Plant Germplasm Registration Notice*

The Germplasm Registration Committee of ICAR in its X[th] meeting held on 20[th] February 2003 at National Bureau of Plant Genetic Resources, New Delhi approved the registration of following 47 germplasm lines/ genetic stocks of the 132 proposals considered.

Cytogenetic Stocks of Wheat (*Triticum aestivum* L.)

GS Sethi and P Plaha
Department of Plant Breeding and Genetics, Ch. Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya Palampur-176062 (Himachal Pradesh)

RL 4 ***(INGR No 03001; IC 296923)***

RL 4 is a cytogenetic stock of wheat, *T. aestivum* having 1R(1D) substitution from triticale. This line was isolated from advanced generation of cross between 'TL68' triticale and 'Sonalika' wheat. It was developed through pedigree selection at the Department of Plant Breeding and Genetics, Ch. Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur.

The plant has erect growth habit with an average height of 78 cm. There is no anthocyanin pigmentation in coleoptile and leaf sheath. Grain is red in colour with semi-hard texture and compressed cheeks with an average 1000-grain weight of 28 g. It starts heading around 108 days and matures by 158 days.

RL 83 ***(INGR No. 03002; IC 296924)***

RL 83 is a cytogenetic stock of wheat, *T. aestivum* having 7R(7D) substitution from triticale. The line was isolated from advanced generation of cross between triticale and bread wheat with pedigree, 'TL161' *Triticale* and 'Sonalika' wheat respectively. It was developed through pedigree selection at the Department of Plant Breeding and Genetics, Ch. Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur.

The plant has erect growth habit with average height of 76 cm. There is no anthocyanin pigmentation in coleoptile and leaf sheath, but auricle is pigmented at flag leaf stage. Grain is amber coloured with semi-hard texture and compressed cheeks with an average 1000-grain weight of 28 g. The genetic stock starts heading in 108 days and matures in around 158 days.

Karnal Bunt Resistant Lines of Wheat (*Triticum turgidum var. durum* Desf.)

Indu Sharma, GS Mahal and Sarvjeet Singh
Wheat Section, Department of Plant Breeding, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

Karnal bunt disease of wheat caused by *Tilletia indica* Mitra is a major bottleneck in wheat export. Durum wheats, in general, score very less disease under natural conditions on account of morphological resistance (long awns, hairy glumes and densely arranged spikelets) and are comparable to bread wheat for physiological resistance. The durum wheat lines proposed for registration were developed and tested for Karnal bunt resistance using syringe inoculation method (Warham *et al.*, 1986; Sharma *et al.*, 2000) for identification of physiological resistance against Karnal bunt at the Punjab Agricultural University (PAU), Ludhiana.

D 482 ***(INGR No. 03003; IC 296426)***

D 482 is a Karnal bunt resistant genotype of wheat with a new genetic background. It was developed from the cross between MEMO'S' and JAIRAJ following pedigree method at the Department of Plant Breeding, Punjab Agricultural University, Ludhiana. It remained free from Karnal bunt from 1997 to 2001 and scored only 0.8 percent disease during 2002.

* Communicated by: Dr. A.K. Singh, Member Secretary, Plant Germplasm Registration Committee, Head, Conservation Division, NBPGR, New Delhi-110 012

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The plant has erect growth habit with an average height of 78 cm. There is no anthocyanin pigmentation in coleoptile and leaf sheath. Grain is red in colour with semi-hard texture and compressed cheeks with an average 1000-grain weight of 28 g. It starts heading around 108 days and matures by 158 days.

RL 83 ***(INGR No. 03002; IC 296924)***

RL 83 is a cytogenetic stock of wheat, *T. aestivum* having 7R(7D) substitution from triticale. The line was isolated from advanced generation of cross between triticale and bread wheat with pedigree, 'TL161' *Triticale* and 'Sonalika' wheat respectively. It was developed through pedigree selection at the Department of Plant Breeding and Genetics, Ch. Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur.

The plant has erect growth habit with average height of 76 cm. There is no anthocyanin pigmentation in coleoptile and leaf sheath, but auricle is pigmented at flag leaf stage. Grain is amber coloured with semi-hard texture and compressed cheeks with an average 1000-grain weight of 28 g. The genetic stock starts heading in 108 days and matures in around 158 days.

Karnal Bunt Resistant Lines of Wheat (*Triticum turgidum var. durum* Desf.)

Indu Sharma, GS Mahal and Sarvjeet Singh
Wheat Section, Department of Plant Breeding, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

Karnal bunt disease of wheat caused by *Tilletia indica* Mitra is a major bottleneck in wheat export. Durum wheats, in general, score very less disease under natural conditions on account of morphological resistance (long awns, hairy glumes and densely arranged spikelets) and are comparable to bread wheat for physiological resistance. The durum wheat lines proposed for registration were developed and tested for Karnal bunt resistance using syringe inoculation method (Warham *et al.*, 1986; Sharma *et al.*, 2000) for identification of physiological resistance against Karnal bunt at the Punjab Agricultural University (PAU), Ludhiana.

D 482 ***(INGR No. 03003; IC 296426)***

D 482 is a Karnal bunt resistant genotype of wheat with a new genetic background. It was developed from the cross between MEMO'S' and JAIRAJ following pedigree method at the Department of Plant Breeding, Punjab Agricultural University, Ludhiana. It remained free from Karnal bunt from 1997 to 2001 and scored only 0.8 percent disease during 2002.

* Communicated by: Dr. A.K. Singh, Member Secretary, Plant Germplasm Registration Committee, Head, Conservation Division, NBPGR, New Delhi-110 012

The genotype has spreading growth habit at seedling stage with purple pigmentation in the auricle and light green foliage. It has an average plant height of 93 cm. with medium spikes and pubescent glume and matures in 160 days. Grains are of amber colour and have vitreousness. The line is high yielding with an average yield of 47.4 quintals per hectare. It has good quality characters, such as good grain appearance (5.7), hectoliter weight (79.5 Kg/ha), protein content (12%), sedimentation value (25 ml.), yellow berry (26.3%) and beta-carotene content (6.3 ppm). It is also resistant to brown and yellow rusts (Table 1).

D 873 *(INGR No. 03004; IC 296427)*

D 873 is Karnal bunt resistant genotype of wheat in a different genetic background. Crossing between DWL 7307 and PDW 222, followed by pedigree selection resulted in development of this line at the Department of Plant Breeding, Punjab Agricultural University, Ludhiana. The line is maintaining resistance against Karnal bunt under artificial inoculation conditions since its identification in 1997. It has remained disease free for five years and developed only 1.4 percent infection during 2001.

The genotype is erect at seedling stage with dark green leaves and purple pigmentation on auricle. The spikes are medium in length with blackish awns. Grains are amber coloured and hard. It matures in 156 days with an average plant height of 96 cm. It has easy threshability with acceptable agronomic traits. It is also free from brown rust (Table 1).

D 879 *(INGR No. 03005; IC 296428)*

D 879 is a Karnal bunt resistant line with a different genetic background. It was developed by pedigree method of selection from the cross between CPAN 6036 and DWL 7307 at the Department of Plant Breeding, Punjab Agricultural University, Ludhiana. It did not develop the disease for four years (1997-2000) and only in the years 2002 and 2001 infection was recorded to the levels of 1.0 and 2.3 percent respectively.

The genotype has intermediate growth habit at the seedling stage. Plants are 97 cm. in height and bear purple auricles, dark green foliage with blackish awns. It matures in 155 days and produces amber coloured bold grains that can be easily threshed. It is agronomically promising and free from brown rust (Table 1).

D 895 *(INGR No. 03006; IC 296429)*

D 895 is a Karnal bunt resistant wheat line with a different genetic background. The genotype was developed at the Department of Plant Breeding, Punjab Agricultural University, Ludhiana by a cross between PDW 222 and

Table 1. Yield and other characteristics of D 482, D 873, D 879 and D 895

Year	Trial	Location	Yield (q/ha)	Percentage Increase Over PBW34 / PDW233	Rusts		Leaf blight	Days to heading
					Yellow	Brown		
D 482								
1994-95	Station	1	71.2	19.3	0	0	–	117
1995-96	IVT	10	45.5	3.9	0	0	3	107
1996-97	State	3	50.2	0.6	0	0	–	119
1996-97	AVT	15	46.6	3.3	0	3	3	111
Mean		29	47.4	3.7	–	–	–	–
D 873		**Percentage increase over PDW 233**						
1995-96	Station	1	52.2	19.7	5S	0	–	113
1996-97	State	3	44.5	–	5S	0	–	114
Mean		4	46.4	–	–	–	–	–
D 879								
1995-96	Station	1	45.3	3.9	10S	0	–	108
1996-97	Station	1	49.3	–	10S	0	–	113
Mean		2	47.3	–	–	–	–	–
D 895								
1995-96	Station	1	46.3	12.7	5S	0	–	109
1996-97	Station	1	58.0	12.4	10S	0	–	115
1997-98	Station	3	43.8	1.4	20S	0	–	102
Mean		5	47.1	5.8	–	–	–	–

Raj 6419 followed by pedigree selection method. The line remained free from Karnal bunt for 5 years (1997-2001) and only in 2002 recorded an infection of 3.3 percent.

The genotype has intermediate growth habit at the seedling stage, with an average plant height of 90 cm. and has white auricle and light green foliage. Spikes are medium in size with white awns. It matures in 156 days. The grains are amber in colour and hard with medium threshability. It is a high yielding line with an average yield of 47.1 q./ha. Also, it is resistant to brown rust (Table 1).

References

Warham EJ (1986) Karnal bunt disease of wheat-A literature review. *Tropical Pest Management* **32** (3): 229-242.

Sharma I, GS Nanda, GS Mahal, and GS Dhindsa (2000) Status of Karnal bunt resistant durum wheats and triticale and their reaction to rusts. *Crop Improvement* **27**(1): 99-103.

Hill Bunt Immune Line of Wheat (*Triticum aestivum* L.) VL 798 (INGR No. 03007; IC 296431)

Jag Shoran and AK Sharma[1]; Lakshmi Kant, SK Pant and JC Bhatt[2]; SK Rana[3]

1. Directorate of Wheat Research, Karnal-132 001, (Haryana)

2. Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora-263 601, (Uttaranchal)

3. Ch. Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176 062, (Himachal Pradesh)

VL 798 is a spring wheat genotype possessing immunity for hill bunt disease. It was developed at the Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora, Uttranchal through application of pedigree selection method on crosses involving CPAN 3004/ CPAN 1922/ PBW 65 as the parents. It has semi-spreading growth habit with an average plant height of 110 cm. with seven effective tillers per plant, 20 spikelets per spike and green coleoptile colour. It takes an average of 172 days to mature. The brown coloured ears produce amber coloured grains with intermediate plumpness and 36 g. 1000-grain weight. The average seed yield per plant is 8.44 g.

In addition, this genetic stock expressed high resistance to brown rust when tested under artificial epiphytotic conditions in All India Coordinated Trials from 1996-97 to 1998-99 with an average coefficient of infection of 3.2. It has been found well adapted to Northern Hill Zone conditions with recommended package of practices.

References

DWR, Progress Report (1999) Vol. V (Crop Protection), pp. 67.

DWR, Progress Report (2000) Vol. V (Crop Protection), pp. 78.

High Grain Weight and Protein Wheat (*Triticum aestivum* L.) Selection 111 *(INGR No. 03008; IC 296469)*

Dalmir Singh

Ex-Principal Scientist, Genetics Division, Indian Agricultural Research Institute, New Delhi-110 012

Selection 111 is a high kernel weight (65-70 g./ 1000-grain weight) genotype of wheat with protein content of 15 to 16 percent on dry seed weight basis. The genotype was isolated from the segregating populations of the crosses involving monosomic 5B of var. Pb. C 591, rust resistant rye and var. Sonalika at the Division of Genetics, Indian Agricultural Research Institute (IARI), New Delhi. First monosomic 5B (2n=41) of var. Pb. C 591 was crossed with rust resistant rye (2n=14) and their F_1 hybrids deficient for chromosome 5B (2n=27) were crossed with var. Sonalika (2n=42). In the subsequent generations, selfing and selections were followed, yielding several recombinants, of which Selection 111 was one with high grain weight and protein content. Aneuploid analysis using monosomics of var. Chinese Spring revealed the location of these traits on chromosome 1A (Singh and Joshi, 1987; Singh *et al.*, 1988; Singh, 1984).

The line is slightly taller than var. Sonalika and matures at the same time as that of Sonalika. It possesses bold spike with 21 to 23 spikelets. The grain yield is superior to Sonalika. It has good root system providing tolerance to lodging. In rotation with paddy, it has been observed that Selection 111 can yield 40-45 quintals of grain per hectare.

Raj 6419 followed by pedigree selection method. The line remained free from Karnal bunt for 5 years (1997-2001) and only in 2002 recorded an infection of 3.3 percent.

The genotype has intermediate growth habit at the seedling stage, with an average plant height of 90 cm. and has white auricle and light green foliage. Spikes are medium in size with white awns. It matures in 156 days. The grains are amber in colour and hard with medium threshability. It is a high yielding line with an average yield of 47.1 q./ha. Also, it is resistant to brown rust (Table 1).

References

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Hill Bunt Immune Line of Wheat (*Triticum aestivum* L.) VL 798 (INGR No. 03007; IC 296431)

Jag Shoran and AK Sharma[1]; Lakshmi Kant, SK Pant and JC Bhatt[2]; SK Rana[3]

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2. Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora-263 601, (Uttaranchal)

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In addition, this genetic stock expressed high resistance to brown rust when tested under artificial epiphytotic conditions in All India Coordinated Trials from 1996-97 to 1998-99 with an average coefficient of infection of 3.2. It has been found well adapted to Northern Hill Zone conditions with recommended package of practices.

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High Grain Weight and Protein Wheat (*Triticum aestivum* L.) Selection 111 *(INGR No. 03008; IC 296469)*

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Selection 111 is a high kernel weight (65-70 g./ 1000-grain weight) genotype of wheat with protein content of 15 to 16 percent on dry seed weight basis. The genotype was isolated from the segregating populations of the crosses involving monosomic 5B of var. Pb. C 591, rust resistant rye and var. Sonalika at the Division of Genetics, Indian Agricultural Research Institute (IARI), New Delhi. First monosomic 5B (2n=41) of var. Pb. C 591 was crossed with rust resistant rye (2n=14) and their F_1 hybrids deficient for chromosome 5B (2n=27) were crossed with var. Sonalika (2n=42). In the subsequent generations, selfing and selections were followed, yielding several recombinants, of which Selection 111 was one with high grain weight and protein content. Aneuploid analysis using monosomics of var. Chinese Spring revealed the location of these traits on chromosome 1A (Singh and Joshi, 1987; Singh *et al.*, 1988; Singh, 1984).

The line is slightly taller than var. Sonalika and matures at the same time as that of Sonalika. It possesses bold spike with 21 to 23 spikelets. The grain yield is superior to Sonalika. It has good root system providing tolerance to lodging. In rotation with paddy, it has been observed that Selection 111 can yield 40-45 quintals of grain per hectare.

Raj 6419 followed by pedigree selection method. The line remained free from Karnal bunt for 5 years (1997-2001) and only in 2002 recorded an infection of 3.3 percent.

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Hill Bunt Immune Line of Wheat (*Triticum aestivum* L.) VL 798 (INGR No. 03007; IC 296431)

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VL 798 is a spring wheat genotype possessing immunity for hill bunt disease. It was developed at the Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora, Uttranchal through application of pedigree selection method on crosses involving CPAN 3004/ CPAN 1922/ PBW 65 as the parents. It has semi-spreading growth habit with an average plant height of 110 cm. with seven effective tillers per plant, 20 spikelets per spike and green coleoptile colour. It takes an average of 172 days to mature. The brown coloured ears produce amber coloured grains with intermediate plumpness and 36 g. 1000-grain weight. The average seed yield per plant is 8.44 g.

In addition, this genetic stock expressed high resistance to brown rust when tested under artificial epiphytotic conditions in All India Coordinated Trials from 1996-97 to 1998-99 with an average coefficient of infection of 3.2. It has been found well adapted to Northern Hill Zone conditions with recommended package of practices.

References

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DWR, Progress Report (2000) Vol. V (Crop Protection), pp. 78.

High Grain Weight and Protein Wheat (*Triticum aestivum* L.) Selection 111 *(INGR No. 03008; IC 296469)*

Dalmir Singh

Ex-Principal Scientist, Genetics Division, Indian Agricultural Research Institute, New Delhi-110 012

Selection 111 is a high kernel weight (65-70 g./ 1000-grain weight) genotype of wheat with protein content of 15 to 16 percent on dry seed weight basis. The genotype was isolated from the segregating populations of the crosses involving monosomic 5B of var. Pb. C 591, rust resistant rye and var. Sonalika at the Division of Genetics, Indian Agricultural Research Institute (IARI), New Delhi. First monosomic 5B (2n=41) of var. Pb. C 591 was crossed with rust resistant rye (2n=14) and their F_1 hybrids deficient for chromosome 5B (2n=27) were crossed with var. Sonalika (2n=42). In the subsequent generations, selfing and selections were followed, yielding several recombinants, of which Selection 111 was one with high grain weight and protein content. Aneuploid analysis using monosomics of var. Chinese Spring revealed the location of these traits on chromosome 1A (Singh and Joshi, 1987; Singh *et al.*, 1988; Singh, 1984).

The line is slightly taller than var. Sonalika and matures at the same time as that of Sonalika. It possesses bold spike with 21 to 23 spikelets. The grain yield is superior to Sonalika. It has good root system providing tolerance to lodging. In rotation with paddy, it has been observed that Selection 111 can yield 40-45 quintals of grain per hectare.

References

Singh D (1984) Exploitation of chromosome 5B mechanism in transferring desirable traits from rye to bread wheat. Ph. D. Thesis submitted to P.G. School, IARI, New Delhi, 1984.

Singh D and BC Joshi (1987) Aneuploid analysis of seed weight in a wheat-rye recombinant, *Indian J Genet.* **47**: 239-242

Singh D, BC Joshi, HC Bansal, K Batra and R Kumar (1988) Aneuploid analysis for protein content in a wheat-rye recombinant. *Indian J. Genet.* **48**: 49-52.

A New Source of Rust Resistance in Wheat (*Triticum aestivum* L.) Selection 212 *(INGR No. 03009; IC 296470)*

Dalmir Singh

Ex-Principal Scientist, Genetics Division, Indian Agricultural Research Institute, New Delhi-110 012

Selection 212 is a genotype with leaf and stem rust resistance genes present on the same chromosome. Also, it is resistant to all the pathogens of leaf and stem rusts of wheat. It was isolated from the segregating generations of the three way crosses involving monosomic 5B of var. Chinese Spring (2n=41), *Secale cereale* (2n=14) and var. Sonalika (2n=42) at the Division of Genetics, Indian Agriculture Research Institute (IARI), New Delhi. The monosomic 5B of var. Chinese Spring was crossed with a rust resistant mutant of rye and their F_1 hybrids deficient for chromosome 5B (2n-27) were backcrossed with var. Sonalika. In the subsequent generations, selfing and selections were followed, which yielded several recombinants with desirable traits, of which Selection 212 was one of the promising selections for rust resistance. The Selection 212 was tested for rust resistance for several generations at Wellington (Tamil Nadu), a hot spot for rust disease. Aneuploid analysis using monosomics of var. Chinese Spring revealed the location of linked genes for leaf and stem rust resistance on chromosome 2B (Sharma & Sharma, 2001; Singh, 1999).

The genotype has amber coloured grains, long spike with height and maturity similar to var. Sonalika. Its rust resistances are easily transferable.

References

Singh D (1999) Homologous induced resistance from *Secale cereale* to hexaploid wheat and its genetics. Proc. Symp. Crop Improvement for Food Security (eds. R.K. Behl, M.S. Punia and B.P.S. Lather), SSARM Hisar, 1999.

Sharma JB and D Singh (2001) Chromosome location of leaf and stem rust resistance genes in a wheat-rye recombinant line 'Selection-212'. *Indian J. Genet.* **61**: 16-18.

Genic Male Sterile Wheat *(Triticum aestivum* L.) P-mst, Genic Male Sterile *(INGR No. 03010; IC 296479)*

Dalmir Singh

Ex-Principal Scientist, Genetics Division, Indian Agricultural Research Institute, New Delhi-110 012

P-mst genotype is a genic male sterile line with resistance to stem rust. It was isolated from the F_3 progenies derived from cross between Selection 212 (Wheat-rye recombinant possessing resistance to leaf and stem rusts of wheat) and HD 2009 (an Indian rust susceptible wheat). Inheritance studies revealed that the male sterility is being controlled by single recessive gene (Singh 2000, 2001). Aneuploid analysis using monosomics of var. Chinese Spring revealed the location of this gene on chromosome 4A (Singh and Biswas, 2002).

The P-mst genotype is about 110 cm. tall. It possesses long spike with 21 to 23 spikelets. The expression of genic male-sterility is caused due to the conversion of anthers into fully fertile ovaries. Since the phenomenon of anther conversion into ovaries is incomplete, therefore male-sterility is partial, thus it is designated as partial genic male-sterility (P-mst). It produces about 10 percent dented seeds, which are capable of producing male-sterile plants in the next generation. Its vegetative growth is slow resulting in late maturity. It is free from wheat rusts. Its hybrids with var. PBW 343 produced 40 percent higher yield than var. PBW 343.

References

Singh D (2000) Inheritance of novel partial male sterility in hexaploid wheat. Annual Wheat Newsletter. **47**: 74-76.

Singh D (2001) Breeding behaviour and inheritance of genic male-sterility in hexaploid wheat. Wheat Inf. Serv. **49**: 19-21.

Singh D and PK Biswas (2002) Monosomic analysis of genic male-sterility in hexaploid wheat. Wheat Inf. Serv., **95**: 1-3.

References

Singh D (1984) Exploitation of chromosome 5B mechanism in transferring desirable traits from rye to bread wheat. Ph. D. Thesis submitted to P.G. School, IARI, New Delhi, 1984.

Singh D and BC Joshi (1987) Aneuploid analysis of seed weight in a wheat-rye recombinant, *Indian J Genet.* **47**: 239-242

Singh D, BC Joshi, HC Bansal, K Batra and R Kumar (1988) Aneuploid analysis for protein content in a wheat-rye recombinant. *Indian J. Genet.* **48**: 49-52.

A New Source of Rust Resistance in Wheat (*Triticum aestivum* L.) Selection 212 *(INGR No. 03009; IC 296470)*

Dalmir Singh

Ex-Principal Scientist, Genetics Division, Indian Agricultural Research Institute, New Delhi-110 012

Selection 212 is a genotype with leaf and stem rust resistance genes present on the same chromosome. Also, it is resistant to all the pathogens of leaf and stem rusts of wheat. It was isolated from the segregating generations of the three way crosses involving monosomic 5B of var. Chinese Spring (2n=41), *Secale cereale* (2n=14) and var. Sonalika (2n=42) at the Division of Genetics, Indian Agriculture Research Institute (IARI), New Delhi. The monosomic 5B of var. Chinese Spring was crossed with a rust resistant mutant of rye and their F_1 hybrids deficient for chromosome 5B (2n-27) were backcrossed with var. Sonalika. In the subsequent generations, selfing and selections were followed, which yielded several recombinants with desirable traits, of which Selection 212 was one of the promising selections for rust resistance. The Selection 212 was tested for rust resistance for several generations at Wellington (Tamil Nadu), a hot spot for rust disease. Aneuploid analysis using monosomics of var. Chinese Spring revealed the location of linked genes for leaf and stem rust resistance on chromosome 2B (Sharma & Sharma, 2001; Singh, 1999).

The genotype has amber coloured grains, long spike with height and maturity similar to var. Sonalika. Its rust resistances are easily transferable.

References

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Sharma JB and D Singh (2001) Chromosome location of leaf and stem rust resistance genes in a wheat-rye recombinant line 'Selection-212'. *Indian J. Genet.* **61**: 16-18.

Genic Male Sterile Wheat *(Triticum aestivum* L.) P-mst, Genic Male Sterile *(INGR No. 03010; IC 296479)*

Dalmir Singh

Ex-Principal Scientist, Genetics Division, Indian Agricultural Research Institute, New Delhi-110 012

P-mst genotype is a genic male sterile line with resistance to stem rust. It was isolated from the F_3 progenies derived from cross between Selection 212 (Wheat-rye recombinant possessing resistance to leaf and stem rusts of wheat) and HD 2009 (an Indian rust susceptible wheat). Inheritance studies revealed that the male sterility is being controlled by single recessive gene (Singh 2000, 2001). Aneuploid analysis using monosomics of var. Chinese Spring revealed the location of this gene on chromosome 4A (Singh and Biswas, 2002).

The P-mst genotype is about 110 cm. tall. It possesses long spike with 21 to 23 spikelets. The expression of genic male-sterility is caused due to the conversion of anthers into fully fertile ovaries. Since the phenomenon of anther conversion into ovaries is incomplete, therefore male-sterility is partial, thus it is designated as partial genic male-sterility (P-mst). It produces about 10 percent dented seeds, which are capable of producing male-sterile plants in the next generation. Its vegetative growth is slow resulting in late maturity. It is free from wheat rusts. Its hybrids with var. PBW 343 produced 40 percent higher yield than var. PBW 343.

References

Singh D (2000) Inheritance of novel partial male sterility in hexaploid wheat. Annual Wheat Newsletter. **47**: 74-76.

Singh D (2001) Breeding behaviour and inheritance of genic male-sterility in hexaploid wheat. Wheat Inf. Serv. **49**: 19-21.

Singh D and PK Biswas (2002) Monosomic analysis of genic male-sterility in hexaploid wheat. Wheat Inf. Serv., **95**: 1-3.

Loose Smut Resistant Line of Wheat (*Triticum aestivum* L.) VL 639 *(INGR No. 03011; IC 296480)*

Jag Shoran and AK Sharma[1]; Lakshmi Kant, SK Pant and JC Bhatt[2]

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2. Department of Plant Breeding and Department of Pathology, Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora-263 601 (Uttaranchal)

VL 639 has high degree of resistance against loose smut of wheat. This material was developed at Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora. (Uttranchal), through pedigree selection method of breeding on a cross between VL 421 and CPAN 1535.

VL 639 is spring wheat having intermediate growth habit with white glume colour. Its average plant height is 91cm. with an average of four effective tillers per plant and 20 spikelets per spike. It takes an average of 162 days to mature. It has white ears with amber coloured grains having 1000-grain weight of 46 g. The average seed yield per plant is 8 g.

This strain was identified as a resistant genetic stock for loose smut in the All India Co-ordinated Wheat Improvement Programme (AICWIP). Further the resistance was confirmed during 1999-2000 in multiple disease-screening nursery of the AICWIP.

Reference

Directorate of Wheat Research, Progress Report (2001) Vol. V (Crop Protection). pp 64.

Bold Seeded and Protein Rich Durum Wheat (*Triticum durum* Desf.) *Bawaji (INGR No. 03012; IC 296483)*

Sushila Kundu

Directorate of Wheat Research (DWR), Karnal-132 001 (Haryana)

Bawaji is a high protein, bold seeded durum wheat selection from a local landrace, *Bawaji* collected from the farmer's field in southern Uttar Pradesh. The collection was handed over to Directorate of Wheat Research (DWR), Karnal for evaluation and further selections. It was evaluated under the project on Maintenance of Biodiversity in Wheat at DWR, Karnal.

The selection has been identified for its long, bold grain and high protein content. This genotype was evaluated for three years at DWR farms under normal agronomic practices. Table 1a & b summaries the details of its morphological and agronomic features respectively.

Design of experiment was augmented. *Bawaji* is tall type durum wheat that matures in 140-150 days. Stem is medium strong and susceptible to lodging, and yellow and brown rust. It is more adapted to central zone and rainfed conditions.

Table 1a. Morphological data of *Bawaji*

Growth habit	Erect	Growth habit	Erect
Anthocyanin pigmentation of		**Ear characters**	
Auricle	Purple	Ear colour	WhiteEar
Auricle pubescence	Absent	shape	Tapering
Foliage colour (boot stage)	Green	Ear density	Dense
		Ear length	Medium
Leaf length	Long	Awn colour	Black
Leaf breadth	Broad	Awn length	Long
Days to heading	91	Outer glume pubescence	Densely pub.
Days to maturity	145	Glume shoulder shape	Round
Waxiness at ear emergence		Glume beak	Medium
Leaf blade	Nil	**Grain characters**	
Leaf sheath	Present	Colour	Amber
Ear	Nil	Texture	Hard
Peduncle	Present	Shape	Elliptical
		Brush hair length	Long
		Crease	Deep
		Germ width	Medium

Table 1b. Agronomic features of *Bawaji*

Character	1999-2000	2000-01	2001-02	Mean	SE
Days to heading	97.0	96.0	87.0	93.0	0.29
Days to maturity	154	145	145	148	0.36
Height (cm.)	118	125	122	121.6	0.44
Spike length (cm.)	12.0	124	11.6	12.0	0.08
Spikelets no./ spike	20	20	20	20	0.09
No. of seeds/ spike	34	48	34	39	0.57
Protein content (%)	14.71	14.48	14.53	14.57	0.05
Flag leaf length (cm.)	34.5	32.8	36.1	34.5	0.06
Flag leaf breadth (cm.)	2.2	2.32	2.3	2.27	0.11
Thousand grain weight (g.)	72.17	68.04	70.0	70.07	0.29

References

Kundu S, SK Singh, Rajender Pal and Shailesh K Singh (2002) Wheat Germplasm Catalogue-II (Elite Genotypes). Research Bulletin No. 11 pp. 55, Directorate of Wheat Research, Karnal, India.

Loose Smut Resistant Line of Wheat (*Triticum aestivum* L.) VL 639 *(INGR No. 03011; IC 296480)*

Jag Shoran and AK Sharma[1]; Lakshmi Kant, SK Pant and JC Bhatt[2]

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VL 639 is spring wheat having intermediate growth habit with white glume colour. Its average plant height is 91cm. with an average of four effective tillers per plant and 20 spikelets per spike. It takes an average of 162 days to mature. It has white ears with amber coloured grains having 1000-grain weight of 46 g. The average seed yield per plant is 8 g.

This strain was identified as a resistant genetic stock for loose smut in the All India Co-ordinated Wheat Improvement Programme (AICWIP). Further the resistance was confirmed during 1999-2000 in multiple disease-screening nursery of the AICWIP.

Reference

Directorate of Wheat Research, Progress Report (2001) Vol. V (Crop Protection). pp 64.

Bold Seeded and Protein Rich Durum Wheat (*Triticum durum* Desf.) *Bawaji (INGR No. 03012; IC 296483)*

Sushila Kundu

Directorate of Wheat Research (DWR), Karnal-132 001 (Haryana)

Bawaji is a high protein, bold seeded durum wheat selection from a local landrace, *Bawaji* collected from the farmer's field in southern Uttar Pradesh. The collection was handed over to Directorate of Wheat Research (DWR), Karnal for evaluation and further selections. It was evaluated under the project on Maintenance of Biodiversity in Wheat at DWR, Karnal.

The selection has been identified for its long, bold grain and high protein content. This genotype was evaluated for three years at DWR farms under normal agronomic practices. Table 1a & b summaries the details of its morphological and agronomic features respectively.

Design of experiment was augmented. *Bawaji* is tall type durum wheat that matures in 140-150 days. Stem is medium strong and susceptible to lodging, and yellow and brown rust. It is more adapted to central zone and rainfed conditions.

Table 1a. Morphological data of *Bawaji*

Growth habit	Erect	Growth habit	Erect
Anthocyanin pigmentation of		**Ear characters**	
Auricle	Purple	Ear colour	WhiteEar
Auricle pubescence	Absent	shape	Tapering
Foliage colour (boot stage)	Green	Ear density	Dense
		Ear length	Medium
Leaf length	Long	Awn colour	Black
Leaf breadth	Broad	Awn length	Long
Days to heading	91	Outer glume pubescence	Densely pub.
Days to maturity	145	Glume shoulder shape	Round
Waxiness at ear emergence		Glume beak	Medium
Leaf blade	Nil	**Grain characters**	
Leaf sheath	Present	Colour	Amber
Ear	Nil	Texture	Hard
Peduncle	Present	Shape	Elliptical
		Brush hair length	Long
		Crease	Deep
		Germ width	Medium

Table 1b. Agronomic features of *Bawaji*

Character	1999-2000	2000-01	2001-02	Mean	SE
Days to heading	97.0	96.0	87.0	93.0	0.29
Days to maturity	154	145	145	148	0.36
Height (cm.)	118	125	122	121.6	0.44
Spike length (cm.)	12.0	124	11.6	12.0	0.08
Spikelets no./ spike	20	20	20	20	0.09
No. of seeds/ spike	34	48	34	39	0.57
Protein content (%)	14.71	14.48	14.53	14.57	0.05
Flag leaf length (cm.)	34.5	32.8	36.1	34.5	0.06
Flag leaf breadth (cm.)	2.2	2.32	2.3	2.27	0.11
Thousand grain weight (g.)	72.17	68.04	70.0	70.07	0.29

References

Kundu S, SK Singh, Rajender Pal and Shailesh K Singh (2002) Wheat Germplasm Catalogue-II (Elite Genotypes). Research Bulletin No. 11 pp. 55, Directorate of Wheat Research, Karnal, India.

Brown, Black and Yellow Rust Resistant Wheat (*Triticum aestivum* L.) Lines

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FLW1 *(INGR No. 03013; IC 296487)*

FLW1 is a line with resistance to brown and black rusts in a new genetic background. Comparative details on its reaction against the three rusts are summarized in Table 1. It was developed through pedigree selection from a cross between UP 2338 and CENTURK at Directorate of Wheat Research, Regional Station, Flowerdale, Shimla. It is a dwarf, awnless, late maturing genotype with non-amber grains and 42 g. 1000-grain weight. Plant type and ear heads are inferior to the check, PBW 343. Similarly, the tillers per meter row and yield per meter row are low as compared to PBW 343.

FLW2 *(INGR No. 03014; IC 296488)*

FLW2 is a line resistant to brown and black rusts and moderately resistant to yellow rust. Comparative details on its reaction against the three rusts are summarized in Table 2. It was developed through pedigree selection from the cross between PBW 343 and Blue Boy II at Directorate of Wheat Research (DWR), Regional Station, Flowerdale, Shimla. It possesses *Lr 24, Lr 26, Sr 24, Sr 31 and Yr 9* genes and an additional resistance factor to yellow rust. It is slightly taller and late maturing than PBW 343 and has non-amber grains with 1000-grain weight of 37 g. Tillers per meter row and yield per meter row are at par with PBW 343.

Table 1. Comparative reaction of FLW1 against Brown, Black and Yellow rust

Genetic Stock/ Parents	Field Data		Seedling Resistance Test			Genes Postulated
		Brown Rust				
	Wellington 01	Karnal 02	77-2	77-5	104 - 2	–
FLW1	R	R	I	I	R	*
UP 2338	50S	30S	I	S	S	*Lr26*
CENTURK	R	–	R	R	R	*
		Black Rust				
	Wellington 01	Karnal 02	122	40-1		–
FLW1	5MR	0	I	MR		*
UP 2338	10MR	0	R	R		*Sr31*
CENTURK	0	0	R	I		–
		Yellow Rust				
	Wellington 01	Karnal 02	P	46S119		–
FLW1	R	15S	S	S		–
UP 2338	R	50S	I	S		*Yr9*
CENTURK	50S	–	S	S		–

* = Gene for resistance not known; R = Resistant; MR = Moderately resistant; S=Susceptible; 0 = Free from rust/no rust response; I= Immune; M = Ascertained with molecular marker; + = Additional resistance factor

Table 2. Comparative reaction of FLW 2 against Brown, Black and Yellow rusts

Genetic Stock/ Parents	Field Data		Seedling Resistance Test			Genes Postulated
		Brown Rust				
	Wellington 01	Karnal 02	77-2	77-5	104-2	
FLW2	Resistant	Resistant	R	R	R	*Lr24, Lr26* (M)
PBW 343	Resistant	15S	I	S	S	*Lr26*
Blue Boy II	Resistant	–	R	R	R	*Lr24*
		Black Rust				
	Wellington 01	Karnal 02	122	40-1		
FLW2	5MR	0	R	MR		*Sr2, Sr24, Sr31* (M)
PBW 343	10MR	0	R	R		*Sr31*
Blue Boy II	40S	–	0	S		*Sr24*
		Yellow Rust				
	Wellington 01	Karnal 02	P	46S119		
FLW2	Resistant	Resistant	R	R		*Yr9 (M)+*
PBW 343	Resistant	Resistant	I	I		*Yr9+*
Blue Boy II	50S	–	S	S		–

Abbreviations similar to Table 1

FLW3 *(INGR No. 03015; IC 296489)*

FLW3 is a line immune to yellow rust and resistant to black rust. Comparative details on its reaction against the three rusts are summarized in Table 3. It was developed through application of pedigree selection method on a cross between UP 2338 and CHINA 84-40022 at DWR, Regional Station, Flowerdale, Shimla. It possesses *Lr 26, Sr 31 and Yr 9* and an additional resistance factor for yellow rust. It is dwarf type with maturity similar to that of PBW 343. The grains are amber coloured with 1000-grain weight of 40 g. Tillers per meter row and yield per meter row are at par with PBW 343.

FLW4 *(INGR No. 03016; IC 296490)*

FLW4 is a line resistant to brown and black rusts in different genetic background. Comparative details on its reaction against the three rusts are summarized in Table 4. It was developed through pedigree selection method on the cross between PBW 343 and ARKAN at Directorate of Wheat Research (DWR), Regional Station, Flowerdale, Shimla. It contains *Lr 24, Lr 26, Sr 2, Sr 24, Sr 31* and *Yr 9* genes. The plant type and ear head are inferior to the check, PBW 343 with short stature, medium maturity and non-amber grains and 1000-grain weight of 33 g. Tillers per meter row and yield per meter row are also low compared to PBW 343.

FLW5 *(INGR No. 03017; IC 296491)*

FLW5 is a line resistant to brown and black rusts in a different genetic background. Comparative details on its reaction against the three rusts are summarized in Table 5. It contains *Lr 24, Lr 26, Sr 2, Sr 24, Sr 31* and *Yr 9* genes. It was developed through pedigree selection from the cross a between UP 2338 and ARKAN at Directorate of Wheat Research (DWR), Regional Station, Flowerdale, Shimla. It is short-statured, late maturing with non-amber grains and 1000 grain-weight

Table 3. Comparative reaction of FLW 3 against Brown, Black and Yellow rusts

Genetic Stock/ Parents	Field Data		Seedling Resistance Test			Genes Postulated
		Brown Rust				
	Wellington 01	Karnal 02	77-2	77-5	104-2	
FLW3	60S	60S	I	S	S	*Lr26* (M)
UP 2338	50S	30S	I	S	S	*Lr26*
China84-40022	60S	–	I	S	S	–
		Black Rust				
	Wellington 01	Karnal 02	122	40-1		
FLW3	15MR	0	R	R		*Sr31*
UP 2338	10MR	0	R	R		*Sr31*
China84-40022	0	–	0	S		–
		Yellow Rust				
	Wellington 01	Karnal 02	P	46S119		
FLW3	R	R	I	I		*Yr9* (M)*
UP 2338	R	50S	I	S		*Yr9*
China84-40022	R	–	I	I		*

Abbreviations similar to Table 1.

Table 4. Comparative reaction of FLW 4 against Brown, Black and Yellow rusts

Genetic Stock/ Parents	Field Data		Seedling Resistance Test			Genes Postulated
		Brown Rust				
	Wellington 01	Karnal 02	77-2	77-5	104 - 2	
FLW4	R	R	I	I	R	*Lr24, Lr26* (M)
PBW 343	R	15S	I	S	S	*Lr26*
ARKAN	R	R	R	R	R	*Lr24*
		Black rust				
	Wellington 01	Karnal 02	122	40-1		
FLW4	5MR	0	I	R		*Sr2, Sr24, Sr31* (M)
PBW 343	10MR	0	R	R		*Sr31*
ARKAN	0	0	R	I		*Sr24+*
		Yellow rust				
	Wellington 01	Karnal 02	P	46S119		
FLW4	R	20S	R	R		*Yr9* (M)
PBW 343	R	R	I	S		*Yr9+*
ARKAN	60S	60S	S	S		–

Abbreviations similar to Table 1.

Table 5. Comparative reaction of FLW 5 against Brown, Black and Yellow rusts

Genetic Stock/ Parents	Field Data		Seedling Resistance Test			Genes Postulated
		Brown rust				
	Wellington 01	Karnal 02	77-2	77-5	104 - 2	
FLW5	R	R	I	R	R	*Lr24, Lr26*
UP 2338	50S	30S	I	S	S	*Lr26*
ARKAN	R	R	R	R	R	*Lr24*
		Black rust				
	Wellington 01	Karnal 02	122	40-1		
FLW5	5MR	0	I	I		*Sr2, Sr24, Sr31+*
UP 2338	10MR	0	R	R		*Sr31*
ARKAN	0	0	R	I		*Sr24+*
		Yellow rust				
	Wellington 01	Karnal 02	P	46S119		
FLW5	R	40S	I	0		*Yr9*
UP 2338	R	50S	I	S		*Yr9*
ARKAN	60S	60S	S	S		-

Abbreviations similar to Table 1.

of 42 g. The number of tillers and yield per meter row are low as compared to PBW 343.

References

Anonymous (2002) Development and evaluation of rust resistant genetic stocks. *Methaensis* **22(3)**: 5-7.

Datta D and SK Nayar (2002) Widening of genetic base for rust resistance in Indian wheats. DWR Progress Report 2001-2002, Germplasm Resources Unit. *Crop Improvement.* **Vol. V**: 39-40.

Cytogenetic Stocks in Wheat Incorporating Genes from Various *Triticum* Species

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Department of Genetics and Biotechnology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

Leaf and Stripe Rust Resistant Substitution Line of Wheat (*Triticum aestivum* L.): PAU wheat *geniculata* 1 *(INGR No. 03018; IC 296432)*

PAU wheat *geniculata* 1 is a cytogenetic stock with 5M-5D substitution, having leaf and stripe rust resistance. It is an interspecific derivative developed at the Punjab Agricultural University, Ludhiana from a cross between *T. aestivum* cv. WL 711, susceptible to leaf as well as stripe rust and accession 3547 of *Aegilops geniculata* (syn. *Aegilops ovata*), a tetraploid non-progenitor species having UUMM genomes with leaf and stripe rust resistance. The F_1 was backcrossed to WL 711, the recurrent parent and was then selfed up to F_9/F_{10} generations. The BC_3F_{10} derivative is a disomic substitution of chromosome 5M of *Aegilops geniculata* for 5D of wheat, which has been confirmed through C-banding and molecular marker analysis (Dhaliwal *et al.*, 2002a). This derivative is resistant to individual pathotypes of leaf rust viz. 12-2, 77-1, 77-2, 77-5, 104-2 and stripe rust viz. 46S102, 46S103 and 46S119 at the seedling stage. This substitution line is completely resistant to both the rusts under natural field conditions (Dhaliwal *et al.*, 2002b). The 5M-5D-substitution line is slightly taller than the recipient parent WL711 with broader spikes and susceptible to lodging. It has partially round shaped, bold amber grains.

References

Dhaliwal HS, P Chhuneja, RK Gill, RK Goel and H Singh (2002) Introgression of disease resistance genes from related species into cultivated wheat through interspecific hybridization. *Crop Improvement* **29**: 1-18

Dhaliwal HS, Harjit Singh and M William (2002b) Transfer of rust resistance from *Aegilops ovata* into bread wheat (*Triticum aestivum* L.) and molecular characterisation of resistant derivatives. *Euphytica* **126**: 153-159.

Leaf Rust, Powdery Mildew and Cereal Cyst Nematode Resistant Substitution Line of Wheat (*Triticum aestivum* L.): PAU wheat *triuncialis* 1 *(INGR No. 03019; IC 296436)*

PAU wheat-*triuncialis* 1 is a cytogenetic stock with 5U-5A substitution incorporating genes conferring resistance to powdery mildew, cereal cyst nematode and slow

Table 5. Comparative reaction of FLW 5 against Brown, Black and Yellow rusts

Genetic Stock/ Parents	Field Data		Seedling Resistance Test			Genes Postulated
		Brown rust				
	Wellington 01	Karnal 02	77-2	77-5	104 - 2	
FLW5	R	R	I	R	R	*Lr24, Lr26*
UP 2338	50S	30S	I	S	S	*Lr26*
ARKAN	R	R	R	R	R	*Lr24*
		Black rust				
	Wellington 01	Karnal 02	122	40-1		
FLW5	5MR	0	I	I		*Sr2, Sr24, Sr31+*
UP 2338	10MR	0	R	R		*Sr31*
ARKAN	0	0	R	I		*Sr24+*
		Yellow rust				
	Wellington 01	Karnal 02	P	46S119		
FLW5	R	40S	I	0		*Yr9*
UP 2338	R	50S	I	S		*Yr9*
ARKAN	60S	60S	S	S		-

Abbreviations similar to Table 1.

of 42 g. The number of tillers and yield per meter row are low as compared to PBW 343.

References

Anonymous (2002) Development and evaluation of rust resistant genetic stocks. *Methaensis* **22(3)**: 5-7.

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PAU wheat *geniculata* 1 is a cytogenetic stock with 5M-5D substitution, having leaf and stripe rust resistance. It is an interspecific derivative developed at the Punjab Agricultural University, Ludhiana from a cross between *T. aestivum* cv. WL 711, susceptible to leaf as well as stripe rust and accession 3547 of *Aegilops geniculata* (syn. *Aegilops ovata*), a tetraploid non-progenitor species having UUMM genomes with leaf and stripe rust resistance. The F_1 was backcrossed to WL 711, the recurrent parent and was then selfed up to F_9/F_{10} generations. The BC_3F_{10} derivative is a disomic substitution of chromosome 5M of *Aegilops geniculata* for 5D of wheat, which has been confirmed through C-banding and molecular marker analysis (Dhaliwal *et al.*, 2002a). This derivative is resistant to individual pathotypes of leaf rust viz. 12-2, 77-1, 77-2, 77-5, 104-2 and stripe rust viz. 46S102, 46S103 and 46S119 at the seedling stage. This substitution line is completely resistant to both the rusts under natural field conditions (Dhaliwal *et al.*, 2002b). The 5M-5D-substitution line is slightly taller than the recipient parent WL711 with broader spikes and susceptible to lodging. It has partially round shaped, bold amber grains.

References

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Dhaliwal HS, Harjit Singh and M William (2002b) Transfer of rust resistance from *Aegilops ovata* into bread wheat (*Triticum aestivum* L.) and molecular characterisation of resistant derivatives. *Euphytica* **126**: 153-159.

Leaf Rust, Powdery Mildew and Cereal Cyst Nematode Resistant Substitution Line of Wheat (*Triticum aestivum* L.): PAU wheat *triuncialis* 1 *(INGR No. 03019; IC 296436)*

PAU wheat-*triuncialis* 1 is a cytogenetic stock with 5U-5A substitution incorporating genes conferring resistance to powdery mildew, cereal cyst nematode and slow

rusting. It is an interspecific derivative developed at the Punjab Agricultural University, Ludhiana from a cross between *T. aestivum* cv. WL 711 (resistant to leaf rust, powdery mildew, Karnal bunt) and accession 3549 of a tetraploid non-progenitor species *Aegilops triuncialis* (UUCC; resistance to cereal cyst nematode). The F_1 was backcrossed to WL 711, the recurrent parent and was then selfed up to F_9/F_{10} generations. This BC_2F_{10} derivative is a disomic substitution of chromosome 5U of *Aegilops triuncialis* for 5A of wheat and has the characteristic spelta head due to the loss of wheat chromosome 5A (Harjit Singh *et al.*, 2000). At the seedling stage it is resistant to individual pathotypes of leaf rust viz. 12-2, 77-1, 77-2, 77-5 and 104-2. This derivative has gene(s) conferring slow rusting for leaf rust (10MS) as compared to 60S in the recipient parent under natural field conditions (Dhaliwal *et al.*, 2002). In addition to leaf rust resistance this substitution line is also resistant to powdery mildew and cereal cyst nematode. The 5U-5A-substitution line is slightly late in maturity as compared to the recipient parent and has longer and lax spikes, difficult to thresh. It has very bold, but soft grains.

References

Harjit Singh, H Tsujimoto, PK Sakhuja, T Singh and HS Dhaliwal (2000) Transfer of resistance to wheat pathogens from *Aegilops triuncialis* into bread wheat. *Wheat Inf. Serv.* **91**: 5-10.

Dhaliwal HS, P Chhuneja, RK Gill, RK Goel and H Singh (2002a) Introgression of disease resistance genes from related species into cultivated wheat through interspecific hybridization. *Crop Improvement* **29**: 1-18.

Leaf Rust and Karnal Bunt Resistant Disomic Addition Line of Wheat (*Triticum aestivum* L.): PAU wheat *triuncialis* 4 *(INGR No. 03020; IC 296439)*

PAU wheat *triuncialis* 4 is cytogenetic stock/addition line of an acrocentric chromosome of *Aegilops triuncialis*, with Karnal bunt and leaf rust resistance. It is an interspecific derivative developed at Punjab Agriculture University, Ludhiana from a cross between *T. aestivum* cv. WL711 (resistant to leaf rust, powdery mildew, Karnal bunt) and accession 3549 of a tetraploid non-progenitor species *Aegilops triuncialis* (UUCC; cereal cyst nematode resistant). The F_1 was backcrossed to WL711, the recurrent parent and was then selfed up to F_9/F_{10} generations. This BC_2F_{10} derivative is an additional line of an acrocentric chromosome from *Aegilops triuncialis* in addition to a translocated chromosome with short arm from *Aegilops triuncialis* (Harjit Singh *et al.*, 2000). This derivative is highly resistant to leaf rust. This genetic stock is also resistant to Karnal bunt (Dhaliwal *et al.*, 2002). This addition line has height and maturity similar to that of recipient parent WL711, but has slightly narrower heads and exhibits a low degree of sterility.

References

Harjit Singh, H Tsujimoto, PK Sakhuja, T Singh and HS Dhaliwal (2000) Transfer of resistance to wheat pathogens from *Aegilops triuncialis* into bread wheat. *Wheat Inf. Serv.* **91**: 5-10.

Dhaliwal HS, P Chhuneja, RK Gill, RK Goel and H Singh (2002a) Introgression of disease resistance genes from related species into cultivated wheat through interspecific hybridization. *Crop Improvement* **29**: 1-18.

Near Isogenic Leaf Rust Resistant Line of Wheat (*Triticum aestivum* L.)

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PAU HD2329-KLM3b *(INGR No. 03021; IC 296442)*

PAU HD2329-KLM3B is a near isogenic line incorporating leaf rust resistance gene from Kharchia Local mutant-KLM3B in the wheat cv. HD2329. It was developed at the Punjab Agricultural University, Ludhiana through backcrossing with KLM3B, reported to be an induced rust resistant mutant in rust susceptible *T. aestivum* cultivar Kharchia Local developed by Dr RN Sawhney of Division of Genetics, Indian Agricultural Research Institute (IARI), New Delhi. Most probably it resulted from an out-crossing with some alien rust resistant stock. During genetic analysis KLM3B was found to be non-allelic to *Lr*9, an alien leaf rust resistant gene (Dhillon, 1999). In crosses with rust susceptible cultivar Lal Bahadur, KLM3B was found to posses monogenic dominant leaf rust resistance. During C-banding analysis, the long arm of chromosome 2B seemed to be involved in alien translocation. This near isogenic line PAU HD2329-KLM3B is totally resistant to leaf rust under natural field conditions. In addition to the leaf rust resistance it is also tolerant to stripe rust under field conditions.

rusting. It is an interspecific derivative developed at the Punjab Agricultural University, Ludhiana from a cross between *T. aestivum* cv. WL 711 (resistant to leaf rust, powdery mildew, Karnal bunt) and accession 3549 of a tetraploid non-progenitor species *Aegilops triuncialis* (UUCC; resistance to cereal cyst nematode). The F_1 was backcrossed to WL 711, the recurrent parent and was then selfed up to F_9/F_{10} generations. This BC_2F_{10} derivative is a disomic substitution of chromosome 5U of *Aegilops triuncialis* for 5A of wheat and has the characteristic spelta head due to the loss of wheat chromosome 5A (Harjit Singh *et al.*, 2000). At the seedling stage it is resistant to individual pathotypes of leaf rust viz. 12-2, 77-1, 77-2, 77-5 and 104-2. This derivative has gene(s) conferring slow rusting for leaf rust (10MS) as compared to 60S in the recipient parent under natural field conditions (Dhaliwal *et al.*, 2002). In addition to leaf rust resistance this substitution line is also resistant to powdery mildew and cereal cyst nematode. The 5U-5A-substitution line is slightly late in maturity as compared to the recipient parent and has longer and lax spikes, difficult to thresh. It has very bold, but soft grains.

References

Harjit Singh, H Tsujimoto, PK Sakhuja, T Singh and HS Dhaliwal (2000) Transfer of resistance to wheat pathogens from *Aegilops triuncialis* into bread wheat. *Wheat Inf. Serv.* **91**: 5-10.

Dhaliwal HS, P Chhuneja, RK Gill, RK Goel and H Singh (2002a) Introgression of disease resistance genes from related species into cultivated wheat through interspecific hybridization. *Crop Improvement* **29**: 1-18.

Leaf Rust and Karnal Bunt Resistant Disomic Addition Line of Wheat (*Triticum aestivum* L.): PAU wheat *triuncialis* 4 *(INGR No. 03020; IC 296439)*

PAU wheat *triuncialis* 4 is cytogenetic stock/addition line of an acrocentric chromosome of *Aegilops triuncialis*, with Karnal bunt and leaf rust resistance. It is an interspecific derivative developed at Punjab Agriculture University, Ludhiana from a cross between *T. aestivum* cv. WL711 (resistant to leaf rust, powdery mildew, Karnal bunt) and accession 3549 of a tetraploid non-progenitor species *Aegilops triuncialis* (UUCC; cereal cyst nematode resistant). The F_1 was backcrossed to WL711, the recurrent parent and was then selfed up to F_9/F_{10} generations. This BC_2F_{10} derivative is an additional line of an acrocentric chromosome from *Aegilops triuncialis* in addition to a translocated chromosome with short arm from *Aegilops triuncialis* (Harjit Singh *et al.*, 2000). This derivative is highly resistant to leaf rust. This genetic stock is also resistant to Karnal bunt (Dhaliwal *et al.*, 2002). This addition line has height and maturity similar to that of recipient parent WL711, but has slightly narrower heads and exhibits a low degree of sterility.

References

Harjit Singh, H Tsujimoto, PK Sakhuja, T Singh and HS Dhaliwal (2000) Transfer of resistance to wheat pathogens from *Aegilops triuncialis* into bread wheat. *Wheat Inf. Serv.* **91**: 5-10.

Dhaliwal HS, P Chhuneja, RK Gill, RK Goel and H Singh (2002a) Introgression of disease resistance genes from related species into cultivated wheat through interspecific hybridization. *Crop Improvement* **29**: 1-18.

Near Isogenic Leaf Rust Resistant Line of Wheat (*Triticum aestivum* L.)

HS Dhaliwal, Harjit Singh, P Chhuneja and TS Grewal
Department of Genetics and Biotechnology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

PAU HD2329-KLM3b *(INGR No. 03021; IC 296442)*

PAU HD2329-KLM3B is a near isogenic line incorporating leaf rust resistance gene from Kharchia Local mutant-KLM3B in the wheat cv. HD2329. It was developed at the Punjab Agricultural University, Ludhiana through backcrossing with KLM3B, reported to be an induced rust resistant mutant in rust susceptible *T. aestivum* cultivar Kharchia Local developed by Dr RN Sawhney of Division of Genetics, Indian Agricultural Research Institute (IARI), New Delhi. Most probably it resulted from an out-crossing with some alien rust resistant stock. During genetic analysis KLM3B was found to be non-allelic to *Lr*9, an alien leaf rust resistant gene (Dhillon, 1999). In crosses with rust susceptible cultivar Lal Bahadur, KLM3B was found to posses monogenic dominant leaf rust resistance. During C-banding analysis, the long arm of chromosome 2B seemed to be involved in alien translocation. This near isogenic line PAU HD2329-KLM3B is totally resistant to leaf rust under natural field conditions. In addition to the leaf rust resistance it is also tolerant to stripe rust under field conditions.

PAU WL711-KLM3B *(INGR No. 03022; IC 296443)*

PAU WL711-KLM3B is a near isogenic line having leaf rust resistance gene from Kharchia Local mutant -KLM3B in the wheat cv. WL711. It was developed at the Punjab Agricultural University, Ludhiana through backcrossing with KLM3B, reported to be an induced rust resistant mutant in rust susceptible *T. aestivum* cultivar Kharchia Local developed by Dr RN Sawhney of Division of Genetics, Indian Agricultural Research Institute (IARI), New Delhi. Most probably it resulted from an out-crossing with some alien rust resistant stock. During genetic analysis KLM3B was found to be non-allelic to *Lr*9, an alien leaf rust resistant gene (Dhillon, 1999). In crosses with rust susceptible cultivar Lal Bahadur, KLM3B was found to posses monogenic dominant leaf rust resistance. During C-banding analysis, the long arm of chromosome 2B seemed to be involved in alien translocation. This near isogenic line PAU WL711-KLM3B is totally resistant to leaf rust under natural field conditions and tolerant to stripe rust under field conditions.

References

Dhillon N (1999) Molecular tagging of leaf rust resistance genes in wheat (*Triticum aestivum*) using PCR based markers (M.Sc. dissertation).

Leaf Rust, Stripe Rust and Powdery Mildew Resistant Line of Wheat (*Triticum durum* Desf.) PAU *durum–araraticum* 1 *(INGR No. 03023; IC 296446)*

HS Dhaliwal, Harjit Singh, P Chhuneja and TS Grewal
Department of Genetics and Biotechnology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

PAU *durum-araraticum* 1 is a leaf rust, adult plant stripe rust (APR) and powdery mildew resistant interspecific derivative. It was developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. Malvi Local, susceptible to leaf rust and stripe rust and accession 4692 of *T. araraticum* (AAGG) resistant to leaf rust, stripe rust and powdery mildew. F_1 was backcrossed to Malvi Local, the recurrent parent and then selfed up to F_9/F_{10} generation. BC_2F_{10} derivative had normal chromosome number (2n=28) and regular pairing. This interspecific derivative is resistant to individual pathotypes of leaf rust viz. 12-2, 77-1, 77-2 and 77-5 at the seedling stage, but it is susceptible to stripe rust pathotypes 46S102, 46S103 and 46S119. The genotype is completely resistant to leaf rust, stripe rust and powdery mildew under natural field conditions (Dhaliwal *et al.*, 2002). Therefore, this line seems to possess a gene conferring resistance to powdery mildew in addition to the leaf rust resistance gene, which is effective at seedling and at adult plant stage, and an APR gene for stripe rust resistance. It is taller than Malvi Local and is slightly late in maturity. It has small, amber and vitreous grains.

References

Dhaliwal HS, P Chhuneja, RK Gill, RK Goel and H Singh (2002a) Introgression of disease resistance genes from related species into cultivated wheat through interspecific hybridization. *Crop Improvement* **29**: 1-18.

Leaf and Stripe Rust Resistant Wheat (*Triticum aestivum* L.) PAU wheat *monococcum* 1 *(INGR No. 03047; IC 296440)*

HS Dhaliwal, Harjit Singh, P Chhuneja and TS Grewal
Department of Genetics and Biotechnology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

PAU wheat *monococcum* 1 is a genetic stock with leaf rust resistance transferred from *T. monococcum*. This interspecific derivative having leaf rust and adult plant stripe rust (APR) resistance was developed at the Punjab Agricultural University, Ludhiana from a cross between an amphiploid (*T. durum* cv. PBW114 x *T. monococcum*, accession 14087) and *T. aestivum* cultivar WL 711. A rust resistant BC_1F_3 progeny was backcrossed to WL 711 and two progenies having leaf rust resistance gene from *T. monococcum* were identified. These rust

PAU WL711-KLM3B *(INGR No. 03022; IC 296443)*

PAU WL711-KLM3B is a near isogenic line having leaf rust resistance gene from Kharchia Local mutant -KLM3B in the wheat cv. WL711. It was developed at the Punjab Agricultural University, Ludhiana through backcrossing with KLM3B, reported to be an induced rust resistant mutant in rust susceptible *T. aestivum* cultivar Kharchia Local developed by Dr RN Sawhney of Division of Genetics, Indian Agricultural Research Institute (IARI), New Delhi. Most probably it resulted from an out-crossing with some alien rust resistant stock. During genetic analysis KLM3B was found to be non-allelic to *Lr*9, an alien leaf rust resistant gene (Dhillon, 1999). In crosses with rust susceptible cultivar Lal Bahadur, KLM3B was found to posses monogenic dominant leaf rust resistance. During C-banding analysis, the long arm of chromosome 2B seemed to be involved in alien translocation. This near isogenic line PAU WL711-KLM3B is totally resistant to leaf rust under natural field conditions and tolerant to stripe rust under field conditions.

References

Dhillon N (1999) Molecular tagging of leaf rust resistance genes in wheat (*Triticum aestivum*) using PCR based markers (M.Sc. dissertation).

Leaf Rust, Stripe Rust and Powdery Mildew Resistant Line of Wheat (*Triticum durum* Desf.) PAU *durum–araraticum* 1 *(INGR No. 03023; IC 296446)*

HS Dhaliwal, Harjit Singh, P Chhuneja and TS Grewal
Department of Genetics and Biotechnology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

PAU *durum-araraticum* 1 is a leaf rust, adult plant stripe rust (APR) and powdery mildew resistant interspecific derivative. It was developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. Malvi Local, susceptible to leaf rust and stripe rust and accession 4692 of *T. araraticum* (AAGG) resistant to leaf rust, stripe rust and powdery mildew. F_1 was backcrossed to Malvi Local, the recurrent parent and then selfed up to F_9/F_{10} generation. BC_2F_{10} derivative had normal chromosome number (2n=28) and regular pairing. This interspecific derivative is resistant to individual pathotypes of leaf rust viz. 12-2, 77-1, 77-2 and 77-5 at the seedling stage, but it is susceptible to stripe rust pathotypes 46S102, 46S103 and 46S119. The genotype is completely resistant to leaf rust, stripe rust and powdery mildew under natural field conditions (Dhaliwal *et al.*, 2002). Therefore, this line seems to possess a gene conferring resistance to powdery mildew in addition to the leaf rust resistance gene, which is effective at seedling and at adult plant stage, and an APR gene for stripe rust resistance. It is taller than Malvi Local and is slightly late in maturity. It has small, amber and vitreous grains.

References

Dhaliwal HS, P Chhuneja, RK Gill, RK Goel and H Singh (2002a) Introgression of disease resistance genes from related species into cultivated wheat through interspecific hybridization. *Crop Improvement* **29**: 1-18.

Leaf and Stripe Rust Resistant Wheat (*Triticum aestivum* L.) PAU wheat *monococcum* 1 *(INGR No. 03047; IC 296440)*

HS Dhaliwal, Harjit Singh, P Chhuneja and TS Grewal
Department of Genetics and Biotechnology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

PAU wheat *monococcum* 1 is a genetic stock with leaf rust resistance transferred from *T. monococcum*. This interspecific derivative having leaf rust and adult plant stripe rust (APR) resistance was developed at the Punjab Agricultural University, Ludhiana from a cross between an amphiploid (*T. durum* cv. PBW114 x *T. monococcum*, accession 14087) and *T. aestivum* cultivar WL 711. A rust resistant BC_1F_3 progeny was backcrossed to WL 711 and two progenies having leaf rust resistance gene from *T. monococcum* were identified. These rust

PAU WL711-KLM3B *(INGR No. 03022; IC 296443)*

PAU WL711-KLM3B is a near isogenic line having leaf rust resistance gene from Kharchia Local mutant -KLM3B in the wheat cv. WL711. It was developed at the Punjab Agricultural University, Ludhiana through backcrossing with KLM3B, reported to be an induced rust resistant mutant in rust susceptible *T. aestivum* cultivar Kharchia Local developed by Dr RN Sawhney of Division of Genetics, Indian Agricultural Research Institute (IARI), New Delhi. Most probably it resulted from an out-crossing with some alien rust resistant stock. During genetic analysis KLM3B was found to be non-allelic to *Lr*9, an alien leaf rust resistant gene (Dhillon, 1999). In crosses with rust susceptible cultivar Lal Bahadur, KLM3B was found to posses monogenic dominant leaf rust resistance. During C-banding analysis, the long arm of chromosome 2B seemed to be involved in alien translocation. This near isogenic line PAU WL711-KLM3B is totally resistant to leaf rust under natural field conditions and tolerant to stripe rust under field conditions.

References

Dhillon N (1999) Molecular tagging of leaf rust resistance genes in wheat (*Triticum aestivum*) using PCR based markers (M.Sc. dissertation).

Leaf Rust, Stripe Rust and Powdery Mildew Resistant Line of Wheat (*Triticum durum* Desf.) PAU *durum–araraticum* 1 *(INGR No. 03023; IC 296446)*

HS Dhaliwal, Harjit Singh, P Chhuneja and TS Grewal
Department of Genetics and Biotechnology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

PAU *durum-araraticum* 1 is a leaf rust, adult plant stripe rust (APR) and powdery mildew resistant interspecific derivative. It was developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. Malvi Local, susceptible to leaf rust and stripe rust and accession 4692 of *T. araraticum* (AAGG) resistant to leaf rust, stripe rust and powdery mildew. F_1 was backcrossed to Malvi Local, the recurrent parent and then selfed up to F_9/F_{10} generation. BC_2F_{10} derivative had normal chromosome number (2n=28) and regular pairing. This interspecific derivative is resistant to individual pathotypes of leaf rust viz. 12-2, 77-1, 77-2 and 77-5 at the seedling stage, but it is susceptible to stripe rust pathotypes 46S102, 46S103 and 46S119. The genotype is completely resistant to leaf rust, stripe rust and powdery mildew under natural field conditions (Dhaliwal *et al.*, 2002). Therefore, this line seems to possess a gene conferring resistance to powdery mildew in addition to the leaf rust resistance gene, which is effective at seedling and at adult plant stage, and an APR gene for stripe rust resistance. It is taller than Malvi Local and is slightly late in maturity. It has small, amber and vitreous grains.

References

Dhaliwal HS, P Chhuneja, RK Gill, RK Goel and H Singh (2002a) Introgression of disease resistance genes from related species into cultivated wheat through interspecific hybridization. *Crop Improvement* **29**: 1-18.

Leaf and Stripe Rust Resistant Wheat (*Triticum aestivum* L.) PAU wheat *monococcum* 1 *(INGR No. 03047; IC 296440)*

HS Dhaliwal, Harjit Singh, P Chhuneja and TS Grewal
Department of Genetics and Biotechnology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

PAU wheat *monococcum* 1 is a genetic stock with leaf rust resistance transferred from *T. monococcum*. This interspecific derivative having leaf rust and adult plant stripe rust (APR) resistance was developed at the Punjab Agricultural University, Ludhiana from a cross between an amphiploid (*T. durum* cv. PBW114 x *T. monococcum*, accession 14087) and *T. aestivum* cultivar WL 711. A rust resistant BC_1F_3 progeny was backcrossed to WL 711 and two progenies having leaf rust resistance gene from *T. monococcum* were identified. These rust

resistant progenies have normal chromosome number (2n = 42) and pairing (Dhaliwal *et al.*, 2002). The progenies are resistant to the leaf rust pathotype 77-5 at the seedling stage and are completely resistant to leaf rust in the field conditions. Genetic analysis in crosses with rust susceptible cultivar indicated that a single dominant gene controls the leaf rust resistance. In addition to leaf rust resistance, one of these lines also has an APR gene conferring stripe rust resistance. Molecular analysis indicated that the *monococcum* gene for leaf rust resistance transferred to the wheat chromosome 1A is linked to SSR marker Xgwm136 (Vasu *et al.*, 2001). This derivative has a plant type similar to that of WL711.

References

Dhaliwal HS, P Chhuneja, RK Gill, RK Goel and H Singh (2002a) Introgression of disease resistance genes from related species into cultivated wheat through interspecific hybridization. *Crop Improvement* **29**: 1-18.

Lines Incorporating High Molecular Weight Glutenin Subunits from Different *Triticum* spp. into Durum Wheat (*Triticum durum* Desf.)

HS Dhaliwal, Harjit Singh, P Chhuneja and TS Grewal
Department of Genetics and Biotechnology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

PAU HMW *GLU-A1-1* (INGR No. 03024; IC 296452)

PAU HMW *Glu-A1-1* is a genetic stock having high molecular weight (HMW) glutenin subunits with high SDS sedimentation value transferred from *Triticum boeoticum* into durum wheat *Triticum durum*. It was developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. PBW 34 and *T. boeoticum* acc. 4873 (A^bA^b). The F_1 was backcrossed to PBW 34, the recurrent parent. The transfer of HMW glutenin subunits coded by *Glu-A1* locus from *T. boeoticum* to *T. durum* was validated by SDS-PAGE of half seed. The donor *T. boeoticum* acc. 4873 had a HMW glutenin 1Ax subunit of low mobility and a series of less prominent subunit (bands) of faster mobility including one dominant band of Ay subunit. The mobility of HMW glutenin subunit coded by *Glu-A1x* allele was between 1Ax1 and 1Dx2 glutenin subunits of bread wheat. The Ay subunit had mobility intermediate between those of 1Bx7 and 1By8 of bread wheat. These two subunits coded by *Glu-A1* locus have been transferred in this interspecific derivative. With the transfer of these subunits the SDS micro-sedimentation value of the derivative has increased by 51 percent over and above the recurrent *T. durum* cv. PBW 34 (Dhaliwal *et al.*, 2002; Randhawa *et al.*, 1995, 1997).

PAU HMW *GLU-A1-7 (INGR No. 03025; IC 296458)*

PAU HMW *Glu-A1-7* is a genetic stock having high molecular weight (HMW) glutenin subunits with high SDS sedimentation value transferred from *Triticum urartu*. It has been developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. PBW 34 and *T. urartu* acc. 5340 (AA). The F_1 was backcrossed to PBW 34, used as the recurrent parent. The transfer of HMW glutenin subunits coded by *Glu-A1* locus from *T. urartu* to *T. durum* was confirmed by SDS-PAGE of half seed. The donor *T. urartu* acc. 5340 had two HMW glutenin subunits Ax and Ay. The mobility of HMW glutenin subunit coded by *Glu-A1x* allele was between 1Ax1 and 1Dx2 glutenin subunits of bread wheat. The Ay subunit had faster mobility than the 1Dy12 of bread wheat. These two subunits coded by *Glu-A1* locus have been transferred in this interspecific derivative. With the transfer of these subunits SDS micro-sedimentation value of the derivative has increased by 46 per cent over and above the recurrent parent *T. durum* cv. PBW 34 (Dhaliwal *et al.*, 2002; Randhawa *et al.*, 1995, 1997).

PAU HMW *GLU-A1-8 (INGR No. 03026; IC 296459)*

PAU HMW *Glu-A1-8* is a genetic stock having high molecular weight (HMW) glutenin subunits with high SDS sedimentation value transferred from *Triticum dicoccoides*. It has been developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. PBW 34 and *T. dicoccoides* acc. 4632 (AABB). The F_1 was backcrossed to PBW34, used as the recurrent parent and selfed upto BC_2F_6. The transfer of HMW glutenin subunits coded by *GluA1* locus from *T. dicoccoides* to *T. durum* was validated by SDS-PAGE of half seed. The mobility of Ax subunit of donor *T. dicoccoides* acc. 4632 was similar to 1Ax1 glutenin

resistant progenies have normal chromosome number (2n = 42) and pairing (Dhaliwal *et al.*, 2002). The progenies are resistant to the leaf rust pathotype 77-5 at the seedling stage and are completely resistant to leaf rust in the field conditions. Genetic analysis in crosses with rust susceptible cultivar indicated that a single dominant gene controls the leaf rust resistance. In addition to leaf rust resistance, one of these lines also has an APR gene conferring stripe rust resistance. Molecular analysis indicated that the *monococcum* gene for leaf rust resistance transferred to the wheat chromosome 1A is linked to SSR marker Xgwm136 (Vasu *et al.*, 2001). This derivative has a plant type similar to that of WL711.

References

Dhaliwal HS, P Chhuneja, RK Gill, RK Goel and H Singh (2002a) Introgression of disease resistance genes from related species into cultivated wheat through interspecific hybridization. *Crop Improvement* **29**: 1-18.

Lines Incorporating High Molecular Weight Glutenin Subunits from Different *Triticum* spp. into Durum Wheat (*Triticum durum* Desf.)

HS Dhaliwal, Harjit Singh, P Chhuneja and TS Grewal
Department of Genetics and Biotechnology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)

PAU HMW *GLU-A1-1* (INGR No. 03024; IC 296452)

PAU HMW *Glu-A1-1* is a genetic stock having high molecular weight (HMW) glutenin subunits with high SDS sedimentation value transferred from *Triticum boeoticum* into durum wheat *Triticum durum*. It was developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. PBW 34 and *T. boeoticum* acc. 4873 (A^bA^b). The F_1 was backcrossed to PBW 34, the recurrent parent. The transfer of HMW glutenin subunits coded by *Glu-A1* locus from *T. boeoticum* to *T. durum* was validated by SDS-PAGE of half seed. The donor *T. boeoticum* acc. 4873 had a HMW glutenin 1Ax subunit of low mobility and a series of less prominent subunit (bands) of faster mobility including one dominant band of Ay subunit. The mobility of HMW glutenin subunit coded by *Glu-A1x* allele was between 1Ax1 and 1Dx2 glutenin subunits of bread wheat. The Ay subunit had mobility intermediate between those of 1Bx7 and 1By8 of bread wheat. These two subunits coded by *Glu-A1* locus have been transferred in this interspecific derivative. With the transfer of these subunits the SDS micro-sedimentation value of the derivative has increased by 51 percent over and above the recurrent *T. durum* cv. PBW 34 (Dhaliwal *et al.*, 2002; Randhawa *et al.*, 1995, 1997).

PAU HMW *GLU-A1-7 (INGR No. 03025; IC 296458)*

PAU HMW *Glu-A1-7* is a genetic stock having high molecular weight (HMW) glutenin subunits with high SDS sedimentation value transferred from *Triticum urartu*. It has been developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. PBW 34 and *T. urartu* acc. 5340 (AA). The F_1 was backcrossed to PBW 34, used as the recurrent parent. The transfer of HMW glutenin subunits coded by *Glu-A1* locus from *T. urartu* to *T. durum* was confirmed by SDS-PAGE of half seed. The donor *T. urartu* acc. 5340 had two HMW glutenin subunits Ax and Ay. The mobility of HMW glutenin subunit coded by *Glu-A1x* allele was between 1Ax1 and 1Dx2 glutenin subunits of bread wheat. The Ay subunit had faster mobility than the 1Dy12 of bread wheat. These two subunits coded by *Glu-A1* locus have been transferred in this interspecific derivative. With the transfer of these subunits SDS micro-sedimentation value of the derivative has increased by 46 per cent over and above the recurrent parent *T. durum* cv. PBW 34 (Dhaliwal *et al.*, 2002; Randhawa *et al.*, 1995, 1997).

PAU HMW *GLU-A1-8 (INGR No. 03026; IC 296459)*

PAU HMW *Glu-A1-8* is a genetic stock having high molecular weight (HMW) glutenin subunits with high SDS sedimentation value transferred from *Triticum dicoccoides*. It has been developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. PBW 34 and *T. dicoccoides* acc. 4632 (AABB). The F_1 was backcrossed to PBW34, used as the recurrent parent and selfed upto BC_2F_6. The transfer of HMW glutenin subunits coded by *GluA1* locus from *T. dicoccoides* to *T. durum* was validated by SDS-PAGE of half seed. The mobility of Ax subunit of donor *T. dicoccoides* acc. 4632 was similar to 1Ax1 glutenin

subunit of bread wheat and that of Ay is between subunit 1Ax1 and 1Ax2 of bread wheat. These two subunits coded by *Glu-A1* locus have been transferred from *T. dicoccoides* in this interspecific derivative. With the transfer of these subunits SDS micro-sedimentation value of the derivative has increased by 38 percent over and above the recurrent *T. durum* cv. PBW 34 (Dhaliwal *et al.*, 2002; Randhawa *et al.*, 1995, 1997).

PAU HMW *GLU-A1-15 (INGR No. 03027; IC 296466)*

PAU HMW *Glu-A1-15* is a genetic stock having high molecular weight (HMW) glutenin subunits with high SDS sedimentation value transferred from *Triticum araraticum*. It has been developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. PBW 34 and *T. araraticum* acc. 4724 (AAGG). The F_1 was backcrossed to PBW 34, used as the recurrent parent and selfed upto BC_2F_6. The transfer of HMW glutenin subunits coded by *Glu-A1* locus from *T. araraticum* to *T. durum* was confirmed by SDS-PAGE of half seed. The donor *T. araraticum* acc. 4724 had a HMW glutenin Ax subunit of mobility slower than 1Ax1 of bread wheat, whereas Gx had mobility between 1Ax1 and 1Dx2. and mobility of Ay and Gy was between 1Dx5 and 1Bx7. One or two subunits coded by *Glu-A1* locus have been transferred in this interspecific derivative. With the transfer of these subunits SDS microsedimentation value of the derivative has increased by 20 percent over and above the recurrent *T. durum* cv. PBW 34 (Dhaliwal *et al.*, 2002; Randhawa *et al.*, 1995, 1997).

References

Dhaliwal HS, M Garg, H Singh, P Chhuneja and H Kaur (2002) Transfer of HMW-glutenin subunits from wild wheat into *Triticum durum* and improvement of quality. *Cereal Research Communication* **30**: 173-179

Randhawa HS, HS Dhaliwal and H Singh (1997) Diversity for HMW glutenin subunit composition and the origin of polyploid wheats. *Cereal Research Communication* **25**: 77-84

Randhawa HS, HS Dhaliwal, H Singh and Harinder Kaur (1995) Cataloguing of wheat germplasm for HMW glutenin subunit composition. In. Proc. Second Asia Pacific Conference on Agricultural Biotechnology, ed RP Sharma. pp 13-26

Genetic Stock in Wheat (*Triticum aestivum* L.) with Superior Yield Components Giant 3 *(INGR No. 03028; IC 296529)*

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Directorate of Wheat Research, Karnal-132 001 (Haryana)

Giant 3 is a genetic stock with long spike (15 cm) having high grain number per spike (97), more spikelets per spike (22), and extended grain filling period (51 days). It was developed at the Directorate of Wheat Research, Karnal under pre-breeding programme, using Buitre (long spike) and the best released variety PBW 343 (Rao *et al.*, 2002). PBW 343 pedigree is K134 (60) /VEE/BOW/PVN/PBW343 (PHR98K42-0L-10K0L10K-0L-2K-0L-35K-0L-0K).The desirable characters present in long spike Buitre material were high biomass, more spikelets and grains per spike. The associated negative traits, such as shriveled grains and susceptibility to rusts have restricted their direct use in breeding programmes/cultivation. Production of Giant 3 is an effort towards introgression of desirable traits from long spiked Buitre germplasm into high yielding adapted genetic background. As a breeding methodology, a low selection pressure was applied in early generations to allow progress of more recombinants to subsequent generations and high selection pressure in later generations following pedigree method for selecting desirable recombinants.

Giant 3 possesses dark green broad leaves producing high biomass and is resistant to brown and yellow rust at adult plant stage. Seedling reaction studies also showed resistance to black, brown and yellow rusts (Rao *et al.*, 2003). This genetic stock has acceptable plant height (90 cm.), days to 50 percent heading and days to physiological maturity. Therefore, it is very much suited to breeding programmes for production of genotypes with superior yield components. The high grain number coupled with medium bold grains (1000-grain weight, 44 g as against 41g in the check PBW 343) indicates an increase in grain number without reducing the grain weight (Table 1). The grain colour of the Giant 3 is amber like check PBW 343.

subunit of bread wheat and that of Ay is between subunit 1Ax1 and 1Ax2 of bread wheat. These two subunits coded by *Glu-A1* locus have been transferred from *T. dicoccoides* in this interspecific derivative. With the transfer of these subunits SDS micro-sedimentation value of the derivative has increased by 38 percent over and above the recurrent *T. durum* cv. PBW 34 (Dhaliwal *et al.*, 2002; Randhawa *et al.*, 1995, 1997).

PAU HMW *GLU-A1-15 (INGR No. 03027; IC 296466)*

PAU HMW *Glu-A1-15* is a genetic stock having high molecular weight (HMW) glutenin subunits with high SDS sedimentation value transferred from *Triticum araraticum*. It has been developed at the Punjab Agricultural University, Ludhiana from a cross between *T. durum* cv. PBW 34 and *T. araraticum* acc. 4724 (AAGG). The F_1 was backcrossed to PBW 34, used as the recurrent parent and selfed upto BC_2F_6. The transfer of HMW glutenin subunits coded by *Glu-A1* locus from *T. araraticum* to *T. durum* was confirmed by SDS-PAGE of half seed. The donor *T. araraticum* acc. 4724 had a HMW glutenin Ax subunit of mobility slower than 1Ax1 of bread wheat, whereas Gx had mobility between 1Ax1 and 1Dx2. and mobility of Ay and Gy was between 1Dx5 and 1Bx7. One or two subunits coded by *Glu-A1* locus have been transferred in this interspecific derivative. With the transfer of these subunits SDS microsedimentation value of the derivative has increased by 20 percent over and above the recurrent *T. durum* cv. PBW 34 (Dhaliwal *et al.*, 2002; Randhawa *et al.*, 1995, 1997).

References

Dhaliwal HS, M Garg, H Singh, P Chhuneja and H Kaur (2002) Transfer of HMW-glutenin subunits from wild wheat into *Triticum durum* and improvement of quality. *Cereal Research Communication* **30**: 173-179

Randhawa HS, HS Dhaliwal and H Singh (1997) Diversity for HMW glutenin subunit composition and the origin of polyploid wheats. *Cereal Research Communication* **25**: 77-84

Randhawa HS, HS Dhaliwal, H Singh and Harinder Kaur (1995) Cataloguing of wheat germplasm for HMW glutenin subunit composition. In. Proc. Second Asia Pacific Conference on Agricultural Biotechnology, ed RP Sharma. pp 13-26

Genetic Stock in Wheat (*Triticum aestivum* L.) with Superior Yield Components Giant 3 *(INGR No. 03028; IC 296529)*

NVPR Ganga Rao, V Mahajan, S Nagarajan and Jag Shoran
Directorate of Wheat Research, Karnal-132 001 (Haryana)

Giant 3 is a genetic stock with long spike (15 cm) having high grain number per spike (97), more spikelets per spike (22), and extended grain filling period (51 days). It was developed at the Directorate of Wheat Research, Karnal under pre-breeding programme, using Buitre (long spike) and the best released variety PBW 343 (Rao *et al.*, 2002). PBW 343 pedigree is K134 (60) /VEE/BOW/PVN/PBW343 (PHR98K42-0L-10K0L10K-0L-2K-0L-35K-0L-0K).The desirable characters present in long spike Buitre material were high biomass, more spikelets and grains per spike. The associated negative traits, such as shriveled grains and susceptibility to rusts have restricted their direct use in breeding programmes/cultivation. Production of Giant 3 is an effort towards introgression of desirable traits from long spiked Buitre germplasm into high yielding adapted genetic background. As a breeding methodology, a low selection pressure was applied in early generations to allow progress of more recombinants to subsequent generations and high selection pressure in later generations following pedigree method for selecting desirable recombinants.

Giant 3 possesses dark green broad leaves producing high biomass and is resistant to brown and yellow rust at adult plant stage. Seedling reaction studies also showed resistance to black, brown and yellow rusts (Rao *et al.*, 2003). This genetic stock has acceptable plant height (90 cm.), days to 50 percent heading and days to physiological maturity. Therefore, it is very much suited to breeding programmes for production of genotypes with superior yield components. The high grain number coupled with medium bold grains (1000-grain weight, 44 g as against 41g in the check PBW 343) indicates an increase in grain number without reducing the grain weight (Table 1). The grain colour of the Giant 3 is amber like check PBW 343.

Table 1. Salient Characteristics on Genetic Stock

Genotype	Key Characters				Other Characters		
	Grains/ Spike	Spikelets/ Spike	Spike length (cm)	Grain filling period (days)	1000- Grain weight (g)	Protein (%)	Sedimentation value (ml.)
GIANT 3	97	22	15	51	44	11.7	38
PBW 343 (Check)	61	19	10	40	41	11.7	36
Improvement (%) over the best check	59.0	15.8	50.0	27.5	–	–	–

References

Rao NVPR, Mahajan V, Shoran J and Gupta RK (2002) Genetic stocks developed through pre-breeding approach in hybrid wheat programme. *Indian Wheat Newsletter* **8**: 4-5.

New CMS Lines of Paddy (*Oryza sativa* L.)

BC Viraktamath, M Ilyas Ahmed, Sukhpal Singh, MS Ramesha and CHM Vijayakumar

Directorate of Rice Research (DR), Rajendranagar, Hyderabad-500030 (Andhra Pradesh)

Hitherto, the CMS lines introduced from IRRI were being used in the national hybrid rice-breeding programme. Since the most commonly used CMS line viz., IR 58025A has some defects, there is a need for developing indigenous CMS lines. The efforts in this direction have lead to development of following CMS lines.

DRR-2A ***(INGR No. 03029; IC 296532)***

DRR-2A is a new cytoplasmic male sterile line involving widely used WA source of male sterility. It was developed at the Directorate of Rice Research, Hyderabad by backcross involving V20A, a Chinese CMS line with WA source of male sterility as female parent and a breeding line, RNR 18953 as male parent. Being non-aromatic, it can be used to develop hybrids without aroma, which otherwise is a major problem in many of the presently available hybrids, where CMS line with aroma has been used. This CMS line is early, flowers between 85-90 days and matures between 110-115 days. It has medium slender grains without any stickiness.

It has good combining ability and requires lower doses (30-35 g./ha.) of GA_3 in hybrid seed production. This characteristic can help to develop hybrids with better grain quality (high milling recovery without aroma) and at lower seed production cost.

DRR-3A ***(INGR No. 03030; IC 296533)***

DRR-3A is another cytoplasmic male sterile line involving widely used WA source of male sterility. It was developed at the Directorate of Rice Research, Hyderabad through backcross, involving V20A, a Chinese CMS with WA source of male sterility as female parent and a breeding line, IET 9792 as male parent. This is a new plant type with long bold grains and strong culm with few tillers. Therefore, it would be a suitable plant type to breed indica-tropical-japonica hybrids with super high yield. Besides, it is also non-aromatic, early duration type flowering between 90-95 days and maturing between 115-120 days.

References

Ahmed MI, S Singh, BC Viraktamath, MS Ramesha and CHM. Vijayakumar (1998) Studying comparative suitability of CMS lines. IRRN. Vol. **23**, N-1, 5 p.

Viraktamath BC, M Ilyas Ahmed, MS Ramesha and S Singh (2002) Developing and evaluating CMS lines in India for their usability. Abstracts presented to 4th International Symposium on Hybrid Rice held at Hanoi, Vietnam during May 14-17, 2002.

Progress Report (1989-1998) of ICAR/UNDP/FAO project on "Promotion of Research and Development Efforts on Hybrids in Selected Crops-Rice". 1998. Published by the Project Director, Directorate of Rice Research (ICAR), Hyderabad.

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Early Type Chickpea (*Cicer arietinum* L.) Mutant, H-82-2(M) (*INGR No. 03031; IC 296430*)

VS Lather and RS Waldia
Pulse Section, Department of Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004 (Haryana)

H-82-2 (M) is a fast early vigour, early flowering and early maturing mutant with long internodal length. It is a spontaneous mutant of chickpea isolated from population of cultivar H-82-2 at the Chaudhary Charan Singh Haryana Agricultural University, Hisar during 1993-94 post-rainy season. The progenies of this mutant were studied for true breeding and morpho-physiological characters. The mutant showed consistent fast early growth (shoot length 13.41 cm. compared to 6.52 cm. for H-82-2), long internodal distance 3.38 cm (15 days seedling) and earliness in flowering, pod initiation and maturity. The details of morpho-agronomic features of this mutant are summarized in Table 1. In chickpea early growth and vigour is important for providing increased biomass. This line can be used to generate desirable variability for early fast growth, which will allow chickpea cultivars to compete with weeds at early stage and escape *Fusarium* wilt attack, particularly in irrigated and late sown areas of northern India.

Table 1. Characteristic of chickpea mutant H-82-2(M) and parent line H-82-2

Character	H-82-2(M)	H-82-2
15 days seedling		
Shoot length (cm.)	13.41±0.34	6.52±0.23
Root length (cm.)	6.52±0.31	4.29±0.19
Internodal distance (cm.)	3.38±0.23	1.20±0.11
At maturity		
Plant height (cm.)	63.36±0.82	56.78±0.72
Primary branches	2.80±0.41	2.40±0.43
Secondary branches	7.60±0.62	8.80±0.63
Internodal distance (cm.)	5.88±0.59	3.06±0.44
Days to flowering	62.0±0.51	71.00±0.46
Days to pod initiation	75.00±0.50	101.00±0.57
Days to maturity	129.00±0.55	146.00±0.58
Total pods/ plant	41.50±0.84	52.80±0.99
Seeds/ pod	1.36	1.46
100-seed weight (g.)	15.56	15.30
Seed colour	Creamish brown	Creamish brown
Seed yield/ plant (g.)	10.82	12.50

Reference

Lather VS, RS Waldia and IS Mehta (1997) *International Chickpea Newsletter* **Vol 4**: pp 11

Serpentine Leafminer Resistant Castor (*Ricinus communis* L.) RG 1930 (*INGR No. 03032; IC 296922*)

K Anjani
Directorate of Oilseeds Research, Rajendranagar, Hyderabad-500030 (Andhra Pradesh)

RG 1930 is a unique genetic stock possessing durable resistance to serpentine leafminer (*Liriomyza trifolii*). This pathogen is reportedly resistant to most insecticides, therefore host-plant resistance is the only solution for its effective control. This genetic stock was collected from Assam (Anjani *et al.*, 1994) and was identified as a source of resistance to leafminer at the Directorate of Oilseeds Research, Hyderabad based on visual observations of infested leaves per plant and larval mines per plant from cotyledonary leaf stage to maturity in the field from 1994 to 2000. The number of leaves infested per plant was zero and the larval mines per plant ranged from 0-5. The biochemical studies revealed presence of high total phenols (mg./g. leaf) (36.9) in RG 1930 compared to the susceptible checks Aruna (12.6) and Sowbhagya (11.1), 48-1 (13.8) and DCS-9 (12.8) (Prasad and Anjani, 2001).

RG 1930 is a purple colour morphotype, where entire plant including stem, branches, leaves and spikes are purple in colour. This rare morphotype is localized to northeastern states.

References

Anjani K, SK Chakravarty and MVR Prasad (1994) Collecting castor (*Ricinus communis* L.) germplasm in North-eastern Hill Province of India. *IBPGR Newsletter for Asia, The Pacific and Oceania.* **17**: 13.

Prasad YG and K Anjani (2001) Resistance to serpentine leafminer (*Liriomyza trifolii*) in castor (*Ricinus communis*). *Indian J. Agri. Sci.* **71(5)**: 351-352.

Early Type Chickpea (*Cicer arietinum* L.) Mutant, H-82-2(M) (*INGR No. 03031; IC 296430*)

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Low Glucosinolate and Low Erucic Acid Mustard (*Brassica juncea* L.) HEERA *(INGR No. 03033; IC 296501)*

AS Khalatkar
Botany Department, Nagpur University, Nagpur and Dhara Vegetable Oil & Food Co. Ltd., Vadodara-390023 (Gujarat)

Heera is a genetic stock with low glucosinolate content (16.96 m moles/ g. of seed) and low erucic acid in oil (0.12 %). It was developed through pedigree breeding method from a cross between exotic material ZYR-4 and BJ 1058 by late Dr. AS Kalatkar at the Department of Botany, Nagpur University, Nagpur during 1995. The project on development of '00' lines was supported by the Dhara Vegetable Oil & Foods Company Ltd. (DOFCO), Vadodara, a wholly owned subsidiary of the National Dairy Development Board (NDDB), Anand.

This genetic stock possesses plants, which are tall and late in maturity compared to the Indian mustard varieties viz. Pusa Bold and Varuna. It is yellow seeded and has a small seed size (about 2.67 g. per 1000-seed) with low oil content (33±2%). Also, it is resistant to the white rust disease.

NUDH-YJ-5 *(INGR No. 03034; IC 296507)*

YY Barve, SS Bhadauria and RK Gupta
Botany Department, Nagpur University, Nagpur and Dhara Vegetable Oil & Foods Co. Ltd., Vadodara-390023 (Gujarat)

NUDH-YJ-5 is a genetic stock of Indian mustard with low glucosinolate content (9.3 m moles/g. of seed) and low erucic acid (0.14%) content, classified into '00' types. It was developed from a cross between NU6 (a selection from Pusa Bold x Heera, with about 40 m moles /g of defatted meal and over 45% erucic acid in oil) and EH-1 (EMS induced dwarf, early mutant of Heera) at the Department of Botany, Nagpur University, Nagpur under the project funded by Dhara Vegetable Oil & Foods Company Ltd. (DOFCO), Vadodara during the year 2000.

NUDH–YJ-5 has medium height, early maturity (100 days) and yellow seed with oil content of 37±2.5 percent. It is comparable in yield (1809 kg./ha.) to local check GM-1 (1855 kg./ha.) and Varuna (2103 kg./ha.) over locations and years. Also, it is resistant to white rust disease.

Seedless and Long Duration Fruiting Pointed Gourd, (*Trichosanthes dioica* Roxb.) IIVRPG-105 *(INGR No. 03035; IC 296492)*

D Ram, G Kalloo, MK Banerjee and Billu Singh
Indian Institute of Vegetable Research, 1, Gandhi Nagar (Naria) P. Box No. 5002, P.O. B.H.U. Varanasi-221005 (Uttar Pradesh)

Pointed gourd is a vegetatively propagated dioecious perennial vine belonging to family Cucurbitaceae. Due to its nutritional and medicinal qualities such as diuretic, laxative and cardio-tonic effects it is a preferred vegetable. Also, it invigorates the heart and brain to improve the disorders of the circulatory system. Its seeds are hard and therefore, seedless fruit are in demand. Parthenocarpy in development of seedless fruit is an established mechanism observed in many species including Cucurbitaceous species, e.g. *Cucumis sativus* L. (Sturtevant, 1890; Tatlioglu, 1992). Also, in other vegetables (Gustfson, 1941; Mori, 1947; Takashima and Hatta, 1995) plant growth regulators based induced parthenocarpy has been reported. Seedless fruits

Low Glucosinolate and Low Erucic Acid Mustard (*Brassica juncea* L.) HEERA *(INGR No. 03033; IC 296501)*

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This genetic stock possesses plants, which are tall and late in maturity compared to the Indian mustard varieties viz. Pusa Bold and Varuna. It is yellow seeded and has a small seed size (about 2.67 g. per 1000-seed) with low oil content (33±2%). Also, it is resistant to the white rust disease.

NUDH-YJ-5 *(INGR No. 03034; IC 296507)*

YY Barve, SS Bhadauria and RK Gupta
Botany Department, Nagpur University, Nagpur and Dhara Vegetable Oil & Foods Co. Ltd., Vadodara-390023 (Gujarat)

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Botany Department, Nagpur University, Nagpur and Dhara Vegetable Oil & Foods Co. Ltd., Vadodara-390023 (Gujarat)

NUDH-YJ-5 is a genetic stock of Indian mustard with low glucosinolate content (9.3 m moles/g. of seed) and low erucic acid (0.14%) content, classified into '00' types. It was developed from a cross between NU6 (a selection from Pusa Bold x Heera, with about 40 m moles /g of defatted meal and over 45% erucic acid in oil) and EH-1 (EMS induced dwarf, early mutant of Heera) at the Department of Botany, Nagpur University, Nagpur under the project funded by Dhara Vegetable Oil & Foods Company Ltd. (DOFCO), Vadodara during the year 2000.

NUDH–YJ-5 has medium height, early maturity (100 days) and yellow seed with oil content of 37±2.5 percent. It is comparable in yield (1809 kg./ha.) to local check GM-1 (1855 kg./ha.) and Varuna (2103 kg./ha.) over locations and years. Also, it is resistant to white rust disease.

Seedless and Long Duration Fruiting Pointed Gourd, (*Trichosanthes dioica* Roxb.) IIVRPG-105 *(INGR No. 03035; IC 296492)*

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Pointed gourd is a vegetatively propagated dioecious perennial vine belonging to family Cucurbitaceae. Due to its nutritional and medicinal qualities such as diuretic, laxative and cardio-tonic effects it is a preferred vegetable. Also, it invigorates the heart and brain to improve the disorders of the circulatory system. Its seeds are hard and therefore, seedless fruit are in demand. Parthenocarpy in development of seedless fruit is an established mechanism observed in many species including Cucurbitaceous species, e.g. *Cucumis sativus* L. (Sturtevant, 1890; Tatlioglu, 1992). Also, in other vegetables (Gustfson, 1941; Mori, 1947; Takashima and Hatta, 1995) plant growth regulators based induced parthenocarpy has been reported. Seedless fruits

also provide possibility to fruiting round the year by which growers can get more price of their produce in the market in off-season.

IIVRPG-105 is an obligate parthenocarpic long duration fruiting genetic stock with seedless fruits. It was selected through screening of a total of 220 diverse genotypes/local landraces for parthenocarpy at Indian Institute of Vegetable Research, Varanasi. In each line fully mature female buds (mature but not open) were covered by butter paper envelops and tightened with thin wire to prevent cross pollination through insects, for identification of lines setting parthenocarpic fruits (Durham, 1985). Fruit setting was critically observed and the lines setting fruits despite begging were isolated. Fully immature fruits of edible stage were bisected and observed for seed development. Fruit of the selected line were found free from seeds not only at edible stage but also at mature stage. In second test, the isolated line was closely planted with male and female plant at regular intervals. Despite this it was observed that the identified line produced fruits devoid of seeds. In the third test collected pollens were applied on the stigma of open female flowers and covered with butter paper envelopes to avoid out-crossing. Even after this treatment the line produced seedless fruits confirming the parthenocarpic nature. The fruit characteristics of this line in comparison to the local checks are summarized in Table 1.

Morphologically, this line has medium sized (10-15 cm.) orbicular and un-lobed leaves with rough surface and light green colour. Plants attain a height of more than three meters. Fruiting starts at 7th node and continues up to full plant growth stage. Fruits are medium in size, light green, striped, elliptical in shape and pointed. The flesh of the fruit is light whitish. Length of fruit ranges between 4.81-5.21 cm. Shelf life of fruits is up to 10 days, six day more than the other seeded varieties. Close planting is recommended on bower system for growth and better management.

Table 1. Performance of parthenocarpic lines of pointed gourd

Lines	Fruits/ plant	Fruit length (cm)	Fruit diameter (cm)	Individual fruit (g)	Yield/ plant (kg)
IIVRPG-105	**135**	**4.39**	**2.85**	**20.7**	**2.28**
IIVRPG-01	42	4.20	2.43	17.8	0.748
IIVRPG-06	19	4.98	3.19	22.3	0.424
IIVRPG-10	200	6.14	2.68	25.2	5.040
IIVRPG-137	78	7.41	2.16	28.7	2.239

References

Durham GB (1985) Has parthenogenesis been confused with hermaphroditism in *Cucurbita* ? *Amer. Nat.* **59**: 283-294

Gustafson FC (1941) Probable causes for the difference in facility of producing parthenocarpic fruit in different plants. *Proc. Amer. Soc. Hort. Sci.* **35** : 479-481.

Mori H (1947) On parthenocarpy in *Cucurbita moschata* Duch. induced by growth promoting substances and their effectiveness for preventing fruit abscission. *J. Hort. Assn. Japan.* **16**: 154-160.

Sturtevant EL (1890) Seedless fruit. *Mem.Torrey Bot. Club.***1**: 141-181.

Takashima S and S Hatta (1995) Effect of phytohormones on parthenocarpy in cucurbits. *J. Hort. Assn. Japan.* **24:** 59-61.

Tatlioglu T (1992) Cucumber (*Cucumis sativus* L.) In G. Kalloo and B.O. Bergh (eds.). Genetic improvement of vegetable crops. *Pergamon Press.* Oxford, U.K. pp 197-234.

Root-knot Nematodes Resistant Tomato, (*Lycopersicon esculentum* Mill.), Hisar Lalit (NT-8) *(INGR No. 03036; IC 296468)*

RK Jain[1], RD Bhutani[3], G Kalloo[2], DS Bhatti[1] and Kirti Singh[3]

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3. Department of Vegetable Science, CCS Haryana Agricultural University, Hisar-125 004 (Haryana)

Hisar Lalit is a genetic stock with high resistance to root knot nematodes (*Meloidogyne javanica* and *Meloidogyne incognita*). This genotype was developed through hybridization between a released tomato variety HS-101 (susceptible, but high yielding) as recurrent parent and Resistant Bangalore (R 2) as donor parent at the Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar. Backcross pedigree method followed by simple selection was used for its development with cultivation of segregating populations in nematode infested soils for selection of resistant genotypes.

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Table 1. Description of parents and Hisar Lalit (NT-8) tomatoes

Character	Resistant Bangalore(Resistant)	HS-101(Susceptible)	Hisar Lalit(NT-8)
Plant habit	56.8 cm, semi-determinate, late	43.7 cm, determinate dwarf, early	48.7 cm, semi-determinate, early
Fruits per plant	8.5	20.6	22.5
Fruit weight (g.)	60.5	34.4	53.3
Yield potential	Poor yielder	High yielder	High yielder
Fruit colour	Red	Red	Deep red
Fruit shape	Round	Round	Round
Days to first picking	80 days	65-70 days	65-70 days
Root-knot index	–	4.5	1.0
Resistance reaction	Resistant	Susceptible	Resistant

The plants of this genetic stock are semi-determinate with stem being hairy and brittle at early stage and woody at maturity (Table 1). There is synchronization in flowering and fruiting. There was 51 to 79 percent reduction in the population of *Meloidogyne javanica* where this genetic stock was grown compared to increase in pest population from 29 to 105 percent in plots with HS-101 a susceptible genotype. Its root-knot index (resistance index) was 1.0 compared to 4.5-5.0 of HS-101. It is a high yielding genotype producing medium size, round red attractive fruits with average production of 200-250 q./ ha., 116 percent higher than check under multi-location trials.

The resistance to *Meloidogyne javanica and M. incognita* was confirmed under the All India Coordinated Research Trials on Plant Parasitic Nematodes at Anand (Gujarat). For cultivation, planting on raised beds is recommended at a seed rate of 500-600 g. of seed per hectare. This genotype is best suited for nematode infested soils of Haryana, Gujarat and adjoining areas under irrigated condition.

Gynoecious Line of Bitter Gourd, (*Momordica charantia* L.) Gy-63 *(INGR No. 03037; IC 296539)*

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Bitter gourd (*Momordica charantia*) is a monoecious cucurbit, known for its nutritional, medicinal and curative properties. Commercial hybrid seed production in this crop is being carried out by pinching the staminate flower buds in the monoecious line followed by hand pollination or insect pollination. Gynoecious flowering habit (sex form) has been commercially exploited in cucurbits like cucumber (*Cucumis sativus* L.) for hybrid seed production (Kalloo, 1988). Occurrence of gynoecious lines (pistillate line) in bitter gourd is very rare, though Zhou *et al.*, (1998) reported its utilization in hybrid seed production.

Gy-63 is a gynoecious genetic stock with high yield and attractive fruits. It was identified at Indian Institute of Vegetable Research, Varanasi through screening of germplasm (259 lines) during summer. Three gynoecious plants designated as Gy-35, Gy-63 and Gy-263B, were identified in three populations, viz. VRBT-35, VRBT-63 and IC-68263B respectively. Attempts were made to cross each gynoecious plant with (i) monoecious plant of the same population (sister plant) or (ii) monoecious plant of other population and (iii) gynoecious plant producing staminate flower. F_1 plants were examined for the presence or absence of pistillate and staminate flowers. Simultaneously, three independent gynoecious plants and progenies of five crosses were also examined for the possible involvement of genetic and environmental factors in the expression of gynoecious flowering habit. Two gynoecious plants (Gy-35 and Gy-63) did not produce staminate flower till their physiological maturity, but Gy-263B produced few staminate flowers at later stages. Thus gynoecious expression in Gy-263B was unstable. Expression of few staminate flowers is advantageous for the maintenance of truly gynoecious plants through selfing. Gynoecious sex expression in Gy-63 was stable over several developmental stages. For the determination of genetic behaviour, crossed fruits involving three gynoecious plants and their five crosses were raised and F_1 plants were observed for the expression

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of flowering habit. Interestingly, in the same cross, variable number of F_1 gynoecious and monoecious plants were observed. Maximum numbers of three gynoecious plants were recovered from the progeny of 8 plants in the cross between Gy 263B and one of their sister-plant. Similarly, in 2 crosses, viz. Gy35 x Gy263B and Gy263B x VRBT63 also one gynoecious plant was recovered (Table 1). The results pertaining to recovery of gynoecious plants in very small F_1 population indicates that this trait is heritable and under the control of certain major gene(s) recessive in nature (Ram *et al.*, 2002).

Absolute gynoecious line GY-63 is the first truly tropical gynoecious line in bitter gourd. Its plants are very vigorous and bear light green leaves of medium to big size. The flowering starts from 7th node within 45 to 48 days and fruits attain edible maturity in 64 days after seeding (8-10 days after fruit set). Fruits are green in colour. Fruits attain a length up to 15 cm and a diameter of 3.55 cm. Average individual fruit weight is 75–100 g. An average of 30 fruits per plant can be harvested. It possesses good keeping quality, less seed and more flesh. This gynoecious line yields better under bower system.

Table 1. Flowering percentage of pistillate flowers in F_1s derived from gynoecious plants

Female plant	Male plant	F_1 plant			Pistillate *flower (%) mean (range)
		Gyn.	Mon.	Total	
Gy35	IC-68263	0	8	8	50.6 (34.9-58.5)
Gy35	Gy263	1	6	7	48.3 (28.2-58.1)
Gy35	VRBT63	0	3	3	52.5 (29.5-57.9)
Gy63	Gy263	3	5	8	46.3 (46.3-87.5)
Gy263B	Gy263	1	1	2	20.0

Gyn.= Gynoecious; Mon.= monoecious; * = Observation on monoecious plants: "Plants of Pusa Hybrid 2 (13.4%) and PBIG1 (11.3%)

References

Kalloo G (1988) *Vegetable Breeding*, CRC Press, Florida, USA. Vol. 1, pp 105-35

Ram D, Sanjeet Kumar, MK Banerjee and G Kalloo (2002) Occurrence, identification and preliminary characterization of gynoecism in bitter gourd (*Momordica charantia*) *Indian J. Agri. Sci.* **72:** 348-349.

Ram D, Sanjeet Kumar, MK Banerjee, Billu Singh and Sanjay Singh (2002). Developing bitter gourd (*Momordica charantia L.*) populations with a very high proportion of pistillate flowers. *Cucurbit Genetic Cooperative Report* No.25, pp 65-66.

Zhou WB, SB Luo and JN Luo (1998) An early maturing and high yielding bitter gourd F_1 hybrid Cullii No.1. *Plant Breeding Abstracts* **68**:1002 *China vegetables* **2**: 27-29.

High Yielding Neem (*Azadirachta indica* A. Juss.) CRIDA-8 *(INGR No. 03038; IC 296921)*

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CRIDA-8 is a neem genetic stock with high azadirachtin content in seed and a high kernel to seed ratio identified by Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad following a comprehensive nation wide survey. CRIDA-8 is a high yielding tree of twenty-five years of age with a yield potential of 75 kg. air-dried fruit per annum based on data collected for five years, from 1997-2001. It has 2.1 m. clean bole with compact crown. The tree has been identified in village Hayathanagar of Ranga Reddy district of Andhra Pradesh by a simple method of selection.

The tree has a compact crown with a girth of 150 cm. at breast height, flowers in May/June and fruit fall completes by the end of July. It flowers only once in the season. The fruits are relatively small and oblong. The fruit has 56 percent kernel, which has 21 percent oil content. The 100 seed weight is 15 g. The azadirachtin content in the kernel was determined to be 0.75 percent in kernels on the basis of five years data.

Both seed raised and micro-propagated progeny from this tree have been produced and evaluated at three locations viz. Hyderabad, Pune and Kovilpatti with an average height of 5.2 m and girth of 27 cm. The performance of seed raised progeny was similar. However, micro-propagated plants flowered at the end of 28 months, whereas seedlings flowered after 36 months. The progeny

of flowering habit. Interestingly, in the same cross, variable number of F_1 gynoecious and monoecious plants were observed. Maximum numbers of three gynoecious plants were recovered from the progeny of 8 plants in the cross between Gy 263B and one of their sister-plant. Similarly, in 2 crosses, viz. Gy35 x Gy263B and Gy263B x VRBT63 also one gynoecious plant was recovered (Table 1). The results pertaining to recovery of gynoecious plants in very small F_1 population indicates that this trait is heritable and under the control of certain major gene(s) recessive in nature (Ram *et al.*, 2002).

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of the plus tree has been analysed for azadirachtin and other seed related traits. In case of micro propagated plants the plants have behaved true to the mother plant. (Venkateshwarlu and Mukhopadhyaya, 1999). The AFLP studies also confirmed the true to type character of the progeny produced through micro-propagation (Singh *et al.*, 2002).

The germplasm selected exhibits intermediate growth rate with high adaptation to both red and black soil area under 500-1200 mm. rainfall zones. It can be planted on the boundaries and also in blocks with 8 m. x 6 m. spacing. Six months old seedlings or micro-propagated planting material can be transplanted in 45 x 45 cm pits in the beginning of the monsoon. The tree establishes well under rainfed conditions. However, in dry areas with short monsoon terminating in September, watering during first summer helps in better establishment and growth. Intercrops like green gram, black gram, groundnut and cowpea can be grown in the interspaces for 3-4 years.

References

Venkateshwarlu B and Mukhopadhyaya J (1999) Azadirachtin content in the seeds of micropropagated neem plants in relation to its mother tree *Current Science* 7(5), pp626-627.

Singh A, MS Negi, VK Moses, B Venkateshwarlu, PS Srivastava and M Lakshmikumaran (2002). Molecular analysis of micropropagated neem plants using AFLP markers for ascertaining clonal fidelity. *In Vitro Cell. Dev. Biol.* Vol **38(5)**, pp 519-524.

Scented Rose-geranium, *Pelargonium graveolens* L' Herit. NIC 23414 *(INGR No. 03039; IC 296494)* of Quality Aroma

KS Negi, DC Bhandari and KC Pant[1]; ML Maheshwari[2]; P Suneja[3]

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2. E8, Street E, Mayapuri, New Delhi-110 064

3. National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi-110 012

Scented Rose-Geranium, NIC 23414 is a genetic stock with high quality aroma identified at National Bureau of Plant Genetic Resources, Regional Station Bhowali. The essential oils obtained from NIC 23414, Scented Rose-Geranium under Uttranchal conditions is acceptable in the industry. It has good major chemical constituents, such as Cis-rose oxide 0.4777%, Trans-rose-oxide 0.1110%, Isomenthone 7.80%, Linalool 21.25%, Citronellol 32.28% and Geraniol 28.56%. Scented Rose-Geranium (*Pelargonium graveolens* L' Herit.) was introduced from Indonesia to the herbal garden of National Bureau of Plant Genetic Resources, Regional Station, Bhowali in 1991 by Mr GD Kelkar. Stem cuttings of rose-geranium were also obtained from M/s SH Kelkar & Co., from their research farm at Hyderabad, Andhra Pradesh during 1990.

Scented Rose-Geranium, NIC 23414 is perennial (up to seven years), pubescent or sparsely hairy herb with creeping rhizomatous root-stocks, 120-160 cm. tall; leaves sub-orbicular, deeply 5-12 lobed, 20 cm. across, segments irregularly lobed, pubescent on both surfaces, lower leaves petiolate, upper ones sessile, dark green; flowers pale pink-purple with dark purple centre/veins, one cm. across, solitary or 8-10 together; sepals 5, free, 4-5 mm. long, lanceolate, acute; petals 5 free 10 mm. long, obovate; capsule 1-2 cm. long, forming beak, enclosed by persistent erect calyx lobes, single seeded.

This genotype is evergreen and resistant to frost, diseases and pests. Terminal shoot-apex with 4-6 nodes of the stem from healthy plants with profuse branching are good to multiply and for regeneration round the year except rainy season. After six months, 50-200 stem cuttings may be obtained from a single plant for oil extraction. Plantation of geranium is done with 30 cm. plant-to-plant and row-to-row distance, yielding about 554 quintals herbage (leave and tender stem) after four cuttings (at three months interval) with and a yield of 42 kg. of essential oil per ha/year. Large-scale extraction of geranium herbage through steam and hydro-distillation units yielded 0.07 and 0.15 percent essential oil respectively. The cultivation of Scented Rose-Geranium, NIC 23414 has been popularized among 60 farmers of nine districts in Uttranchal.

of the plus tree has been analysed for azadirachtin and other seed related traits. In case of micro propagated plants the plants have behaved true to the mother plant. (Venkateshwarlu and Mukhopadhyaya, 1999). The AFLP studies also confirmed the true to type character of the progeny produced through micro-propagation (Singh *et al.*, 2002).

The germplasm selected exhibits intermediate growth rate with high adaptation to both red and black soil area under 500-1200 mm. rainfall zones. It can be planted on the boundaries and also in blocks with 8 m. x 6 m. spacing. Six months old seedlings or micro-propagated planting material can be transplanted in 45 x 45 cm pits in the beginning of the monsoon. The tree establishes well under rainfed conditions. However, in dry areas with short monsoon terminating in September, watering during first summer helps in better establishment and growth. Intercrops like green gram, black gram, groundnut and cowpea can be grown in the interspaces for 3-4 years.

References

Venkateshwarlu B and Mukhopadhyaya J (1999) Azadirachtin content in the seeds of micropropagated neem plants in relation to its mother tree *Current Science* 7(5), pp626-627.

Singh A, MS Negi, VK Moses, B Venkateshwarlu, PS Srivastava and M Lakshmikumaran (2002). Molecular analysis of micropropagated neem plants using AFLP markers for ascertaining clonal fidelity. *In Vitro Cell. Dev. Biol.* Vol **38(5)**, pp 519-524.

Scented Rose-geranium, *Pelargonium graveolens* L' Herit. NIC 23414 *(INGR No. 03039; IC 296494)* of Quality Aroma

KS Negi, DC Bhandari and KC Pant[1]; ML Maheshwari[2]; P Suneja[3]

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2. E8, Street E, Mayapuri, New Delhi-110 064

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Scented Rose-Geranium, NIC 23414 is perennial (up to seven years), pubescent or sparsely hairy herb with creeping rhizomatous root-stocks, 120-160 cm. tall; leaves sub-orbicular, deeply 5-12 lobed, 20 cm. across, segments irregularly lobed, pubescent on both surfaces, lower leaves petiolate, upper ones sessile, dark green; flowers pale pink-purple with dark purple centre/veins, one cm. across, solitary or 8-10 together; sepals 5, free, 4-5 mm. long, lanceolate, acute; petals 5 free 10 mm. long, obovate; capsule 1-2 cm. long, forming beak, enclosed by persistent erect calyx lobes, single seeded.

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Variegated Leaved Balsam, *Impatiens wallerana* Hook. F. 'Queen of Balsams' A Leafy Ornamental, TBGT 30225 *(INGR No. 03040; IC 296493)*

PA Jose and Jacob Thomas
Division of Horticulture and Garden Development, Tropical Botanic Garden and Research Institute (TBGRI), Pacha-Palode, Thiruvananthapuram-695 562 (Kerala)

Impatiens wallerana belonging to the family Balsaminaceae is commercially known as Busy lizy or the Patient Lucy. It is a native of East Africa. It is a perennial tender succulent herb, which grows below one meter in height with green foliage and varied flower colour depending on the variety. The capsule is oblique-fusiform with seldom seed setting in cultivated plants.

TBGT 30225 is a variegated leaved genetic stock of *Impatiens wallerana.* A young branch with variegated leaves developed spontaneously as 'sport' in a normal potted plant of *Impatiens* growing at Tropical Botanic Garden and Research Institute (TBGRI), Thiruvananthapuram. The variegated branch of 8-10 cm. was then excised from the mother plant for isolation and propagation of the new variegated plant type (Jose and Thomas, 1994; Jose and Thomas 1999a). The clone has retained the variegation and subsequently multiplied vegetatively for five generations. The new variegated plant has been characterized by variegated leaves, which are having irregular creamy-white marginal patches merging with the faded central green portion.

This succulent herb is 50-70 cm. tall, profusely branched. Leaves variegated, irregular with creamy-white marginal patches merging with the faded central green portions, simple, alternate and dense towards tip, ovate-elliptic, 4-7 x 1.8-4.5 cm. in size, glabrous with petiole length of 0.7–4.5 cm. Flowers are asymmetrical, solitary or binate from the leaf axis. Bracts and bracteoles are subulate to 3 mm. long. Sepals are three upper two are smaller rosy green, lower petaloid with a long spur. Petals are showy with five lobes crimson red in colour. Stamens are five, united in a short tube towards apex. Ovary is superior, glabrous and capsule oblique fusiform.

There was no clear-cut difference between the parent and mutant except in the leaf variegation (Jose and Jacob Thomas, 1999 b). However, slight differences were observed in stem and flower size in relation to the vegetative/flowering habit of the variegated plant. The new germplasm is an excellent specimen for displaying in gardens or green houses. It is also suited for flowerbeds, borders, window boxes, porch boxes and pot cultivation. It performs well under semi-shade conditions.

References

Jose PA and J Thomas (1994) A spontaneous mutant of *Allamanda neriifolia. Indian Horticulture* **39**: 36-37.

Jose PA and J Thomas (1999a) Plant germplasm registration notice-INGR 99017 *Allamanda neriifolia, Indian J. Pl. Genet. Resources.* **12**: 273-275.

Jose PA and J Thomas (1999b) A 'sport' of *Impatiens wallerana,* New variegated garden plant. *Indian Horticulture* **43**: 37.

Green Flowered Stripped Lip Orchid, (*Eulophia andamanensis* Reich b.f.), Pretty Green Bay *(INGR No. 03041; IC 296534)*

DR Singh, Sujatha Nair and TVRS Sharma
Central Agricultural Research Institute (CARI), P.B. No. 181, Port Blair–744101 (Andaman and Nicobar Islands)

Pretty Green Bay is an orchid having green flowers with stripped lips belonging to the subfamily Vandoideae, tribe Cymbidieae and subtribe Cyrtopodiinae. This terrestrial orchid is spread all over the tropics and sub-tropics of the world. In Asiatic tropics they are found in India, Sri Lanka, Indonesia and the Pacific Islands. Numerous species of this genus occur throughout India. *Eulophia andamanensis* is endemic to Andaman and Nicobar Islands. They are being collected and maintained at Central Agricultural Research Institute (CARI), Port Blair and are propagated either through the division or separation of pseudo-bulbs or by tissue culture. This orchid has been identified for its potential as an export commodity owing to its good keeping quality and other features like long spikes with many green florets opening over a period of nearly one month. (Singh, 2003).

Pretty Green Bay is a ground orchid with underground or sub-terrestrial tubers with or without distinct pseudo-

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Pretty Green Bay is a ground orchid with underground or sub-terrestrial tubers with or without distinct pseudo-

bulbs. The scape or the stalk of the flower-bunch comes out at the base from one side of the tuber. Leaves are short during flowering and linear lanceolate. Flowers are medium size, fully open and spread out, displaying the pretty lip. Bracts are shorter than the pedicel, sepals 2-3" long and the lip are shorter than the sepal (Singh, 2003). Sepals and petals are similar and sub-equal, the dorsal sepal and petals are broader, while the lateral sepals are often fused at base with the column, with which the base of the lip may also be fused. Sepals are linear, lanceolate, 3-5 nerved and acuminate. Sepals and petals are green in color, lip creamish green with maroon horizontal stripes (Singh, 2003). Lip is distinctive, usually three lobed, with the two side-lobes erect and clasping the column, the broad mid-lobe is out-thrust, spreading, entire or again bi-lobed erect and clasping the column, the broad mid-lobe is out-thrust, spreading, entire or again bi-lobed. The upper surface of the disc is variously crested, ridged or lamellated, rarely smooth. Base of the lip has a small sac or a short spur. Column is stout often with two lateral flaps. Pollinia are two, each deeply cleft and with a short broad stalk. Blooming period is November to March. Florets are borne on long spike of 0.6 - 1.3 m. (Singh, 2002). The pods are formed by self-pollination and the pod length varies from 5.6 - 6.2 cm., while the girth from 0.5 - 1.0 cm. Numerous seeds are produced per pod (Table 1).

In addition to ornamental cultivation, the spikes can be used in ikebana and in different flower arrangements. As the colour of the florets is rare it can be used in breeding programmes to incorporate this colour. It can also be grown in pots. The potting media comprising charcoal, coconut husk and leaf mould in equal parts is found to be ideal for its growth and flowering (Singh, 2003).

Table 1. Salient features of *Eulophia andamanensis*

Length of spike (cm.)	61.2 – 130
Life of spike (days)	49.67
Flower size (cm.)	6.65
Number of spike/ plant	2 – 4
Number of florets/ spike	29 – 45
Number of suckers/ plant	2 – 4
Number of florets fresh at a time	15 – 20
Leaf venation	Parallel, midrib and 6 veins prominent on under surface of leaf
Leaf arrangement	Alternate
Size of pseudo-bulb	Length 20 cm., Breadth (at base) 5.5 cm.
Average weight of pseudo-bulbs (g.)	325
Shape of pseudo-bulb	Elongated

References

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Singh DR, Sujatha A Nair and VB Pandey (2003) Standardization of Potting Media for an endemic orchid *Eulophia andamanensis*. *Journal of Ornamental Horticulture*. **6**(2): 149.

Singh DR, Sujatha A Nair and RP Medhi (2003) Orchids of Bay Islands. Research Bulletin No. 14, Published by the Director, Central Agricultural Research Institute, P.B. No. 181, Port Blair – 744 101.

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Regular Bearing, High Temperature Tolerant Dashehari Clone Mango (*Mangifera indica* L.), Akshay *(INGR No. 03042; IC 296830)*

Hari Govind Singh

Ex. Vice Chancellor, GBPUA&T, Pantnagar, Village Poore Beni Bhadwari, P.O. Konhara via Amethi, Distt, Sultanpur (Uttar Pradesh)

Akshay is a Dashehari clone of mango identified for regular bearing at a mango orchard of 234 plants grown at Village Poore-Beni Bhadwaria, Kondara, Amethi, district Sultanpur. Akshay Dashehari clone was planted in 1976. It has been observed that average weight of mango fruits of this variety even under high temperature is 210 percent higher as compared to other deshehari plants of similar age, showing that temperature did not affect weight and size of fruits. Generally, physiological and environmental factors attribute to irregular or alternate bearing, which are the major disorders in mango production in northern India.

Akshay has been identified as a regular bearing clone because of its consistent performance for the last seven

bulbs. The scape or the stalk of the flower-bunch comes out at the base from one side of the tuber. Leaves are short during flowering and linear lanceolate. Flowers are medium size, fully open and spread out, displaying the pretty lip. Bracts are shorter than the pedicel, sepals 2-3" long and the lip are shorter than the sepal (Singh, 2003). Sepals and petals are similar and sub-equal, the dorsal sepal and petals are broader, while the lateral sepals are often fused at base with the column, with which the base of the lip may also be fused. Sepals are linear, lanceolate, 3-5 nerved and acuminate. Sepals and petals are green in color, lip creamish green with maroon horizontal stripes (Singh, 2003). Lip is distinctive, usually three lobed, with the two side-lobes erect and clasping the column, the broad mid-lobe is out-thrust, spreading, entire or again bi-lobed erect and clasping the column, the broad mid-lobe is out-thrust, spreading, entire or again bi-lobed. The upper surface of the disc is variously crested, ridged or lamellated, rarely smooth. Base of the lip has a small sac or a short spur. Column is stout often with two lateral flaps. Pollinia are two, each deeply cleft and with a short broad stalk. Blooming period is November to March. Florets are borne on long spike of 0.6 - 1.3 m. (Singh, 2002). The pods are formed by self-pollination and the pod length varies from 5.6 - 6.2 cm., while the girth from 0.5 - 1.0 cm. Numerous seeds are produced per pod (Table 1).

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Akshay has been identified as a regular bearing clone because of its consistent performance for the last seven

years (1993-1999). Sixty to 65 percent new shoots on this clone are produced in May, which subsequently bear fruits. The fruit size is medium with excellent fruit quality. The fruits of Akshay clone compared well with other Dashehari plants of similar age. During 1999 the fruit weight and size of Dashehari has been reduced drastically. This may have happened due to extremely high temperature in April. The average maximum temperature for April (1989-1998) was 36-37°C, whereas for April 1999, it was 39-40°C. The fertilizer and irrigation were applied uniformly. The average weight of mango fruits of Akshay, which were plucked randomly, was 210 percent higher as compared to other Dashehari plants of similar age, canopy and fruit number. Thus the weight and size of fruits of Akshay were relatively less affected due to high temperature during month of April, providing stability under the changing environment.

Genotype bears leaves of medium size, oval to lanceolate in shape with entire to slightly wavy margin and sub-acuminate apex. Fruit bearing is regular and heavy, with excellent fruit quality identical to Dashehari mango with tolerance to high temperature.

Reference

Singh HG (1999) Some observations on Akshay – A regular bearing Dashehari Clone of Mango. Short communication *Indian Journal of Pl. Genet. Resources* **12**(2): pp 268.

Sugarcane Clones (*Saccharum officinarum* L.)

M Jayaprakash[5], J. Papa Rao[1], K Prasada Rao[1], B Ramachandra Rao[1], Smt. K. Krishanamma[2], JVR Bhupal Rao[2], P. Ravindra Babu[2] and K Jhansi[4]

1. Sugarcane Research Station, Anakapalle, Andhra Pradesh
2. Sugarcane Research Station, Vuyyuru, Andhra Pradesh
3. Regional Agricultural Research Station, Anakapalle, Andhra Pradesh
4. Division of Forage Crops, Veterinary Research Wing, ANGRAU, Hyderabad, Andhra Pradesh
5. Regional Rice and Sugarcane Research Station, Rudrur, Andhra Pradesh

91 V 83 (Co V 95101) ***(INGR No. 03043; IC 296849)***

91 V 83 (Co V 95101) is an early maturing, non-lodging high yielding sucrose rich clone with good ratooning performance, resistant to red rot and smut diseases. The genetic stock was developed at the Sugarcane Research Station, Vuyyuru, Andhra Pradesh from a bi-parental cross between Co 798 and Co 62198 followed by selection. The clone is early maturing and sucrose rich (19-20 %) suited to serve as an opening mill cane. It is suitable for cultivation under adverse and low-input conditions. The plant possesses erect growth habit with dirty gray exposed and yellowish green unexposed stem. Cane diameter is 2.52 cm. and cane yield is between 120-130 t/ha.

83 V 15 ***(Co V 92102) (INGR No. 03044; IC 296848)***

83 V 15 (Co V 92102) is a genotype with mid to late maturity period. Though it lodges early, but does not snap and continues to grow. It is resistant to red rot and smut diseases and also capable to withstand salinity up to 4 E.C. It was developed at the Sugarcane Research Station, Vuyyuru, Andhra Pradesh from a bi parental cross between CoC 671 and Co 6806 followed by selection. The clone exhibits mid to late (8^{th} week) flowering with 88.8 percent pollen fertility. It is rich in sucrose (18-19%) and resistant to red-rot and smut. The plant possesses semi-erect growth habit with purple exposed and yellowish green unexposed stem. Cane diameter is 2.52 cm. with cane yield of 120-130 t/ha.

High L-dopa Content Mucuna, (*Mucuna* spp.) Lines

TN Shivananda and T Vasantha Kumar

Indian Institute for Horticulture Research (IIHR), Hessaraghatta Lake, Bangalore-560 089 (Karnataka)

Mucuna pruriens Baker and *Mucuna utilis* Wall. ex Wight are high value medicinal crops grown extensively in South India for their amino-acid derivative L 3, 4-Dihydroxyphenylalanine (L-DOPA) present in seeds. Cultural practices have been developed for optimum production of plant biomass, as in the drug preparation

years (1993-1999). Sixty to 65 percent new shoots on this clone are produced in May, which subsequently bear fruits. The fruit size is medium with excellent fruit quality. The fruits of Akshay clone compared well with other Dashehari plants of similar age. During 1999 the fruit weight and size of Dashehari has been reduced drastically. This may have happened due to extremely high temperature in April. The average maximum temperature for April (1989-1998) was 36-37°C, whereas for April 1999, it was 39-40°C. The fertilizer and irrigation were applied uniformly. The average weight of mango fruits of Akshay, which were plucked randomly, was 210 percent higher as compared to other Dashehari plants of similar age, canopy and fruit number. Thus the weight and size of fruits of Akshay were relatively less affected due to high temperature during month of April, providing stability under the changing environment.

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91 V 83 (Co V 95101) is an early maturing, non-lodging high yielding sucrose rich clone with good ratooning performance, resistant to red rot and smut diseases. The genetic stock was developed at the Sugarcane Research Station, Vuyyuru, Andhra Pradesh from a bi-parental cross between Co 798 and Co 62198 followed by selection. The clone is early maturing and sucrose rich (19-20 %) suited to serve as an opening mill cane. It is suitable for cultivation under adverse and low-input conditions. The plant possesses erect growth habit with dirty gray exposed and yellowish green unexposed stem. Cane diameter is 2.52 cm. and cane yield is between 120-130 t/ha.

83 V 15 ***(Co V 92102) (INGR No. 03044; IC 296848)***

83 V 15 (Co V 92102) is a genotype with mid to late maturity period. Though it lodges early, but does not snap and continues to grow. It is resistant to red rot and smut diseases and also capable to withstand salinity up to 4 E.C. It was developed at the Sugarcane Research Station, Vuyyuru, Andhra Pradesh from a bi parental cross between CoC 671 and Co 6806 followed by selection. The clone exhibits mid to late (8^{th} week) flowering with 88.8 percent pollen fertility. It is rich in sucrose (18-19%) and resistant to red-rot and smut. The plant possesses semi-erect growth habit with purple exposed and yellowish green unexposed stem. Cane diameter is 2.52 cm. with cane yield of 120-130 t/ha.

High L-dopa Content Mucuna, (*Mucuna* spp.) Lines

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Mucuna pruriens Baker and *Mucuna utilis* Wall. ex Wight are high value medicinal crops grown extensively in South India for their amino-acid derivative L 3, 4-Dihydroxyphenylalanine (L-DOPA) present in seeds. Cultural practices have been developed for optimum production of plant biomass, as in the drug preparation

years (1993-1999). Sixty to 65 percent new shoots on this clone are produced in May, which subsequently bear fruits. The fruit size is medium with excellent fruit quality. The fruits of Akshay clone compared well with other Dashehari plants of similar age. During 1999 the fruit weight and size of Dashehari has been reduced drastically. This may have happened due to extremely high temperature in April. The average maximum temperature for April (1989-1998) was 36-37°C, whereas for April 1999, it was 39-40°C. The fertilizer and irrigation were applied uniformly. The average weight of mango fruits of Akshay, which were plucked randomly, was 210 percent higher as compared to other Dashehari plants of similar age, canopy and fruit number. Thus the weight and size of fruits of Akshay were relatively less affected due to high temperature during month of April, providing stability under the changing environment.

Genotype bears leaves of medium size, oval to lanceolate in shape with entire to slightly wavy margin and sub-acuminate apex. Fruit bearing is regular and heavy, with excellent fruit quality identical to Dashehari mango with tolerance to high temperature.

Reference

Singh HG (1999) Some observations on Akshay – A regular bearing Dashehari Clone of Mango. Short communication *Indian Journal of Pl. Genet. Resources* **12**(2): pp 268.

Sugarcane Clones (*Saccharum officinarum* L.)

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91 V 83 (Co V 95101) ***(INGR No. 03043; IC 296849)***

91 V 83 (Co V 95101) is an early maturing, non-lodging high yielding sucrose rich clone with good ratooning performance, resistant to red rot and smut diseases. The genetic stock was developed at the Sugarcane Research Station, Vuyyuru, Andhra Pradesh from a bi-parental cross between Co 798 and Co 62198 followed by selection. The clone is early maturing and sucrose rich (19-20 %) suited to serve as an opening mill cane. It is suitable for cultivation under adverse and low-input conditions. The plant possesses erect growth habit with dirty gray exposed and yellowish green unexposed stem. Cane diameter is 2.52 cm. and cane yield is between 120-130 t/ha.

83 V 15 ***(Co V 92102) (INGR No. 03044; IC 296848)***

83 V 15 (Co V 92102) is a genotype with mid to late maturity period. Though it lodges early, but does not snap and continues to grow. It is resistant to red rot and smut diseases and also capable to withstand salinity up to 4 E.C. It was developed at the Sugarcane Research Station, Vuyyuru, Andhra Pradesh from a bi parental cross between CoC 671 and Co 6806 followed by selection. The clone exhibits mid to late (8^{th} week) flowering with 88.8 percent pollen fertility. It is rich in sucrose (18-19%) and resistant to red-rot and smut. The plant possesses semi-erect growth habit with purple exposed and yellowish green unexposed stem. Cane diameter is 2.52 cm. with cane yield of 120-130 t/ha.

High L-dopa Content Mucuna, (*Mucuna* spp.) Lines

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Mucuna pruriens Baker and *Mucuna utilis* Wall. ex Wight are high value medicinal crops grown extensively in South India for their amino-acid derivative L 3, 4-Dihydroxyphenylalanine (L-DOPA) present in seeds. Cultural practices have been developed for optimum production of plant biomass, as in the drug preparation

all plant parts are used, though seed is the most economically important part. Hence seed yield is mainly recorded for economic yield potential. *M. pruriens* has highly vigorous plants growing to a height of 10 to 12 feet compared to *M. utilis*, growing to a height of 6 to 7 feet with less branching habit. Staking is required for *M. pruriens* with 8 to 10 feet bamboo poles. Seeds of both the species are used as aphrodisiac. It is grown as a wasteland crop on borders, as cattle avoid it.

COWHAGE /ATMAGUPTA, IIHR-19855 *(INGR No. 03045; IC 296847) Mucuna pruriens Baker*

COWHAGE /ATMAGUPTA IIHR-19855 is a *Mucuna pruriens* accession with high L-DOPA content (9.5%) in seeds. This high yielding accession with high L- DOPA content was identified at Indian Institute for Horticulture Research (IIHR), Bangalore. L-DOPA content as analyzed using HPLC method at the Section of Medicinal Crops of the IIHR. The results were at par with the results obtained at Al Ameen College of Pharmacy. The L-DOPA content recorded in the present accession is much higher than the values reported earlier (4.5%).

The genotype possesses intermediate growth habit with extended duration of flowering (200 days) and pod maturity period of 150 to 180 days. The pods are more or less 'S' shaped and possess 3-4 seeds. However, this species is not grower friendly as the pods have hirsute surface with long highly itchy hairs, which is a unique feature of this species. Plant growth is highly vigorous and needs strong support. Seeds have dormancy.

COWHAGE /ATMAGUPTA IIHR-19854 *(INGR No. 03046; IC 296846)*

***Mucuna utilis* Wall. Ex Wright** COWHAGE/ATMA-GUPTA IIHR-19854 is a *Mucuna utilis* accession with high L-DOPA content (5.5%) in seeds. This is a cultivated species of *Mucuna* and this accession has been identified with next highest L-DOPA content, which was analyzed using HPLC method at the Section of Medicinal Crops of the Indian Institute for Horticulture Research. The results were at par with the results obtained at Al Ameen College of Pharmacy. Plants are determinate type, taking 120-150 days to reach maturity and last for 120 days in field cultivation. The pod surface is smooth and non-itchy. The pod colour is moth greenish when immature, but becomes black on maturity. Seeds can be harvested from the fruits easily. Seeds are cream coloured, bold and non-dormant.

Reference

Annual Report (2000-01). IIHR, Bangalore pp 97-99.