43.59	99.5	139.3	29.77	12.03
48	PBW34	3.003	312.9	91.65	7.13	15.35	2.32	45.35	101.5	140.9	16.24	12.16
49	PDW233	2.854	309.8	92.47	7.97	16.13	2.34	35.16	104.7	143.7	34.50	12.73
Grand mean		2.90	300.4	89.30	7.86	17.47	2.62	45.60	103.1	143.0	23.24	12.27
LSD P=0.05		0.301	13.18	3.16	0.57	1.15	0.29	2.17	1.42	2.18	3.50	0.95
CV(%)		7.42	7.89	2.52	5.19	4.71	7.98	3.40	0.97	1.09	10.76	5.52

Table 3. Adjusted means for 49 genotypes evaluated in 1997-98 for eleven characters

Sl. No.	Genotypes	Grain yield/plot (kg)	No. of productive tillers/m^2	Plant height (cm)	Length of spike (cm)	No. of spikelets/ spike	Weight of spike (g)	1000-grain weight	Days to flowering	Days to maturity	Sedimentation value(ml)	Protein content (%)
T. turgidum × *T. durum* derivatives												
1	B01	1.614	283.8	88.08	8.65	17.77	2.13	48.93	87.6	122.7	19.25	12.80
2	B09	1.834	278.8	86.71	8.01	17.77	2.38	41.90	88.8	125.3	24.75	12.72
3	B06	1.648	254.2	90.06	8.11	16.54	2.74	55.64	86.5	126.2	25.60	14.16
4	B313	1.917	275.3	82.84	7.29	16.03	2.18	48.77	87.8	124.5	30.00	13.09
5	B314	1.728	300.7	81.21	7.27	16.09	2.33	49.13	90.4	125.7	31.25	11.41
6	B623	1.792	280.5	90.84	7.02	15.89	2.21	45.41	87.7	124.2	29.00	12.62
7	B730	1.679	294.6	91.00	9.67	17.69	2.40	49.43	85.9	123.7	23.75	12.24
8	B530	1.597	300.9	84.12	8.97	18.83	2.82	43.73	88.9	122.9	34.00	13.35
9	B536	1.718	305.8	72.41	8.05	17.75	2.21	47.53	89.2	123.4	24.75	12.10
10	B1452	1.746	280.2	82.25	7.44	19.90	2.25	39.50	94.5	128.3	19.25	12.60
11	B1162	1.797	291.3	84.06	7.75	19.96	2.41	49.66	92.2	126.8	21.00	12.46
12	B1164	1.817	306.2	85.98	7.74	20.32	2.34	41.01	95.2	129.0	24.25	12.72
13	B1455	1.835	276.5	87.55	7.83	20.97	2.71	42.45	94.9	128.5	20.50	11.53
14	B1176	1.707	288.9	86.24	7.82	16.94	2.53	34.44	94.2	127.5	17.25	12.27
15	B759	1.912	308.3	86.97	7.60	18.45	2.69	37.27	95.8	129.4	25.25	12.04
T. timopheevi × *T. durum* derivatives												
16	B188	1.605	313.4	78.76	7.33	16.45	2.10	45.90	92.3	126.2	23.50	11.59
17	B599	1.794	296.9	84.31	8.19	15.27	2.09	44.51	85.7	123.8	35.50	12.67
18	B125	1.868	298.9	83.20	8.16	16.30	2.27	47.67	88.8	124.1	30.00	12.22
19	B220	1.722	285.9	86.10	8.32	16.20	1.93	54.93	89.3	122.3	35.50	12.13
20	B230	1.909	296.7	82.39	8.03	16.32	2.35	46.56	92.0	123.8	34.25	11.76
21	B441	1.792	308.2	85.29	7.36	18.77	1.95	35.58	93.0	127.8	17.50	11.85
22	B271	1.973	292.5	88.42	8.00	18.68	2.61	46.18	88.6	126.5	25.25	12.67
23	B275	1.829	305.9	85.29	7.91	17.60	2.28	43.27	93.1	127.5	17.00	12.37
24	B286	1.727	297.1	78.69	7.39	16.22	2.32	42.43	87.4	123.7	16.50	12.58
25	B287	1.662	297.4	84.20	7.47	17.64	2.18	44.35	91.8	124.4	14.75	12.48
26	B302	1.784	305.8	79.34	7.09	16.98	2.36	48.38	88.8	124.4	26.75	11.26
27	B308	1.962	315.9	96.33	7.59	20.92	2.22	39.26	92.9	126.9	26.75	11.88
28	B829	1.879	286.2	84.32	8.17	15.72	2.50	48.69	88.1	123.1	25.00	12.46
29	B858	1.697	313.4	84.03	7.77	18.97	2.48	48.22	90.7	126.5	23.50	11.96
30	B627	1.752	276.4	78.09	7.41	17.74	2.59	46.92	88.4	120.5	25.25	12.22
T. aestivum × *T. durum* derivatives												
31	B485	1.556	90.5	69.34	7.02	21.46	2.17	39.18	84.0	128.4	16.00	13.51
32	B487	1.572	271.6	84.73	8.45	19.11	2.80	39.76	93.5	127.0	16.50	13.22
33	B490	1.717	289.3	88.67	8.08	18.60	2.60	43.25	92.4	125.9	19.50	11.03
34	B494	1.718	276.8	83.66	8.56	21.13	2.14	41.23	94.1	126.6	15.50	12.50
35	B514	1.721	269.7	82.33	7.53	18.53	2.66	43.19	94.1	125.9	14.75	12.84
36	B860	1.578	287.7	84.65	8.38	18.76	2.45	37.79	92.6	127.6	14.50	13.25
37	B520	1.582	282.4	88.38	8.58	18.76	2.60	47.74	92.8	127.6	31.00	12.54
38	B1191	1.857	281.3	93.82	8.09	19.33	2.57	44.36	90.7	126.1	19.25	13.29
39	B780	1.798	297.2	88.47	7.88	19.85	2.80	33.21	90.6	126.1	18.75	12.73
40	B782	1.527	276.1	88.72	8.75	21.41	2.92	39.86	92.4	126.8	18.00	12.71
41	B783	2.008	270.2	89.22	8.14	20.18	3.30	43.11	90.8	126.6	18.25	12.18
42	B744	1.538	298.9	90.27	8.66	18.51	2.48	43.06	92.4	126.3	34.50	13.07
43	B792	1.862	297.4	86.70	8.29	18.71	2.49	40.48	89.1	123.7	22.25	12.41
44	B795	1.899	228.8	81.94	7.68	16.16	2.52	44.10	89.0	22.2	23.25	11.24
45	B871	1.665	293.7	84.37	7.98	19.80	3.02	50.02	94.2	129.4	25.25	12.41
46	B872	1.711	304.0	85.12	7.83	17.60	2.89	48.17	94.0	128.0	21.50	13.30
Checks												
47	Raj1555	1.671	288.3	90.10	7.28	14.87	2.20	42.16	92.0	124.9	28.50	11.02
48	PBW34	1.881	301.6	85.12	7.18	16.22	2.33	44.88	90.7	125.6	16.50	11.42
49	PDW233	1.845	313.6	89.21	7.64	17.73	2.06	38.05	94.6	127.4	34.75	12.30
Grand mean		1.885	292.7	85.18	7.91	18.11	2.44	44.02	91.1	125.7	23.63	12.41
LSD P=0.05		0.253	129.0	4.04	0.64	1.63	0.42	4.48	2.44	2.01	2.79	0.92
CV(%)		10.31	7.07	3.39	5.80	6.43	12.29	7.25	1.91	1.14	8.46	5.31

Amongst the group I derivatives in the first year B1455(3.489 kg), B1452(3.427 kg), B759 (3.358 kg), and B1164 (3.342 kg) had significantly higher yield than the checks PBW34 (3.003 kg), PDW233 (2.854 kg) and Raj1555 (2.506 kg). However, none of the derivatives of group II and group III except B782 (Group III) had shown significant higher yield than check PBW 34. Examining grain yield across the years revealed that yields were low in the second year due to unfavourable weather compared to the first year. B1164 had showed significantly higher yield (3.342 kg) and protein content (13.23%) over the checks Raj1555 (2.506 kg, 12.03%) and PBW34 (3.003kg, 12.16%), respectively. Levy and Feldman [16] and Tahir and Pashyani [17] obtained derivatives with high protein content and yield involving *T. turgidum* var. *dicocoides* in the crosses. Derivatives B730 (9.28cm, 9.67cm) and B530 (8.79cm, 8.97cm) had shown significantly higher length of spike in both the years over all the derivatives and checks. These results support the findings of Buyukli [9] that obtained similar results in the F_3-F_4 between *T. durum* and *T. turgidum* for spike length. Sukhanova [18] reported that incorporation of *T. turgidum* in durum with increased number of grains per ear and grain size, however, Ciaffi *et al.* [19] obtained progenies with high protein content.

The group II derivatives B230, B599 and B220 were found promising compared to the checks and other derivatives for sedimentation value and thousand grain weight traits. B230 had a significantly higher sedimentation value (40.14ml) than all the other derivatives and checks. B599 derivative on the other hand had higher sedimentation values (34.69ml, 35.50ml) and protein content (12.35%, 12.67%) compared with other group II derivatives. B271 and B308 had shown significantly higher grain yield 1.973 kg/plot and 1.962 kg/plot over check Raj 1555 (1.671 kg/plot), respectively. Pandey and Singh [20] in their study reported similar results that derivatives between durum and *T. timopheevi* out yielded the control, PBW34. However, Deodikar *et al.* [2] and The *et al.* [5] used *T. timopheevi* as a source of disease resistance in durum and bread wheat, respectively.

Among group III derivatives B485 (77.49 cm, 69.34 cm), B514 (87.53 cm, 82.33 cm) and B860 (85.98 cm, 84.65 cm) had shown lower height in both the years but yields were not significant over check cultivars. B795 had a high number of productive tillers/m2 (338.08, 328.82) than all the derivatives and checks in both the years. For number of spikelets per spike trait B 485 (19.75, 21.46), B783 (19.50, 20.18) and B780 (19.90, 19.85) exhibited significantly higher number of spikelets per spike than the check cultivars in both the years. Lebsock [21] and Lebsock *et al.* [22] reported that the hexaploid semidwarf wheat Willet sib/Norin10/Brevor was utilized to transfer Rht 1 to durum wheat. B744 and B1191 had a significantly higher protein content (13.27% and 13.06%) than the check Raj 1555 (12.03%) in the first year and all the checks in the second year. These results support the findings of Miazga *et al.* [23] and Zhang *et al.* [24] who obtained higher protein content in lines derived from *T. aestivum* × *T. durum* crosses. However, Waddington *et al.* [25] obtained grain yield improvement based on grain number per square metre due to more grains per spikelets. Littlejohn and Pienaar [26] and Sawhney and Sharma [27] also reported improvement of durums through the use of common wheat through backcrossing. Ceoloni *et al.* [7] reported transfer of common wheat chromosome 1D seed storage protein genes into durum wheat via chromosome engineering.

In conclusion, results of this study show the introgression of characteristics of the donor species into durum derivatives, which were evolved through backcrossing breeding programme. Thus it is suggested that these derivatives had merit than the currently grown cultivars and can be tested under multilocation tests for finding their suitability as cultivars.

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