Plant Germplasm Registration Notice*

The Plant Germplasm Registration Committee of ICAR in its XVI[th] meeting held on 14[th] May 2007 at the National Bureau of Plant Genetic Resources, New Delhi approved the registration of following 50 germplasm lines out of the 121 proposals considered.

1. FLW20 (IC548327; INGR07001), a Wheat (*Triticum aestivum*) Germplasm with Amber Grain and Pyramided Rust Resistance Genes, *Sr* 24 and *Sr25*

Dibendu Datta, RN Brahma, M Prashar and SC Bhardwaj
Directorate of Wheat Research, Regional Station, Flowerdale, Shimla, Himachal Pradesh

FLW20 (INGR No.07001, IC548327) was derived from the cross between PBW343 and *TcLr19* and FLW6 at Directorate of Wheat Research, Regional Station, Flowerdale. This stock is completely resistant to brown rust and black rust and moderately resistant to yellow rust. It carries rust resistance genes, *Lr9+Lr19+Lr24+; r26+Sr24+Sr25+Sr31+Yr9+Yr27*. This stock has amber seed with test weight 38.5 g, average plant height is 88 cm and matured in about 119 days. This stock has good agronomic characteristics with good yield potential.

2. VL858 (IC546940; INGR07002), a Wheat (*Triticum aestivum*) Germplasm with Excellent Chapati Quality

Lakshmikant, V Mahajan, HS Gupta, BD Pandey, SK Pant and RK Gupta
Vivekanand Parvatiya Krishi Anusandhan Sansthan, Almora-263601, Uttarakhand

VL 858, was developed through pedigree selection from a cross OPATA/RAYON/KAUZ at Vivekananda Parvatiya Krishi Anusandhan Sansthan (ICAR), Almora. It has excellent chapatti quality (8.11 on 0 to 10 scale) under irrigated to very good (7.83 on 0 to 10 scale) under rainfed conditions. In addition, it possesses high hectolitre weight (79.15 and 80.43 kg/hl), high carotene (4.6 to 4.1), iron (33.0 & 36.6), zinc (3.5 & 24.0) and manganese (57.4 & 29.7) ppm under rainfed and irrigated conditions, respectively. It is spring wheat, having intermediate growth habit and green coleoptile's colour. Its average plant height is 95-100 cm. It takes on an average 160-170 days to maturity. It has dull white colour ears with amber coloured grain, ovoid shape and 38-39 gm thousand grain weights. It has been tested in All India Coordinated yield evaluation trails of Northern Hills Zone from 2002-03 to 2004-05 and gave grain yield of 28.0 and 45.3 q/ha under rainfed and irrigated conditions, respectively (ACRP Report 2004). In addition it possesses high degree of field resistance to yellow and brown rust diseases. VL 858 is well adapted to Northern Hills Zone conditions and the recommended package of practices has been found suitable for it.

References

All India Coordinated Wheat and Barley Improvement Project (2003-04) *Quality* **Vol. IV** pp 110, 112 and Research Highlights.

All India Coordinated Wheat and Barley Improvement Project (2003-04) *Quality* **Vol. IV** pp 134, 135 and Research Highlights.

* *As Communicated by Drs. AK Singh, Anjali Kak and Veena Gupta, Germplasm Conservation Division, NBPGR*

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3. VL 824 (IC549923 INGR07003), a Wheat (*Triticum aestivum*) Germplasm for Powdery Mildew Resistance

Lakshmikant, HS Gupta, SK Pant, BP Singh, AK Sharma and GS Bankoti
Vivekanand Parvatiya Krishi Anusandhan Sansthan, Almora-263601, Uttarakhand

VL 824, resistant to powdery mildew was developed through pedigree selection from a cross Laj 3302/Turaco/ /Turaco at Vivekananda Parvatiya Krishi Anusandhan Sansthan (ICAR), Almora. It is a spring wheat, having intermediate growth habit and green coleoptile colour. Its average plant height is 97 cm. It takes on an average 160-162 days to maturity. It has white coloured ears with amber coloured grain, ovoid shape and 41 gm thousand grain weight. It has been tested in All India Coordinated yield evaluation trials of Northern Hills Zone from 2000 to 2002 and yielded grain yield of 19.96 q/ha under rainfed conditions. In addition, it possesses high degree of field resistance to yellow and brown rust diseases. VL 828 is well adapted to Northern Hills Zone conditions and the recommended package of practices has been found suitable for it.

Reference

Singh PP, AK Sharma, S Nagrajan, J Kumar, MS Sachan, Jag Shoran, VC Sinha, LB Goel, SK Nayar, M Parashar, A Singh, KD Singh, AN Tewari, J Kumar, KP Singh, SK Pant, Ashwani Kumar, SK Rana, BK Sharma, D Singh, and RN Bhahma (2005). Powdery mildew resistance genotypes in wheat and *Triticale* *Indian Phytopathology* **58(1):** 124.

4. FKW 4 (IC549915 INGR07004), a Wheat (*Triticum aestivum*) Germplasm Incorporating Resistance Gene(s) for Brown Rust Races from Tetraploid Durum Wheat

BS Tyagi, Jag Shoran, SC Bhardwaj, SK Singh and G Singh
Directorate of Wheat Research, Karnal-132001, Haryana

Efforts are on to achieve economic and ecological sustainable wheat production in the country without compromising on yield levels. To strengthen the Indian wheat-breeding programme, Directorate of Wheat Research, Karnal initiated the pre-breeding work to create new genetic variability. Initially, the emphasis was laid on certain inherent limitations, such as susceptibility to rust diseases and seed shrivelling. The cytogenetic stock FKW 4 was derived from the cross between durum variety DWR 1006 and the most popular *aestivum* variety PBW 343. The morpho-agronomic traits (high grain weight, tiller number and good plant type) and leaf rust resistance is stable and inherited steadily from F_4 to the latest generation (F_8). The F_{1s} between FKW4 and PBW 343 were healthy, indicating thereby that the novel resistance genes and bold grain traits from this stock can easily be transferred to bread wheat. Morphology of this stock is different from bread and durum wheat. This stock is completely resistant to all races of leaf rust. It has amber seed, average plant height is 124 cm with good number of tillers along with very high thousand grain weight (60g), protein content (>13%) and matured in about 125 days.

Table1. Seedling Resistance Test and field resistance of FKW 4 at multi-location to virulent pathotypes of brown, black and yellow rusts

Pedigree	Brown Rust							Black Rust			
	SRT					Field data		SRT		Field data	
	77-2	77-5	77-7	77-8	104-2	W-04	K-05	40	40-1	W-04	K-05
AGRA LOCAL	3+	3+	3+	3+	3+	80S	60S	3+	3+	60S	0
PBW343	0;	3+	3+	3+	3+	5MR	30S	2-	2-	15MR	0
WH542	0;	3+	3+	3+	3+	60S	60S	2-	2-	15MR	0
DWR1006	;	;	;	;	;	R	R	2-	2-	R	R
FKW4	;	;	;1-	;	;1-	R	R	2-	2-	R	0

R=Resistance; Immune=0; MR=Moderately resistant; Resistant=;,;1-, 2, 2-; S=Susceptible; Moderately susceptible =2+; 0= Free from rust; Susceptible =3,3+

3. VL 824 (IC549923 INGR07003), a Wheat (*Triticum aestivum*) Germplasm for Powdery Mildew Resistance

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4. FKW 4 (IC549915 INGR07004), a Wheat (*Triticum aestivum*) Germplasm Incorporating Resistance Gene(s) for Brown Rust Races from Tetraploid Durum Wheat

BS Tyagi, Jag Shoran, SC Bhardwaj, SK Singh and G Singh
Directorate of Wheat Research, Karnal-132001, Haryana

Efforts are on to achieve economic and ecological sustainable wheat production in the country without compromising on yield levels. To strengthen the Indian wheat-breeding programme, Directorate of Wheat Research, Karnal initiated the pre-breeding work to create new genetic variability. Initially, the emphasis was laid on certain inherent limitations, such as susceptibility to rust diseases and seed shrivelling. The cytogenetic stock FKW 4 was derived from the cross between durum variety DWR 1006 and the most popular *aestivum* variety PBW 343. The morpho-agronomic traits (high grain weight, tiller number and good plant type) and leaf rust resistance is stable and inherited steadily from F_4 to the latest generation (F_8). The F_{1s} between FKW4 and PBW 343 were healthy, indicating thereby that the novel resistance genes and bold grain traits from this stock can easily be transferred to bread wheat. Morphology of this stock is different from bread and durum wheat. This stock is completely resistant to all races of leaf rust. It has amber seed, average plant height is 124 cm with good number of tillers along with very high thousand grain weight (60g), protein content (>13%) and matured in about 125 days.

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AGRA LOCAL	3+	3+	3+	3+	3+	80S	60S	3+	3+	60S	0
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DWR1006	;	;	;	;	;	R	R	2-	2-	R	R
FKW4	;	;	;1-	;	;1-	R	R	2-	2-	R	0

R=Resistance; Immune=0; MR=Moderately resistant; Resistant=;,;1-, 2, 2-; S=Susceptible; Moderately susceptible =2+; 0= Free from rust; Susceptible =3,3+

Resistance genes were postulated on the basis of differential host-pathogen interaction. The leaf rust resistance pattern of cultivated durum wheat varieties is different from that of *Triticum aestivum*. The infection type matrix of resistant durum wheat viz. DWR 1006 is distinct from known leaf rust resistance genes and hence likely to carry novel resistance genes. DWR 1006 was crossed with PBW 343 to transfer novel resistance with unknown genes into good agronomic base of bread wheat variety. The derived BCF_8 lines showing resistance to all races of leaf rust were selected.

Developing Multiple Rust Resistance Lines in Wheat (*Triticum aestivum*) by Bringing Genes from Different Sources

Dibendu Dutta, M Prashar and SC Bhardwaj
Directorate of Wheat Research, Karnal-132001, Haryana

5. FLW 24 (IC549926; INGR07005), a wheat (*Triticum aestivum*) germplasm resistance to brown and black rusts and predominant pathotypes of yellow rust

FLW24 (INGR No.0762, IC549926), was derived from the cross between PBW343 and Tc*Lr19*. This stock is completely resistant to brown rust and black rust and moderately resistant to yellow rust. It carries the rust resistance genes, *Lr19+Lr26 +Sr31+Yr9+Yr27*. This stock has white seed with test weight of 39.1 gm, average plant height is 88cm and matured in about 119 days. Yield per meter row was at par with PBW343.

6. FLW25 (IC549927; INGR07006), a wheat (*Triticum aestivum*) germplasm as a diverse source for resistance to brown rust.

FLW25 (INGR No.0763, IC549927), was derived from the cross between PBW343 and *Lr28* (CS2D2M3/8). This stock is completely resistant to brown rust and black rust and moderately resistant to yellow rust. It carries the rust resistance genes, *Lr9+Lr19+Lr24+; r26+Sr24+Sr25+ Sr31+Yr9+Yr27*. This stock has white seed with test weight 38.9 gm, average plant height is 85 cm and matured in about 118 days. Yield per meter row was at par with PBW343.

7. FLW26 (IC549928; INGR07007), wheat (*Triticum aestivum*) germplasm, another source for brown rust resistance.

FLW26 (INGR No.0764, IC549928), was derived from the cross between PBW343 and *Lr42* (KS91WGRC11). This stock is completely resistant to brown rust and black rust and moderately resistant to yellow rust. It carries rust resistance genes, *Lr26, Lr42, Sr31, Yr9* and *Yr27*. This stock has white seed with test weight 38.4 gm, average plant height is 88 cm and matured in about 119 days. Yield per meter row was less than PBW343.

8. FLW27 (IC549929; INGR07008), a wheat (*Triticum aestivum*) germplasm, another source for brown rust resistance.

FLW27 (INGR No.0765, IC549929), was derived from the cross between PBW343 and *Lr45*(Tc*4/ST-1). This stock is resistant to brown and black rusts and moderately resistant to yellow rust. It carries rust resistance genes, *Lr26, Lr44, Sr31, Yr9* and *Yr27*. This stock has red seed with test weight 39.1gm, average plant height is 90 cm and matured in about 120 days. Yield per meter row was less than PBW343.

Resistance genes were postulated on the basis of differential host-pathogen interaction. The leaf rust resistance pattern of cultivated durum wheat varieties is different from that of *Triticum aestivum*. The infection type matrix of resistant durum wheat viz. DWR 1006 is distinct from known leaf rust resistance genes and hence likely to carry novel resistance genes. DWR 1006 was crossed with PBW 343 to transfer novel resistance with unknown genes into good agronomic base of bread wheat variety. The derived BCF_8 lines showing resistance to all races of leaf rust were selected.

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FLW24 (INGR No.0762, IC549926), was derived from the cross between PBW343 and Tc*Lr19*. This stock is completely resistant to brown rust and black rust and moderately resistant to yellow rust. It carries the rust resistance genes, *Lr19+Lr26 +Sr31+Yr9+Yr27*. This stock has white seed with test weight of 39.1 gm, average plant height is 88cm and matured in about 119 days. Yield per meter row was at par with PBW343.

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FLW25 (INGR No.0763, IC549927), was derived from the cross between PBW343 and *Lr28* (CS2D2M3/8). This stock is completely resistant to brown rust and black rust and moderately resistant to yellow rust. It carries the rust resistance genes, *Lr9+Lr19+Lr24+; r26+Sr24+Sr25+ Sr31+Yr9+Yr27*. This stock has white seed with test weight 38.9 gm, average plant height is 85 cm and matured in about 118 days. Yield per meter row was at par with PBW343.

7. FLW26 (IC549928; INGR07007), wheat (*Triticum aestivum*) germplasm, another source for brown rust resistance.

FLW26 (INGR No.0764, IC549928), was derived from the cross between PBW343 and *Lr42* (KS91WGRC11). This stock is completely resistant to brown rust and black rust and moderately resistant to yellow rust. It carries rust resistance genes, *Lr26, Lr42, Sr31, Yr9* and *Yr27*. This stock has white seed with test weight 38.4 gm, average plant height is 88 cm and matured in about 119 days. Yield per meter row was less than PBW343.

8. FLW27 (IC549929; INGR07008), a wheat (*Triticum aestivum*) germplasm, another source for brown rust resistance.

FLW27 (INGR No.0765, IC549929), was derived from the cross between PBW343 and *Lr45*(Tc*4/ST-1). This stock is resistant to brown and black rusts and moderately resistant to yellow rust. It carries rust resistance genes, *Lr26, Lr44, Sr31, Yr9* and *Yr27*. This stock has red seed with test weight 39.1gm, average plant height is 90 cm and matured in about 120 days. Yield per meter row was less than PBW343.

Development of Wheat (*Triticum aestivum*) Germplasm with Diverse and New Resistant Source Against Stripe Rust Pathotype 46S119

Sanjay Kumar, Dharam Pal, DK Bhatnagar and Rashmi Bhatnagar
Indian Agricultural Research Institute, Regional Station, Tutikandi, Shimla

9. WBM1587 (IC549931; INGR07009)

WBM1587 is selected from cross MILAN/SHA 7 and was found resistant against pathotype 46S119, the most virulent pathotype of stripe rust (*Puccinia striiformis* Westend) in India. It gives 'fleck' (;) score at seedling and '0' score in adult stage. The resistance in this germplasm is controlled by two dominant complimentary genes and it differs from resistance of PBW343 which is controlled by a recessive gene. WBM 1587 mature in 142 days under northern hills condition with average plant height of 108 cm. Ear is clavate shape and grains are bold ovate. This germplasm can be used widely in generating diverse resistant wheat materials with major objective of stripe rust resistance.

10. WBM 1591 (IC549932; INGR070010)

WBM 1591 is selected from cross PYN/BAU//MILAN and was found resistant against pathotype 46S119, the most virulent pathotype of stripe rust (*Puccinia striiformis* Westend). It gives fleck (;) score at seedling and '0' score in adult stage against pathotype 46S119. The resistance in this germplasm is controlled by two dominant complimentary genes and it differs from resistance of PBW343 which is controlled by a recessive gene. WBM 1591 mature in 160 days under northern hills condition with average plant height of 100 cm. Ear is tapering in shape and grains are medium bold with oblong shape. It can be used widely in generating diverse resistant wheat materials with major objective of stripe rust resistance.

Conservation of CMS Lines of Paddy Having Different Cytoplasmic Sources

UB Apte[1], Dilip S Sawant[2], BB Jadhav[3] and VN Shetye[1]
[1] *Agricultural Research Station, Shirgaon, Ratnagiri-415629 (MS)*
[2] *Regional Agricultural Research Station, Karjat, Raigad-410201 (MS)*
[3] *Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri-415712 (MS)*

At present a few CMS lines of paddy having wild abortive (WA), Borotype (BT) and Gambica (GAM) etc. cytoplasmic sources have been identified for commercial use in hybrid rice development (Yuan and Virmani, 1988; Virmani *et al.* 1996). Therefore, it was imperative that diversified CMS lines should be evolved to avoid danger of epidemics. Most of the CMS lines of paddy used in India for evolving the rice hybrids are of exotic origin. Therefore, it was essential to evaluate CMS lines of indigenous origin with diversified cytoplasmic sources which will perform stably in Indian climatic conditions and in severe incidence of pest and diseases. Therefore, the hybridization programme (Backcross breeding) was under taken at Agricultural Research Station, Shirgaon, Ratnagiri (MS) with a view to evolve CMS lines of paddy invloving different cytoplasmic sources. For the backcross breeding programme the seed material of different CMS lines of different sources were collected from International Rice Research Institute, Philippines and Panvel-2, Sona and Indrayani varieties were used as donor (Male parent) in F_1 and subsequent generations. This led to development of a number of CMS lines. Of these, RTN - 2A, RTN – 3A, RTN – 4A, RTN – 5A, RTN –6A, RTN –11A, RTN – 12A, RTN –13A, RTN – 14A, RTN – 17A and RTN – 18A based on good agronomic features, such as mid-late duration, long slender grain, good panicle exsertion, out crossing rate and stigma exsertion were found significantly superior, suitable for registration. Salient features of each of these lines in addition to cytoplasmic sterility are described below-

11. RTN 2A (IC548328 INGR07011), a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

12. RTN 3A (IC548329 INGR07012), a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

13. RTN 4A (IC548330 INGR07013), a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

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Conservation of CMS Lines of Paddy Having Different Cytoplasmic Sources

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14. RTN 5A (IC548331 INGR07014), a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

15. RTN 6A (IC548332 INGR07015), a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

16. RTN 11A (IC548333 INGR07016), a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

17. RTN 12A (IC548334 INGR07017) a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

18. RTN 13A (IC548335 INGR07018), a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

19. RTN 14A (IC548336 INGR07019), a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

20. RTN 17A (IC548337 INGR07020) a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

21. RTN 18A (IC548338 INGR07021), a rice (*Oryza sativa*) germplasm with male sterility in mid late duration, long slender grain, good panicle and stigma exsertion.

The performance of these CMS lines of paddy under multi-location trials is given in Table 1. The CMS lines RTN-4A, RTN-5A, RTN-13A and RTN-14A were found to be stable performance in all India CMS evaluation Nursery Trial during *kharif* 2005 season at seven locations. All these above mentioned CMS lines of paddy are of indigenous origin with some of them are having diversified cytoplasmic source. Hence, these CMS lines of paddy will be useful in production of rice hybrids with indigenous genetic background and different cytoplasmic sources.

References

Virmani SS, BC Viraktamath, CL Casal, RS Toledo, MT Lopez and JO Manato (1996) *Hybrid Rice Breeding Manual* IRRI, Philippines.

Yuan LP and SS Virmani (1998) Status of hybrid rice research and development in hybrid rice, IRRI, Philippines, pp. 7-24.

Table 1. All India Multi- locational performance of CMS lines of paddy during Kharif 2005 season (Mean data of 7 locations)

CMS Line	Pedigree		DFF		HT		TN		PL		TS		PE%	SE%	SS%	HGW
	Cross	Cytoplasmic Source	A	B	A	B	A	B	A	B	A	B	A	A	A	B
RTN-2A	IR 54755A/ Panvel-2	Assam rice collection (ARC)	104	102	73	79	10.1	10.4	24.3	23.7	200	228	78	47	28	1 . 9
RTN-3A	IR 68885A/ Panvel-2	Induced by gamma irradiation of IR 62829 B	104	102	70	81	10.3	9.9	24.8	23.4	189	190	80	45	25	1.9
RTN-4A	IR 58025A/ Panvel-2	Wild rice with abortive pollen	104	102	71	78	9.9	10.2	25.1	24.4	166	177	80	48	23	1.9
RTN-5A	D 297A/ Panvel-2	Dissi	104	100	71	81	8.9	11.2	25.2	24.6	160	186	79	48	19	2.0
RTN-6A	G 46 A/ Panvel-2	Gambiaca	105	102	73	79	9.4	9.5	24.3	23.9	201	183	80	41	23	2.1
RTN -11A	IR 54755A/ Sona	Assam rice collection (ARC)	103	101	71	77	9.6	11.2	24.0	23.9	197	190	80	43	28	2.0
RTN-12A	IR 68885A/ Sona	Induced by gamma irradiation of IR 62829 B	104	102	72	81	9.9	10.1	25.2	24.4	158	192	78	44	27	1.9
RTN-13A	G 46 A/Sona	Gambiaca	104	102	71	82	10.9	11.6	24.8	23.6	194	218	81	47	34	2.0
RTN-14A	IR 58025A/ Sona	Wild rice with abortive pollen	105	101	72	79	9.2	9.1	23.2	23.7	178	175	78	48	34	2.0
RTN-17A	D 297A/ Indrayani	Dissi	104	101	83	91	9.4	10.1	24.3	24.1	163	168	76	39	23	2.2
RTN-18A	G 46 A/ Indrayani	Gambiaca	104	101	79	92	10.1	11.3	23.1	23.0	167	177	81	47	28	2.2
Checks																
IR 58025A			101	99	74	82	11.0	11.5	23.7	23.9	170	181	79	58	33	2.0
IR 68885A			91	88	72	84	12.2	12.1	23.7	22.7	131	138	81	51	25	2.3
IR 68888A			88	85	72	83	11.2	11.5	24.0	23.2	137	148	81	50	24	2.3

Locations – Jabalpur, Faizabad, Karjat, Pant Nagar, Coimbatore, Ratnagiri and Hyderabad.
A – CMS line, B – Maintainer line.; DFF – Days to 50% flowering, HT – plant height (cm), TN – Tiller number, PL – Panicle length (cm), TS – Total spike lets/panicle, PE – Panicle exsertion (%), SE – Stigma exsertion (%), SS – Seed set (%), HGW – 100 grain weight (g)

22. Pusa 1401 (IC548339; INGR07022), a Basmati rice (*Oryza sativa*) Germplasm with Better Grain, Cooking, Higher Elongation Ratio and Free from Grain Chalkiness

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Pusa 1401 is developed through hybridization between Pusa Basmati-1/ Pusa 1121-92-8-2-7-1 followed by pedigree method of selection. Pusa1401 (IET 18005) has been identified with superior quality Basmati variety than the traditional Basmati variety "Taraori Basmati" (DRR, Annual Progress Report 2004 Vol I, Varietal Improvement, pp 1.283). It has been found better than the most popular traditional basmati "Taraori Basmati" in grain, cooking, eating quality and grain yield (34%). It is semi-dwarf (85 cm) and will not lodge like traditional tall Basmati varieties. Its cooked rice appearance, fluffiness, kernel length after cooking (16.07mm) with least breadth-wise swelling and pleasant aroma is attractive to catch the consumers' attention in the International and domestic market. In the panel tests conducted over three years it was found better in comparison to Taraori Basmati and Pusa Basmati-1 in overall acceptability.

Table 1. Panel Test Scores of Pusa 1401 (IET-18005) in AVT-2 BT, DRR, 2002-04

Characters/ Entry	Pusa 1401			PB1			Taraori Basmati	
Year	2002	2003	2004	2002	2003	2004	2002	2003
Appearance	4.25	4.5	4.8	4.1	3.42	4.5	4	4
Cohesiveness	4	3.9	4.3	3.66	4.27	3.91	4.75	3.67
Taste	3.5	3.3	3.5	3.17	2.92	3.33	3.25	3
Aroma	4	3.9	3.8	4	3.33	3.66	4.25	3.33
Elongation	3.6	3.25	3.7	3.1	2.4	3.2	2.5	2.7
OA	3.98	3.84	4.06	3.66	3.25	3.87	3.59	2.87

Overall acceptability (OA):4.0-4.9 Excellent, 3.0-3.9 Good, 2.0-2.9 Acceptable

Reference

Directorate of Rice Research (DRR) (2002-04) *All India Coordinated Rice Improvement Programme. Annual Reports* (2002-04).

23. BM 68 (Bindli Mutant 68) (IC548340; INGR07023), a Rice (*Oryza sativa*) Germplasm with Resistance to Rice Tungro Virus Disease

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Rice Tungro disease is a serious constraint in rice productivity in South and South East Asian countries. Affected plants have profuse tillering, stunted growth and yellowing of leaves. Tungro disease is caused by two morphologically distinct strains. One is rice tungro spherical virus (RTSV, RNA virus) and rice tungro bacillus virus (RTBV, DNA virus). BM 68 is semi dwarf (85 cm) induced mutant from traditional tall aromatic rice Bindli. It is highly resistant for both of the virus forms of the Tungro Virus (Table 1). It has stiff stem, dark green leaves, semi erect leaf orientation, long panicle, complete panicle exertion, occasional awning, and highly aromatic short bold kernels. Purple pigmentation in apiculi and awns is a distinct character. It has intermediate amylose content (22.5%) and intermediate gelatinization temperature (alkali spreading value 5).

Table 1. Detection of tungro viruses in rice cultivars by Immunosorbent Electron Microscopy (ISEM) (adapted from Niazi *et al.*, 2004)

Cultivars inoculated with RTV 3 strains containing spherical and bacillus viruses	Visual Symptoms	Detection of viruses by ISEM	
		RTSV	RTBV
Crossa	Moderate	–	+
Nakera	Moderate	–	+
BJ–1	Moderate	–	+
Pankaj	Mild	+	–
Pusa Basmati–1	Severe	+	+
Pusa–169	Severe	+	+
IRGC–100139	Severe	+	+
Chenga	Severe	+	+
ARC–11554	No Symptoms	+	+
Bindli Mutant–66	No Symptoms	–	–
Bindli Mutant–68	No Symptoms	–	–
Pankhari–203	No Symptoms	–	–
TN 1	Severe	+	+

Reference

Niazi FR, Jasvir Singh and RP Pant (2004) Differential suseptability of rice cultivars to rice tungro spherical and bacilliform viruses. *Indian Phytopathology* **57(4):** 507-508.

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Overall acceptability (OA):4.0-4.9 Excellent, 3.0-3.9 Good, 2.0-2.9 Acceptable

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ARC–11554	No Symptoms	+	+
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24. UPR 2870-98-125 (IC553263; INGR070024), a Rice (*Oryza sativa*) Germplasm with New Plant Type

SC Mani, MP Pandey, H Singh, JPS Malik, Surendra Singh and S Singh
Govind Ballabh Pant University of Agriculture and Technology, Pantnagar

IC 553263 (UPR 2870-98-125) has been developed by pedigree method of breeding following hybridization between BG 132 and UPRI 95-141 at Govind Ballabh Pant University of Agriculture & Technology, Pantnagar . It is the first *indica* rice variety developed on the concept of New Plant Type for higher yield potential and synchronized tillering. Mean yield of IC 553263 (UPR 2870-98-125) based on 10 trials over three years in two zones was 7665 kg/ha (with a range from 4054 to 11111 kg/ha), compared to Jaya, the national check with 5917 kg/ha. The plants are semi-dwarf (92 cm) with good tillering capacity. The panicles are compact, well exerted and tip-awned. The colour of apiculus is green. UPR 2870-97-125 flowers in 100 days with seed to seed duration of 130 to 135 days. UPR 2870-98-125 is resistant to leaf blast, moderately resistant to bacterial blight and sheath rot diseases. It gives very high milling (73.3%) and head rice (52.4%) recovery, better kernel length and L/B ratio. The alkali spreading score is intermediate (5.00) and desirable as compared to Jaya (6.75). Important morphological and quality characters are given in Table 1.

Table 1. Important morphological characters of IC 553263 (UPR 2870-98-125)

S.No.	Morphological characters	Description
1.	Plant height	92 cm
2.	Number of tillers / plant	10-12
3.	Flowering duration	100 days
4.	Awning	Tip awned
5.	1000-grain weight	26.29 g
6.	Kernel length	6.28 mm
7.	Kernel breadth	2.22 mm
8.	L/B ratio	2.83
9.	Milling recovery	73.35 %
10.	Head rice recovery	52.45 %

25. SC7-2-1-261 (IC549903; INGR07025), a Maize (*Zea mays*) Germplasm Source of Resistance to Maydis Leaf Blight

RC Sharma, SN Rai, RD Singh[1], RM Gadag[2] and S Rakshit[3]
[1] *Division of Plant Pathology, Indian Agricultural Research Institute, New Delhi-110012*
[2] *Division of Genetics, IARI, New Delhi-110012*
[3] *Directorate of Maize Research, Pusa Campus, New Delhi-110012*

Maydis leaf blight (MLB) incited by *Bipolaris maydis* (= *Cochliobolus heterostrophus*) is a major and economically important disease of maize (*Zea mays* L.). A total of 17 elite inbred lines including two resistant checks, CM 104 and CM 105 (2) and one susceptible check CM 119, received from Maize Breeding Unit of Division of Genetics and Directorate of Maize Research, were evaluated against MLB under artificial field inoculations during 1999, 2000 and 2001 at IARI, New Delhi. The disease reactions were assessed on 1-5 scale (1). Among the 14 lines, 3 *viz.* SC-24-(92)-3-2-1-1, Suwan 1(S)C#-f-f and SC-7-2-1-2-6-1 were classified as highly resistant (<1.5 scale) (3). In this note, details of the line SC-7-2-1-2-6-1, as per DUS testing guidelines is presented. The inbred line (SC-7-2-1-2-6-1) was developed from an experimental single cross, through recycling procedure by the Maize Breeding Unit of IARI. The resistant plants were selfed for five generations followed by advancing of the specific selected genotype in each generation till homozygosity. Morphological features of the line are-

1. *Plant:* (a) length (up to flag leaf) – short and (b) ratio between height of insertion of upper ear to plant length – medium
2. *Leaf:* (a) angle between blade and stem (on leaf just above upper ear) - medium (25-75^0), (b) altitude of blade (on leaf just above upper ear) - curved, (c) anthocyanin colouration of sheath (in middle of plant) – absent and (d) width of blade (leaf of upper ear) - narrow
2. *Stem:* anthocyanin colouration of brace roots – present
3. *Tassel:* (a) time of anthesis (on middle third of main axis, 50% of plants) – late, (b) anthocyanin

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1. *Plant:* (a) length (up to flag leaf) – short and (b) ratio between height of insertion of upper ear to plant length – medium
2. *Leaf:* (a) angle between blade and stem (on leaf just above upper ear) - medium (25-75^0), (b) altitude of blade (on leaf just above upper ear) - curved, (c) anthocyanin colouration of sheath (in middle of plant) – absent and (d) width of blade (leaf of upper ear) - narrow
2. *Stem:* anthocyanin colouration of brace roots – present
3. *Tassel:* (a) time of anthesis (on middle third of main axis, 50% of plants) – late, (b) anthocyanin

colouration at base of glume (in middle third of main axis) – present, (c) anthocyanin colouration of glumes excluding base (in middle third of main axis) – absent, (d) anthocyanin colouration of anthers (in middle third of main axis of fresh anthers) – absent, (e) density of spikelets (in middle third of main axis) – medium, (f) angle between main axis and lateral branches (in lower third tassel) – medium (25-750), (g) altitude of lateral branches (in lower third of tassel) – curved, (h) number of primary and lateral branches – absent, (i) length of main axis above lowest side branch – short and (j) length of main axis above upper side branch - short

4. *Ear:* (a) time of silk emergence (50% plants) – late, (b) anthocyanin colouration of silks – absent, (c) length of peduncle – short, (d) length without husk – medium, (e) diameter without husk (in middle) – small, (f) shape – conical, (g) number of rows of grains – many, (h) type of grain (in middle third of ear) – flint, (i) colour of top of grain – yellow and (j) anthocyanin colouration of shank of cob – white; Kernel – row arrangement – straight
5. *Grain:* (a) shape – toothed and (b) size (1000 grain weight) – 225.79g

References

1. Payak MM and RC Sharma (1983) Disease rating scale in maize in India. In: *Techniques of scoring for resistance to important diseases of maize.* All India Coordinated Maize Improvement Project, IARI, New Delhi. pp. 1-4.
2. Sharma RC and MM Payak (1990) Durable resistance to two leaf blights in two inbred lines of maize. *Theor. Appl. Genet.* **80:** 542-544.
3. Sharma RC and SN Rai (2005). Evaluation of maize inbred lines for resistance to maydis leaf blight. *Indian Phytopath.* **58:** 339-340.

26. CRS-1 (IC549901; INGR07026), Sorghum (*Sorghum bicolor)* Germplasm with Better Drought Tolerant Mechanisms

Prabhaker, SS Rao, IK Das and MS Raut
National Research Centre for Sorghum, Hyderabad

Rabi sorghum is grown over a total area of 5.6 million hectares mainly in the states of Maharashtra, Karnataka and Andhra Pradesh with average productivity of 634 kgs/ha. Despite low productivity, it continues to be an important component of dryland economy in these states with fairly consistent area over many years. The low yields are mainly due to various abiotic (drought, nutrients, temperature etc.) and biotic (shoot fly, charcoal rot etc.) stresses. When deep and medium black soils are not fully charged with water, severe drought causes late maturity (M35-1 and CSV 216 R) failing head emergence from boot. Hence, there is a need to develop drought resistant early maturity genotypes suitable for rainfed situations under medium to shallow soil depths.

CRS-1=Selection from Hegari land race from Hegari village, Bijapur district, based on the evaluation data from 2000-01 to 2004-05 under shallow soils in coordinated trials across locations gave significantly higher grain yields and harvest index and was evaluated for critical physiological traits associated with drought adaptation. Evaluation from 2000-01 to 2002-03 indicated that it matured 4 days earlier and showed significantly superior grain yield (21.7%) than M35-1 with better tolerance to shoot fly and charcoal rot (Table 1).

In *rabi* 2002-03 to 2003-04 in coordinated physiology trials CRS-1, was earliest for phenology (days to flowering) and it matured 4-5 days earlier than the popular land race M35-1 and by 8 days than check CSV 216R. SAPD readings were higher for CRS-1. It recorded 35% higher total chlorophyll than check. In both leaf N (%) and specific leaf nitrogen, CRS-1 showed 21% superiority over checks, and for harvest index, CRS 1 showed 34%

Table 1. Performance of CRS-1 (SPV-1537) in coordinated trials from 2000-01 to 2002-03

Varieties	Days to flower	Plant height (cm)	Days to mature	Grain yield (kg/ha)	Increase over (%)	SFDH (%)	CR (%)
CRS-1 (SPV-1537)	70.0	122.0	111.0	970.0	–	34.7	35.0
RSIG-262	73.0	144.0	113.0	941.0	3.08	33.7	32.5
Sel.3	69.0	142.0	108.0	602.0	61.1	54.3	27.4
M35-1	74.0	144.0	114.0	797.0	21.7	42.2	35.1
CSV-216R	80.0	151.0	120.0	763.0	27.1	25.2	37.9
CD at 5%	3.0	13.5	5.0	185.0	–	1.3	2.1
C.V.%	2.3	6.0	2.5	19.9	–	16.2	10.5

colouration at base of glume (in middle third of main axis) – present, (c) anthocyanin colouration of glumes excluding base (in middle third of main axis) – absent, (d) anthocyanin colouration of anthers (in middle third of main axis of fresh anthers) – absent, (e) density of spikelets (in middle third of main axis) – medium, (f) angle between main axis and lateral branches (in lower third tassel) – medium (25-750), (g) altitude of lateral branches (in lower third of tassel) – curved, (h) number of primary and lateral branches – absent, (i) length of main axis above lowest side branch – short and (j) length of main axis above upper side branch - short

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Rabi sorghum is grown over a total area of 5.6 million hectares mainly in the states of Maharashtra, Karnataka and Andhra Pradesh with average productivity of 634 kgs/ha. Despite low productivity, it continues to be an important component of dryland economy in these states with fairly consistent area over many years. The low yields are mainly due to various abiotic (drought, nutrients, temperature etc.) and biotic (shoot fly, charcoal rot etc.) stresses. When deep and medium black soils are not fully charged with water, severe drought causes late maturity (M35-1 and CSV 216 R) failing head emergence from boot. Hence, there is a need to develop drought resistant early maturity genotypes suitable for rainfed situations under medium to shallow soil depths.

CRS-1=Selection from Hegari land race from Hegari village, Bijapur district, based on the evaluation data from 2000-01 to 2004-05 under shallow soils in coordinated trials across locations gave significantly higher grain yields and harvest index and was evaluated for critical physiological traits associated with drought adaptation. Evaluation from 2000-01 to 2002-03 indicated that it matured 4 days earlier and showed significantly superior grain yield (21.7%) than M35-1 with better tolerance to shoot fly and charcoal rot (Table 1).

In *rabi* 2002-03 to 2003-04 in coordinated physiology trials CRS-1, was earliest for phenology (days to flowering) and it matured 4-5 days earlier than the popular land race M35-1 and by 8 days than check CSV 216R. SAPD readings were higher for CRS-1. It recorded 35% higher total chlorophyll than check. In both leaf N (%) and specific leaf nitrogen, CRS-1 showed 21% superiority over checks, and for harvest index, CRS 1 showed 34%

Table 1. Performance of CRS-1 (SPV-1537) in coordinated trials from 2000-01 to 2002-03

Varieties	Days to flower	Plant height (cm)	Days to mature	Grain yield (kg/ha)	Increase over (%)	SFDH (%)	CR (%)
CRS-1 (SPV-1537)	70.0	122.0	111.0	970.0	–	34.7	35.0
RSIG-262	73.0	144.0	113.0	941.0	3.08	33.7	32.5
Sel.3	69.0	142.0	108.0	602.0	61.1	54.3	27.4
M35-1	74.0	144.0	114.0	797.0	21.7	42.2	35.1
CSV-216R	80.0	151.0	120.0	763.0	27.1	25.2	37.9
CD at 5%	3.0	13.5	5.0	185.0	–	1.3	2.1
C.V.%	2.3	6.0	2.5	19.9	–	16.2	10.5

superiority over check. CRS-1 offers great scope for test as variety under receding soil moisture conditions of *rabi* or for use as donor in developing early maturing varieties with resistance to drought. It can also be grown directly under rainfed conditions in medium to shallow type of soils which constitutes about 50% of *rabi* sorghum area.

Reference

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27. CGMS UPAS 120 A (IC548343; INGR07027), Pigeonpea (*Cajanus cajan*) Thermo-insensitive CMS, with Cytoplasm of *Cajanus scarabaeoides*

IP Singh and BB Singh
Indian Institute of Pulses Research, Kanpur

CGMS UPAS 120 A is an early maturing, stable and thermo-insensitive male sterile line developed in conversion programme, bringing male sterility into most popular and early maturing variety UPAS 120 following the backcross method at Indian Institute of Pulses Research, Kanpur. In this method UPAS 120 was used as recurrent (male) parent and GT 288A, a male sterile line developed from cross between *C. scarabaeoides* and GT 288 was used as female parent. F_1 was backcrossed with UPAS 120 and backcrossing was followed for 6 generations. In each backcross progeny only male sterile plants possessing plant type of UPAS 120 were selected. In BC_6 all plants were sterile and possessed plant type of UPAS 120.

This line is tolerant to *Fusarium* wilt and resistant to sterility mosaic disease. It may be used as female parent (male sterile 'A' line) for getting it crossed with desired male parent (restorer 'R' line) for development of CGMS based pigeonpea hybrids. The seed yield was optimum at a ratio of 6 female: 1 male on 4m row length with intra and inter row spacing of 15 cm and 60 cm, respectively in isolation of 300 m from another pigeonpea field.

Table 1. Important morphological characters of CGMS UPAS 120 A

Plant type	Indeterminate
Days to flower	82
Days to maturity	125
Plant height (cm)	131
Primary branches per plant	6.3
Pods per plant	180.25
Seeds per pod	3.4
Pod length (cm)	4.4
Test weight (g)	9.25
Flower colour	Yellow
Pod colour	Mixed (Green with black streaks)
Seed colour	Reddish yellow

28. APG248 (IC553269; INGR07028) a Urd bean (*Vigna mungo*) Induced Mutant with Brown Pod and Yellow Seed

AK Sharma[1], VP Singh, SS Malik[2], SA Kerkhi* and Vipin Kumar[1]
Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005

A urdbean (*Vigna mungo*) mutant with brown pod and yellow seed was developed at Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi through induced mutation. Four hundred pure, uniform, healthy and dry (9.5 % moisture) seeds of cultivar Pant Urd-30 were treated with ^{60}Co gamma rays (100, 200, 300 and 400 Gy doses), EMS (0.2, 0.4, 0.6 and 0.8%) and combination of gamma doses, *viz.*, 100, 200, 300 and 400 Gy with 0.2 per cent EMS during Summer, 2001. In M_2 generation, eight double mutations for seed and pod colour were observed in different frequencies in various treatments of EMS, gamma rays and combination of both. A brown colour pods with yellow rough seed mutant was identified and selected in the 200Gy+0.2 per cent combination dose of gamma rays and EMS. This mutant (Seed Mutant-2) has Brown pods, yellow rough seeds, tall and high yielding with higher (5.0g) 100 seed weight.

This mutant has lower infestation (%) of MYMV and CLS diseases in comparison of the parent (PU-30). Such mutations for different seed colour have been reported in other pulse crops *viz.*, arhar (Ali Kahn and Veeraswamy, 1974), soybean (Takagi and Hiraiwa, 1980) and mungbean (Singh, *et al.*, 1982). A single gene but the simultaneous

superiority over check. CRS-1 offers great scope for test as variety under receding soil moisture conditions of *rabi* or for use as donor in developing early maturing varieties with resistance to drought. It can also be grown directly under rainfed conditions in medium to shallow type of soils which constitutes about 50% of *rabi* sorghum area.

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variations for yields and other morphological characters indicate a gross change or perhaps very closely related linked group of genes are controlling this trait (Saini *et al.*, 1974).

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Development Mutant in Sesame (*Sesamum indicum*)

GSS Murty

Nuclear Agriculture & Biotechnology Division, Bhabha Atomic Research Centre, Mumbai

29. N-129 (IC548341; INGR07029)

At seedling stage sesame (*Sesamum indicum* L.), competes poorly with the weeds due to its slow growth. Hence, it was suggested that early seedling vigor and elongated hypocotyl could be helpful in overcoming weed competition (Ashri, and Poetiary, 1981). Among several induced mutants isolated, a mutant N-129 was isolated in M_2 generation and designated later on as Tall Seedling mutant. It was obtained following 300 Gy gamma ray treatment to the seeds of cv. N62-32 developed by JNKVV, Jabalpur. N-129 is easily identifiable at 20 days after sowing (DAS) and even earlier from other sesame genotypes due to elongated hypocotyl length. At 20 DAS it was significantly taller (16.4 ± 0.5 cm) than its parent (5.4 ± 0.2 cm). The length of first internode in mutant was longer compared to parent (Murty and Joshua, 1986). Mutant has slightly less number of cells per unit length of stem than its parent. However, cell length is greater in mutant. Although mutant is tall in seedling stage it is equivalent to its parent in height at harvest. It is agronomically poor compared to the parent (Murty and Joshua, 1986).

In order to study the inheritance pattern of the induced mutant and to incorporate tall seedling trait, N-129 was crossed with the national check variety TC-25. Phenotypic and genotypic segregations in the F_2 and F_3 generations indicated that the tall seedling trait of mutant (*ts*) is inherited as monogenic recessive (Murty, 1988).

References

Ashri A and P Poetiray (1981) Sesame: Status and Improvement. *FAO Plant Production and Protection Paper,* (Rome 1980) **29:** pp 192.

Murty GSS and DC Joshua (1986) An induced tall seedling mutant in sesame. Sesame and *Safflower Newsletter* **2:** 16-17.

Murty GSS (1988) Inheritance of three new mutants in sesame. *Curr. Sci.*, **57(4):** 204-206.

30. APG306 (IC553270; INGR07030)

In sesame (*Sesamum indicum* L.) among several induced mutants, a mutant N-29 with free corolla lobes was isolated in M_2 generation and designated as Polypetalous Corolla mutant. It was obtained following 16 Gy fast neutron treatment at APSARA reactor in the Bahbha Atomic Research Centre, Mumbai-400085 to the seeds of cv. N62-32, developed by JNKVV, Jabalpur. Due to free corolla lobes, it is different from normal sesame flower and wild relatives which are gamopetalous and have tubular obliquely campanulate corolla with four epipetalous, didynamous stamens (Joshi, 1961). N-29 mutant was similar to the parent N62-32 in vegetative characters. The chief distinguishing trait of the mutant is absence of tubular corolla making the petals free as in the case of polypetalous species and united only at the base, giving the false appearance of polypetalous corolla. In the absence of tubular corolla, the epipetalous stamens in mutant remain away from the stigma. These results in poor capsule set but facilitates cross pollination by insects like open flowers, compared to the parent and other wild type plants.

In order to understand the mutant trait, N-29 was crossed with its parent and cv. Phule Til-1, which have gamopetalous corolla. The F_1 hybrids showed tubular corolla indicating mutant trait is recessive. The observed segregations in the F_2 and F_3 generations for tubular and polypetalous corolla (*pc*) showed that polypetalous trait of N-29 monogenic recessive to the gamopetalous condition. This trait could be useful to develop hybrid seed under controlled conditions using honey bees.

References

Joshi AB (1961) *Sesamum* (Hyderabad: *Indian Oilseeds Committee*)

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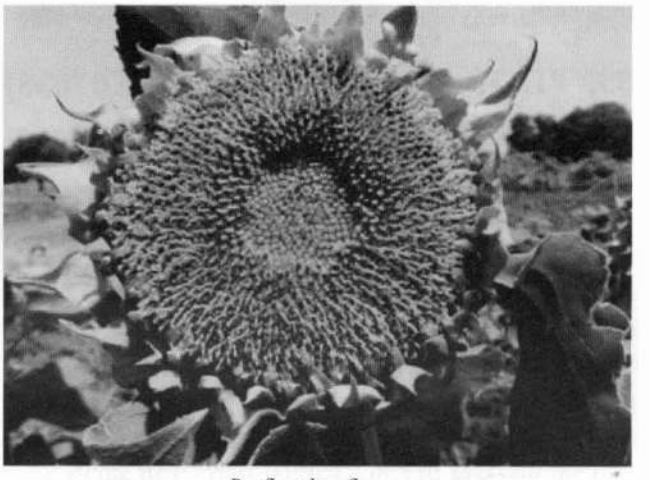
31. (IC548342; INGR07031) a Sunflower (*Helianthus annuus*) Mutant without Ray Florets

M Sujatha
Directorate of Oilseed Research, Hyderabad

The rayfloret-less variant IC548342 has been identified at the Directorate of Oilseeds Research in the interspecific hybrid population between cultivated sunflower (*H. annuus*) and *H. divaricatus* (a source of resistance to *Alternaria helianthi*). In the process of selection and generation advancement of material showing high levels of tolerance to *A. helianthi*, a novel flower variant devoid of ray florets was isolated in BC_2F_8 generation. The plants were late maturing, dwarf (plant height: 60 cm) with slender stems. Leaves and stems were smooth and non-pubescent. Leaves were thick and leathery with short petioles. The floral bracts were invariably pointed and the capitula were flat. The size of the flowers were normal (head diameter: 12.5 cm) and of the same size as that of flowers from sister lines with ray flowers. Such capitula can be called as homogamous, eradiate, eliguliflorous or discoid heads. Selfing and sister plant mating of this morphotype resulted in the development of a stable line bearing ligulate-less flowers. The outermost single layer had modified florets that were intermediate of the ray and disc florets. The corolla colour was yellow and similar to that of the ray florets but was tubular and hermaphrodite as that of the disc florets (Fig. 1). However, this modified layer of florets had slightly longer tubular florets than the regular disc florets. Seeds are black with 100 seed weight of 5.2 g and an oil content of 33.0%. There were no significant differences in the oil content, plant maturity and seed filling frequency in these variants and the sister lines with petaled flowers. The plants possessed field tolerance to *A. helianthi.* These rayfloret-less sunflower plants are being maintained through sister plant mating.



Rayfloretless flower

32. TG 18A (IC553271; INGR07032) a Groundnut (*Arachis hypogaea*) Germplasm with Large Pod and Seed

Chandra Mouli and DM Kale*
Nuclear Agriculture and Biotechnology Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085

In groundnut (*Arachis hypogaea* L.), Spanish group (sub-sp. *fastigiata*) genotypes are bunch type with sequential flowering, early maturing and medium to small pods and non-dormant seeds. On the other hand, Virginia group (sub-sp. *hypogaea*) genotypes are bunch, spreading, semi-spreading or trailing type, profusely branching with alternate flowering and late maturing and large pods and seed dormancy. Spanish bunch combined with large pods were developed at Bhabha Atomic Research Centre, Mumbai by inter-mutant hybridization and irradiation of selected cultures. Among these a mutant designated Trombay Groundnut (TG) 18A was isolated after gamma ray treatment. TG-18A was induced by 200 Gy gamma rays of Virginia bunch culture, TG 18. It had Spanish bunch growth and branching habit with sequential flower pattern. Compared to parent, number of branches got reduced in TG 18A (8 + 17 Vs. 5 + 4). It had green foliage and plant height similar to TG 18. It matured earlier than parent due to its early flowering characteristics by eight and five days in both *kharif* and *rabi* season, respectively. Pegs and pods on the stem and branches were similar to other Spanish bunch variety and very distinct from parent. The size of pod and seed in TG 18A was similar to parent and about two times bigger than other Spanish bunch

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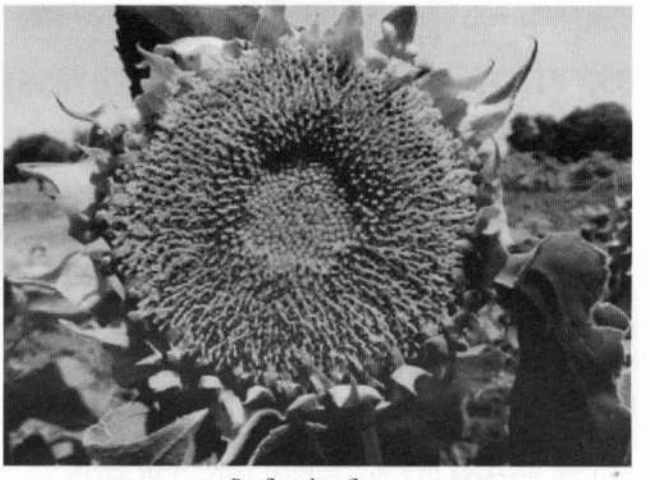

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Chandra Mouli and DM Kale*
Nuclear Agriculture and Biotechnology Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085

In groundnut (*Arachis hypogaea* L.), Spanish group (sub-sp. *fastigiata*) genotypes are bunch type with sequential flowering, early maturing and medium to small pods and non-dormant seeds. On the other hand, Virginia group (sub-sp. *hypogaea*) genotypes are bunch, spreading, semi-spreading or trailing type, profusely branching with alternate flowering and late maturing and large pods and seed dormancy. Spanish bunch combined with large pods were developed at Bhabha Atomic Research Centre, Mumbai by inter-mutant hybridization and irradiation of selected cultures. Among these a mutant designated Trombay Groundnut (TG) 18A was isolated after gamma ray treatment. TG-18A was induced by 200 Gy gamma rays of Virginia bunch culture, TG 18. It had Spanish bunch growth and branching habit with sequential flower pattern. Compared to parent, number of branches got reduced in TG 18A (8 + 17 Vs. 5 + 4). It had green foliage and plant height similar to TG 18. It matured earlier than parent due to its early flowering characteristics by eight and five days in both *kharif* and *rabi* season, respectively. Pegs and pods on the stem and branches were similar to other Spanish bunch variety and very distinct from parent. The size of pod and seed in TG 18A was similar to parent and about two times bigger than other Spanish bunch

variety. The per cent distribution of three different grades of hundred seed weight from the sieve screening of the varieties indicated improved recovery of HPS (Hand Picked Selections) kernels in TG 18A.

TG 18A has 20 days seed dormancy. Kernel out turn of 75 per cent in TG 18A demonstrated an improvement in shelling percentage compared to large seed cultures. The induced sequential flowering habit in TG 18A was governed by duplicate pair of recessive genes.

Reference

Chandramouli and DM Kale (1982) Gamma-ray induced Spanish bunch mutant with large pod groundnut. *Oléagineux* **37(12):** 583-588.

33. PHOP-2-2 (IC553274; INGR07033), a Germplasm with High Oleic and Low Erucic Acid in *Brassica* rapa (toria)

JN Sachan, B Singh, SP Singh, DP Pant, AK Singh, R Kumar and D Singh
GB Pant University of Agriculture & Technology, Pantnagar, Uttarakhand

Rapeseed oil with high oleic acid ratio (18:1), and low erucic acid (<2%) is valuable for human nutrition. However, Indian rapeseed varieties contain only 10-20 per cent oleic acid in oil. Increase of oleic acid content in seed results from reduced erucic acid, which is likely to develop diseases like myocardial fibrosis in adults and lipidosis in children. Therefore, oil quality can be improved by developing varieties with reduced contents. Rapeseed oil with more than 80 per cent oleic acid represents not only improved edible oil, but also opens new possibilities for oleo-chemical uses. Laakso *et al.*, (1995) used selection for increasing the levels of oleic acid in spring turnip (*B. rapa*).

Recurrent selection for high oleic acid content in *B. rapa* exotic cv Parkland (oleic acid=36%) resulted in the development of high oleic (18:1) line PHOP-2-2. Initially 25 individual plants with high oleic acid content were selected from parkland and selfed by bud pollination/ bagging of individual plant. Identification of single plant with increased level of oleic acid (18:1) was the basis of further selection. The half-seed technique (Downey and Harvey, 1963) was used to screen the single plant progeny, followed by selfing and recurrent selection for high oleic content. Extraction and methynolysis of oil from whole seed and half seeds was carried out by modification of Hougen and Bado (1973) method. The fatty acid composition was expressed as per cent of total fatty acids. Instrument used for fatty acid analysis was HP 5890 series II with capillary column at 250°C, detector at 280°C and injector at 260°C. The increase in oleic acid was achieved with selfing in selected plants. The third selfed generation seed of high oleic plants derived through half-seed selection collected during 2002-03 showed a distinct fatty acid profile with oleic acid content up to 70.1% in Parkland (range 57.14 to 70.1%, mean = 60.70%). Oleic acid content in these half-seed derived plants (mean of two bulked seed samples) was almost similar to the corresponding half-seed, which indicated the stability of oleic acid content. The Table 1 presents Physio-morphological traits of PHOP-2-2 compared to checks.

Table 1. Physio-morphological traits of PHOP-2-2, evaluated during 2005-06

Characters/Genotype	PHOT-2-2	PT-303	T-9
Seed yield weight (g)	5.8	10.69	11.69
1000 seed weight (g)	3.38	4.94	5.10
Oil content (%)	38.47	39.20	38.47
Days to maturity (nos.)	108	95	92
Days to flowering (nos)	33	31	31
PH (CM)	107	124	102
LMS (CM)	47.22	51.20	42.10
Siliqua in main shoot (CM)	35	50	42
No. of PB	5	5	6
No. of SB	3	8	5
No. of silique/plant (no.)	184	190	150
No. of seeds/silique	14	15	12
Siliqua length	5.15	4.94	5.10
Colour of seed coat	Yellow	Brown	
Brown			

References

Laakso I, X Howinen and T Seppanen-Lasskso (1995). Modification of linolenic and a linolenic acid levels in spring turnip rape by long term selection. *Proceeding of 9th International Rapeseed Congress* D-2.

Downy RK and BL Harvey (1963) Method for breeding for oil quality in rape. *Canadian Journal of Plant Science*, **43:** 271-275.

Hougen FW and V Bodo (1973) Extraction and methynolysis for oil from whole or crushed rapeseed for fatty acid analysis. *J. am. Oil Chem. Soc.* **44:** 104-111.

Sachan JN, Basudeo Singh, AK Singh, DP Pant and Rakesh Kumar (2004) Fatty acid profile in S3 lines selected for high oleic acid in toria (*Brassica rapa* var. *toria*). *Pantnagar Journal of Research* **2(1):** 20-21.

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No. of PB	5	5	6
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Colour of seed coat	Yellow	Brown	
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34. POHT-2-8-11 (IC553275; INGR07034), a Low Linolenic Acid, *Brassica rapa* (toria)

JN Sachan, B Singh, SP Singh, D Singh and AK Singh
GB Pant University of Agriculture and Technology, Pantnagar

High linolenic acid in oil of rapeseed reduces stability, developing an undesirable odour during frying. Extensive efforts were carried out to develop nutritionally superior genotypes at Pantnagar center. Individual plants containing low linolenic acid, were selected from *Brassica rapa* exotic cv. Tobin with 11.90 per cent linolenic acid and Parkland with 10.20 per cent linolenic acid in oil. For selection, half seed technique of Downey and Harvey (1963) was adopted. Half seed selection was followed by selfing and recurrent selection for low linolenic acid content. Extraction and methodologies of oil from whole seed and half seeds was carried out by modification of Hougen and Bado (1973) method. The fatty acid composition was expressed as per cent of total fatty acids. Instrument used for fatty acid analysis was HP5890 Series II with capillary column at 250°C, detector at 280°C and injector at 260°C. The third selfed generation derived from half seed of low linolenic acid plants shows a distinct fatty acid profile and exhibited considerable decrease in linolenic acid in Tobin (range 3.03-5.43%, mean = 4.21%), with same decrease in Parkland (range=8.23-8.95%, mean = 8.60%) from the original parental materials, Tobin and Parkland. Fatty acid composition is an embryonic character, thus selfed seeds of Tobin and Parkland obtained after first selfing were analysed for fatty acid composition and the desired types were selected. PHOT-2-8-11, selected from Tobin, containing lowest linolenic acid i.e. 3.03 per cent, can be utilized in breeding for low linolenic acid. Table 1 presents Physio-morphological traits of PHOT-2-8-11 in comparison to checks.

Table 1. Physiomorphological traits of PHOT-2-8-11, evaluated during 2005-06

Characters/Genotype	PHOT-2-2	PT-303	T-9
Seed yield weight (g)	9.69	10.69	11.69
1000 seed weight (g)	3.65	4.94	5.10
Oil content (%)	38.69	39.20	38.47
Days to maturity (nos.)	110	95	92
Days to flowering (nos)	34	31	31
Plant height (CM)	124	124	102
Lateral Mean Spread (CM)	56.22	51.20	42.10
Siliqua in main shoot (CM)	44	50	42
No. of Primary branches	5	5	6
No. of Secondary branches	3	8	5
No. of silique/plant	184	190	150
No. of seeds/silique	14	15	12
Siliqua length	5.15	4.94	5.10
Colour of seed coat	Yellow	Brown	Brown

References

Downey RK and BL Harvey (1973) Method for breeding for oil quality in *Brassica rapa*. *Canadian Journal of Plant Sciences* **23**: 211-215.

Hougen FW and V Bodo (1973) Extraction and methynolysis for oil from whole or crushed rapeseed for fatty acid analysis. *J. Am. Oil Chem. Soc.* **44**: 104-111.

Sachan JN, Basudeo Singh, AK Singh, SP Singh and Sharad Pandey (2003) Development of low linolenic acid toria (*Brassica rapa*). *In. National Seminar on Advances in Genetics and Plant Breeding*. Impact of DNA Revolution, Oct., 30-31, 2003, USA, Dharwad.

35. CSPF-1 (IC549909; INGR07035) a Cotton Mutant (*Gossypium hirsutum* L.)

SL Ahuja [1], KN Gururajan[2], LS Dhayal[1], D Monga[1] and BM Khadi[3]
[1] *Central Institute for Cotton Research, Regional Station, Sirsa-125055, Haryana*
[2] *Central Institute for Cotton Research, Regional Station, Coimbatore (TN)-641003*
[3] *Central Institute for Cotton Research, Nagpur-440010*

CSPF-1 is a cotton (*Gossypium hirsutum* L.) with pink flower colour. The ability of cotton to tolerate duplication and deficiencies complicates the recovery of mutants from high energy radiation treatments (Kohel *et al.* 1970). Majority of cultivated upland cottons have petal colour varying from white, cream, light yellow, yellow or pale purple which often becomes pinkish or purplish with age. However, these colours are not uncommon in the so-called primitive cottons or race stocks. *G.hirsutum* cotton genotype with pink coloured flowers is relatively uncommon. CSPF-1 is a spontaneous mutant with pink petals, identified in a plant during 2003-04 crop seasons from the F_3 population of T-7 x LSC-5, involving both *G hirsutum* cultivars (Flower of T-7 has cream petals, yellow anther and that of LSC-5 is cream petal segregating for anther colour cream or yellow). The mutant identified

34. POHT-2-8-11 (IC553275; INGR07034), a Low Linolenic Acid, *Brassica rapa* (toria)

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Table 1. Physiomorphological traits of PHOT-2-8-11, evaluated during 2005-06

Characters/Genotype	PHOT-2-2	PT-303	T-9
Seed yield weight (g)	9.69	10.69	11.69
1000 seed weight (g)	3.65	4.94	5.10
Oil content (%)	38.69	39.20	38.47
Days to maturity (nos.)	110	95	92
Days to flowering (nos)	34	31	31
Plant height (CM)	124	124	102
Lateral Mean Spread (CM)	56.22	51.20	42.10
Siliqua in main shoot (CM)	44	50	42
No. of Primary branches	5	5	6
No. of Secondary branches	3	8	5
No. of silique/plant	184	190	150
No. of seeds/silique	14	15	12
Siliqua length	5.15	4.94	5.10
Colour of seed coat	Yellow	Brown	Brown

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bred true to type. The mutant colour identified is governed by a dominant gene (as indicated in crosses of RS-2013 x CSPF-1 and CSPF-1x RS-2013), possess good fiber properties and agronomic attributes and therefore, can serve as morphological genetic marker in genetic mapping, varietal identification and in production of superior hybrids (Table 1).

Table 1. Distinctive morpho-agronomic features of pink flower mutant CSPF-1

Character	Normal F_3 Plant	Pink flower mutant
Plant height(cm)	125-135	140-150
Number of monopodial branches/plant	5-6	5-7
Number of sympodial branches/plant	13-15	15-17
Days to maturity	170	180
Bolls/plant	35-40	50-60
Boll weight (g)	2.97	3.0
Seed cotton yield/plant(g)	62-70	100-120
Ginning Out Turn(%)	33.3	35 3
Petal colour	Cream	Pink
Seed index (g)	7.50	8.1
2.5% span length (mm)	26.2	28.6
Uniformity ratio (%)	52.0	45.0
Micronaire value 10^{-6} g/in	4.6	3.9
Maturity coefficient (%)	78	75
Tenacity (g/tex) (3.2mm)	21.3	24.0

Reference

Kohel RJ, TR Richmond and. CF Lewis (1970) Texas marker-1 Description of a genetic standard for *Gossypium hirsutum* L. *Crop Sci.* **10:** 670-71.

36. CPF-1 (IC549924; INGR07036) a Cotton (*Gossypium hirsutum*) Mutant

SL Ahuja[1], LS Dhayal[1], BR Patil[2], MB Badodkar[2], D Monga[1] and BM Khadi[3]

[1] *Central Institute for Cotton Research, Regional Station, Sirsa-125055, Haryana*

[2] *Dr. Punjab Rao Deshmukh Krishi Vidyapeeth, Krishi Nagar, Akola-444104*

[3] *Central Institute for Cotton Research, Nagpur-440010*

CPF-1 is a Cotton (*Gossypium hirsutum*) mutant with pink filament. Pink filament is relatively uncommon in *G. hirsutum* although it is diagnostic in few other *Gossypium* species (Fryxell 1984 and Wilson 1987). Inheritance of pink filament (Wilson, 1987) is conditioned by two complementary dominant gene pairs, which were designated Pf_1 and Pf_2. CPF-1 is a spontaneous mutant with pink anther filament. The mutant identified bred true to type and lacks petal spots in initial stage of flowering and very light petal spot is visible only at full blooming on the inner sides of the petals, unlike that of the mutant identified by Wilson (1987) with prominent petal spots at the initial stage. It was identified from the population of AKH-0308 (a strain derived from the combination of *Gossypium* species (*G. hirsutum* x *G. barbadense*) x *G. hirsutum*) x Derivative (*G. hirsutum* x *G. anomalum* x *G. sturtianum*), All the species involved in the parent culture were obtained from PKV Akola had yellow anther filament colour. The mutant trait is governed by a dominant gene action (as indicated in crosses of RS-2013 x CPF-1 and CPF-1x RS-2013). Possess good fibre properties and agronomic attributes and therefore, can serve as morphological genetic marker in mapping, for varietal identification and in production of superior hybrids (Table 1).

Table 1. Distinctive Morpho-agronomic characters of Pink filament mutant CPF-1

Character	Mutant CPF-1	AKH-0308 (parent)
Plant height(cm)	140.00	111.00
Number of monopodial branches/plant	7.0	4.00
Number of sympodial branches/plant	12.33	11.5
Days to maturity	165	170-180
Stem Colour	Purple	Green
Internode length(cm)	5-10	8-10
Leaf lobing	Small (5 lobed)	3 lobed
Leaf colour	Dark green	Dark green
Leaf surface	Lower surface hairy	Hairy
Nectary/leaf	1-3	1-2
Bolls/plant	**32.0**	**64.0**
Boll weight (gm)	**3.5**	**3.4**
Seed cotton yield/plant(g)	90.0	130.0
Ginning Out Turn (%)	34.5	36.5
Petal colour	Yellow	Light yellow
Petal spot	Very light at full blooming	Absent
Anther filament	Pink	Cream
Fruit Shape	Oval pointed	Oval
Seeds/locule	7-8	5-7
Seed index (g)	7.50	7.1
Fibre 2.5% span length (mm)	27.6	25.8
Fibre uniformity ratio (%)	49.0	50.0
Fibre micronaire value 10^{-6}g/in	4.7	4.3
Fibre maturity coefficient (%)	75	75
Fibre tenacity (g/tex) (3.2mm)	22.2	21.6

bred true to type. The mutant colour identified is governed by a dominant gene (as indicated in crosses of RS-2013 x CSPF-1 and CSPF-1x RS-2013), possess good fiber properties and agronomic attributes and therefore, can serve as morphological genetic marker in genetic mapping, varietal identification and in production of superior hybrids (Table 1).

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Bolls/plant	35-40	50-60
Boll weight (g)	2.97	3.0
Seed cotton yield/plant(g)	62-70	100-120
Ginning Out Turn(%)	33.3	35 3
Petal colour	Cream	Pink
Seed index (g)	7.50	8.1
2.5% span length (mm)	26.2	28.6
Uniformity ratio (%)	52.0	45.0
Micronaire value 10^{-6} g/in	4.6	3.9
Maturity coefficient (%)	78	75
Tenacity (g/tex) (3.2mm)	21.3	24.0

Reference

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36. CPF-1 (IC549924; INGR07036) a Cotton (*Gossypium hirsutum*) Mutant

SL Ahuja[1], LS Dhayal[1], BR Patil[2], MB Badodkar[2], D Monga[1] and BM Khadi[3]

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Plant height(cm)	140.00	111.00
Number of monopodial branches/plant	7.0	4.00
Number of sympodial branches/plant	12.33	11.5
Days to maturity	165	170-180
Stem Colour	Purple	Green
Internode length(cm)	5-10	8-10
Leaf lobing	Small (5 lobed)	3 lobed
Leaf colour	Dark green	Dark green
Leaf surface	Lower surface hairy	Hairy
Nectary/leaf	1-3	1-2
Bolls/plant	**32.0**	**64.0**
Boll weight (gm)	**3.5**	**3.4**
Seed cotton yield/plant(g)	90.0	130.0
Ginning Out Turn (%)	34.5	36.5
Petal colour	Yellow	Light yellow
Petal spot	Very light at full blooming	Absent
Anther filament	Pink	Cream
Fruit Shape	Oval pointed	Oval
Seeds/locule	7-8	5-7
Seed index (g)	7.50	7.1
Fibre 2.5% span length (mm)	27.6	25.8
Fibre uniformity ratio (%)	49.0	50.0
Fibre micronaire value 10^{-6}g/in	4.7	4.3
Fibre maturity coefficient (%)	75	75
Fibre tenacity (g/tex) (3.2mm)	22.2	21.6

References

Fryxell PA (1984) Taxonomy and germplasm resources. In Kohel RJ and CF Lewis (eds.): *Cotton. Agronomy Series No. 24 Am. Soc. Agron.*, Madison pp. 27-57.

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Wilson FD (1987) Inheritance of pink filament in cotton. *J. Hered.* **78**: 223-224.

37. CS 53 (IC553273; INGR07037) Jute (*Corchorus olitorious*) Germplasm with Premature Flowering Resistance, Chocolate Seed and Finer Quality Fiber

S Chattopadhyay, SK Chaudhury and PG Karmakar

Central Research Institute for Jute and Allied Fibres, Barrackpore, Kolkata-700120

CS 53, a tossa jute mutant with chocolate seed coat colour was developed at Central Research Institute for Jute and Allied Fibres, Barrackpore, West Bengal through hybridization between the jute varieties JRO 632 and the irradiated pollen (12kR X-Ray) of JRO 878 (Chattopadhyay and Mitra,1994). The mutant was isolated from the segregating population and stabilized at F_8 generation through selfing. It was tested for its yield and fibre quality in multilocation trials under All India Co-ordinated Project (Chattopadhyay *et al.*, 2006). Plant height of CS 53 is 3.5-4.0 m, stem is green, 1.4-2.4 cm in diameter, unbranched with rudimentary axillary buds in leaf axils, leaf is green, lanceolate, semi erect (50°), length, width and leaf area are 14.46 cm, 5.0 cm and 47.65 sq cm respectively. Flower yellow, elongated (8-10 cm) producing non-dehiscent fruit. Thousand seeds weight is 1.940 g. The seed coat colour is chocolate and is governed by monogenic recessive gene. Mean days to 50 per cent flowering is 190-195 days when sown in mid-March and seed to seed maturity is 180-185 days for June sown crop.

It is resistant to premature flowering, thereby suitable for early sowing and it produces finer quality (2.4 tex) and moderately strong fibre (24.5 g/tex), which will be more acceptable to the industry for the production of value added products. The potential dry fiber yield range from 26.23 to 36.94 with an average of 29.43 q/ha and is suitable for whole tossa jute growing belt of the country where jute is followed by transplanted paddy. CS 53 has expressed field resistance to major pests (yellow mite, stem weevil, semilooper and hairy caterpillar) and diseases (stem rot, root rot and anthracnose) in All India Coordinated Trials.

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38. CoSnk 0344 (IC526807; INGR0738) a Sugarcane (*Saccharum spp.*) Germplasm with Resistance to Sugarcane Wooly Aphid

S Patil, PS Tippannavar, BM Khadi, N Balasundram, SA Patil, S Lingappa, PM Salimath and NS Kambar

Agricultural Research Station, Sankeshwar, UAS, Dharvad

Sugarcane is favorably adapted to a wide range of agricultural situations but its productivity is generally limited by abiotic and biotic stresses. Efforts were made to identify environment specific and widely adapted Sugarcane Wooly Aphid (SWA) caused by *Ceratovacuna lanigera* Zenther, resistant clones. Screening of a large number accessions against SWA at Agricultural Research Station, Sankeshwar, University of Agricultural Sciences, Dharwad, Karnatka resulted in identification of CoSnk 0344 as a wooly aphid resistant clone, which is widely adapted. It is highly tolerant to moisture and salinity water logged complex stresses. It has thick, green, solid, cylindrical zigzag internodes without splits, bud groove is present and the canopy is open and droopy. This clone has been found to be superior to the recommended check both under natural and artificial inoculation conditions and is a stable source.

References

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39. BS35 (IC553284; INGR07039) a Chilli (*Capsicum frutescens*) Germplasm Resistant to Leaf Curl Virus Disease

Sanjeet Kumar, B Singh, M Singh, SK Rai, S Kumar and M Rai
Indian Institute of Vegetable Research, Varanasi

BS-5 is a pepper leaf curl resistant genotype of (*Capsicum annuum*) identified at Indian Institute of Vegetable Research, Varanasi. The initial screening of 304 genotypes of four cultivated and one wild species of *Capsicum* resulted in identification of BS 35. It was then subjected to viruliferous white fly under glass house conditions. Using scion and root stalk of susceptible genotype, Pusa Jawala, it was further challenged through grafting and alternate grafting. When subjected to PCR amplification with degenerated primers, designed to detect Pep marker associated with LCV, the genotype didn't show any amplification suggesting that this genotype is free from LCV viruses and thereby resistant.

40. JN-189 (IC553285; INGR07040) a Potato (*Solanum tuberosum)* Germplasm with Resistance to Leaf Hopper Burn and Potato Stem Necrosis Tospi Virus

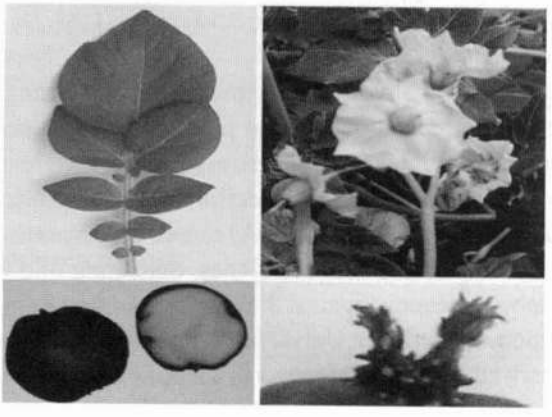
RB Singh, SK Pandey, SM Paul Khurana and P Manivel
Agricultural Research Station, Central Potato Research Institute, Ummedganj, Kota

JN-189 hybrid was identified following the recurrent breeding selection method from the F_1 progeny of a cross Kufri Jawahar x *S. andigena* (Cross was made in 1974) by CPRI, Shimla at Agricultural Research Station Ummedganj, Kota (Rajasthan). The morphological description of JN-189 is presented in Table 1. JN-189 yields between 27-30 t/ha in crop duration of 90-100 days with 5-7 per cent disease incidence of PSND and 2-3 per cent incidence of leaf hopper burn under 'hot spot' conditions.

Potato stem necrosis disease (PSND) caused by a Tospo virus is a serious problem in early potato crop in the Central & Western parts (including plateau) of India. The disease causes economic losses, which vary from place to place and year to year and have been estimated to range from 15 to 30 per cent. Leafhoppers (*Amrasca* sp.) are another problem mostly in early potato crop exposed to higher temperatures. The important symptom of leafhopper feeding is the typical hopper burn and severe feeding can cause up to 30 per cent reduction in crop yields depending on the variety, location and crop growth phase. Screening of potato germplasm at Kota (Rajasthan), identified as the hot spot for both the diseases, genetic stock JN-189 consistently showed high resistance against both the diseases. It is a medium maturing culture and produces attractive light purple, oval tubers with medium deep eyes and pale yellow flesh. It can be used as a donor parent in developing potato varieties with combined resistance to PSND and leafhoppers.

Table 1. Morphological description of indigenous potato hybrid JN-189

Character	Description
Plant	Medium height, plant canopy semi-compact, stem thick, predominantly purple, secondary colour green, and wings feebly developed and straight.
Foliage	Leaves structure intermediate, leaflet width broad, leaflet coalescence frequency nil, rachis and midrib pigmentation absent.
Flowers	Flowering shy, floral stalk light purple, floral stalk-pedicel articulation clearly visible and located above the middle, calyx completely pigmented, bud purple, corolla light purple, corolla shape stellate, anther yellow and cone normally developed, stylar length longer than stamen column and stigma bi-lobed.
Tubers	Tuber round, skin colour predominantly creamy white, secondary colour light purple splashed through out, eyes deep, eyebrows normal, and flesh white.
Sprouts	Sprout red-purple predominantly and white to green at the apex, shape conical, pubescence of base slight and sprout tip closed.



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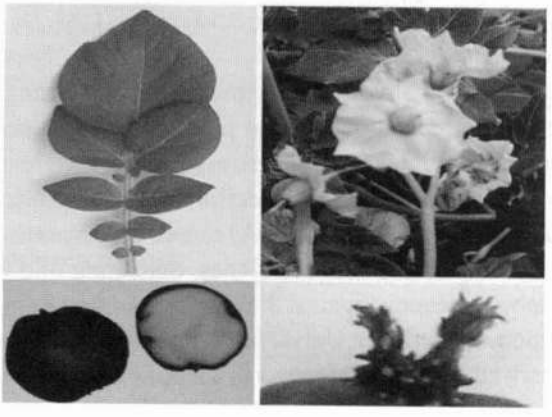

Figure1

41. NRC AP-2 (IC548348; INGR07041), a Kalmegh (*Andrographis paniculata*) Germplasm with Compact Plant Type with Higher Andrographoloide Contents

KA Geetha, Satyabrata Maiti and Narendra Gajbhiye
National Research Centre for Medicinal and Aromatic Plants, Boriavi, Anand

In medicinal and aromatic plants there has been effort for search of plant types that produces higher quantities of main ingredient of economic importance. The screening of Kalmegh *Andrographis paniculata* germplasm at National Research Centre for Medicinal & Aromatic Plants, Boriavi, Anand resulted in identification NRC AP-2, which is a compact plant morpho-type and produces comparatively higher andrographoloide content (0.83 gram/plant). The fresh herbage yield is 209g/plant and dry herbage yield is 76.6g/plant .The plant reaches a height of 57.2 and with a spread of 107 cm.

42. NIC 023413 (IC522963; INGR07042) a Rose Geranium (*Pelargonium graveolens*) Germplasm with Quality Aroma

KS Negi[1], KC Muneem[1], VK Pant[1], Poonam Suneja[2], KC Pant[1] and ML Maheshwari[3]
[1] *National Bureau of Plant Genetic Resources, Regional Station Bhowali-263132, Niglat, Dist. Nainital (Uttarakhand)*
[2] *National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi-110012*
[3] *E8, Street, E, Mayapuri, New Delhi-110064*

Scented Rose Geranium (*Pelargonium graveolens* L' Herit) was introduced to dooryard/ backyard/ kitchen garden of Almora, Uttarakhand in 1988. Stem cuttings of rose geranium were obtained from Mr. V Joshi, Gardener, Mohalla- Bakshikhola, P.O. and Distt. Almora, Uttarakhand. These are being maintained at herbal garden of National Bureau of Plant Genetic Resources (NBPGR), Regional Station Bhowali. NIC 23413 is a genetic stock with high quality aroma identified at NBPGR, Bhowali. The essential oils obtained from NIC 23413 under Uttarakhand conditions are acceptable in the industry. It has good major chemical constituents, such as, Cis-rose oxide 0.918 per cent, Trans-rose-oxide 0.295 per cent, Iso-menthone 17.10 per cent, Linalool 11.565 per cent, Citronellol 62.03 per cent and Geraniol 4.07 per cent. NIC 23413 is accepted for its high contents of citronellol compounds and lemon or odomas like odour. NIC 23413 is a perennial hairy or scabrous plant (up to seven years) with creeping rhizomatous root stocks, 120-180 cm tall; leaves light green, sub-orbicular, palmately (5-7) lobed, 25 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 8-10 mm long, obovate; capsule 1-2 cm long, forming beak, single seeded, enclosed by persistent erect calyx.

This genotype is evergreen resistant to frost, diseases and pests. Terminal shoot- apex with 4-6 nodes of the stem froms healthy plants with profuse branching that are good to multiply and regenerate round the year except rainy season. Plantation of geranium is done with 30 cm plant-to-plant and row-to-row distance, yielding about 1200-1500 quintals herbage (leave and tender stem) after four cuttings (at three months interval) with and a yield of 84-105 kg of essential oil per ha/year. Large scale extraction of geranium herbage through steam and hydro distillation units yielded 0.07 and 0.14 percent essential oil respectively.

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43. UPG-16 (IC522969; INGR07043) a Jasmine (*Jasminum ritchiei*) Germplasm with Variegated Leaves

PA Jose, AG Pandurangan and M Abdul Jabbar
Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram-695562

Jasminum ritchiei Clarke, a wild jasmine belonging to the family Oleaceae, is distributed in India and Sri Lanka. The plant is a branched climbing shrub having green leaves with obtuse base and acuminate apex. Flowers are 3-7, arranged in cyme and are milky white with mild fragrance. It usually flowers in August-October. UPG-16 is a variegated leaved natural genetic stock collected and established in the campus of Tropical Botanic Garden and Research Institute, located at Palode, Thiruvananthapuram, Kerala. The clonal multiplication in 5 successive generations retained the parent variegation confirming stability of character (Jose and Jacob Thomas, 1994; 1999; Jose *et al.* 2006).

It is a branched climbing shrub with variegated leaves, where the upper surface has characteristic mosaic of white patches. Leaf shape ranges from ovate-obovate to oblanceolate with acute base. Leaves are simple with size varying from 2.3-3.2 x 1.5-1.9 cm. The flowers are 1-4, loosely arranged in a cyme. The plant naturally reproduces by the root sprouts produced from the mature plants. Clonal propagation through stem cuttings is an ideal and easy method for the multiplication. Tolerance of the plants towards insect-pest incidence extends its agronomic success in cultivation. By virtue of being habituated at mean sea level, it is an excellent flower cum foliage jasmine for the plains.

References

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

Jose PA and Jacob Thomas (1999) A 'Sport' of *Impatiens wallerana*, new variegated garden plant. *Indian Horticulture* **43**: 37.

Jose PA, AG Pandurangan and M Abdul Jabbar (2006) New variegated mutant jasmine for plains. *Indian Horticulture* **51**: 24-25.

44. B-159 (IC396388; INGR07044) a Snap Melon (*Cucumis melo mormordica*) Germplasm with Downy Mildew Resistance

S Pandy, B Singh, M Rai and KK Pandey
Indian Institute Vegetable Research, Varanasi

Downy mildew has been one of the major biotic stresses causing severe yield losses in case of melons, particularly musk melon. There have been efforts to identify lines with resistance to downy mildew and therefore a large number of accessions have been screened against this disease. Screening of germplasm at Indian Institute Vegetable Research, Varanasi resulted in identification B-159, a snap melon genetic stock with resistance to downy mildew. The identified line is easily crossable with muskmelon and therefore can be utilized in breeding for resistant hybrid and varieties. The fruits B-159 are long and light green in colour. The mature fruit weighs 0.82 kg with average length of 37 cm and average diameter of 7.22 cm. The average number of fruits per plant is 2.75.

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Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram-695562

Jasminum ritchiei Clarke, a wild jasmine belonging to the family Oleaceae, is distributed in India and Sri Lanka. The plant is a branched climbing shrub having green leaves with obtuse base and acuminate apex. Flowers are 3-7, arranged in cyme and are milky white with mild fragrance. It usually flowers in August-October. UPG-16 is a variegated leaved natural genetic stock collected and established in the campus of Tropical Botanic Garden and Research Institute, located at Palode, Thiruvananthapuram, Kerala. The clonal multiplication in 5 successive generations retained the parent variegation confirming stability of character (Jose and Jacob Thomas, 1994; 1999; Jose *et al.* 2006).

It is a branched climbing shrub with variegated leaves, where the upper surface has characteristic mosaic of white patches. Leaf shape ranges from ovate-obovate to oblanceolate with acute base. Leaves are simple with size varying from 2.3-3.2 x 1.5-1.9 cm. The flowers are 1-4, loosely arranged in a cyme. The plant naturally reproduces by the root sprouts produced from the mature plants. Clonal propagation through stem cuttings is an ideal and easy method for the multiplication. Tolerance of the plants towards insect-pest incidence extends its agronomic success in cultivation. By virtue of being habituated at mean sea level, it is an excellent flower cum foliage jasmine for the plains.

References

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

Jose PA and Jacob Thomas (1999) A 'Sport' of *Impatiens wallerana*, new variegated garden plant. *Indian Horticulture* **43**: 37.

Jose PA, AG Pandurangan and M Abdul Jabbar (2006) New variegated mutant jasmine for plains. *Indian Horticulture* **51**: 24-25.

44. B-159 (IC396388; INGR07044) a Snap Melon (*Cucumis melo mormordica*) Germplasm with Downy Mildew Resistance

S Pandy, B Singh, M Rai and KK Pandey
Indian Institute Vegetable Research, Varanasi

Downy mildew has been one of the major biotic stresses causing severe yield losses in case of melons, particularly musk melon. There have been efforts to identify lines with resistance to downy mildew and therefore a large number of accessions have been screened against this disease. Screening of germplasm at Indian Institute Vegetable Research, Varanasi resulted in identification B-159, a snap melon genetic stock with resistance to downy mildew. The identified line is easily crossable with muskmelon and therefore can be utilized in breeding for resistant hybrid and varieties. The fruits B-159 are long and light green in colour. The mature fruit weighs 0.82 kg with average length of 37 cm and average diameter of 7.22 cm. The average number of fruits per plant is 2.75.

45. HI 8591 (IC537351; INGR07045) a Durum Wheat (*Triticum durum*) Germplasm with High Yield, Resistance to Stem, Leaf and Stripe Rusts

HN Pandey, RS Thakur, SV Sai Prasad, RC Bhawsar, AN Mishra and PK Varma
Indian Agricultural Research Institute, Regional Station, Indore-452001 (MP)

Durum wheat went out of cultivation in Central India due to poor yield and susceptibility to stem and leaf rusts. Hence, an urgent need was felt to identify few good durum wheat genetic stocks having high yield along with resistance to rusts and other diseases. **HI 8591** is a semi-dwarf, high yielding multiple disease resistant genotype of durum wheat (*Triticum turgidum var. durum*), evolved at Indian Agricultural Research Institute – Regional Station, Indore through pedigree method from the cross "HI 8144 / NI 8625". In its 3 years (1998-1999 to 2000-01) of evaluation in All India Co-ordinated Wheat trials, it performed on par with popular durum variety, HI 8498. It showed high levels of field resistance to black rust (*Puccinia graminis tritici*), leaf rust (*Puccinia triticina*) and stripe rust (*Puccinia stritiformis*) over years including virulent pathotypes 77-2, 77-5, 104-2 and 12-2 of leaf rust and 40A, 40-1, 122 and 117-6 of stem rust. It also showed good resistance to Karnal bunt and foot rot.

HI 8591 has 80 – 85 cm height and erect growth habit. It is medium early in maturity, non-lodging and non-shattering. Spikes are dorsally pressed, fusiform with pubescent glumes and black awns at maturity. Grains are amber, bold and lustrous with > 50 g thousand grain weight.

46. KRL 99 (IC546936; INGR07046) a Wheat (*Triticum durum*) Germplasm for Salinity, Sodicity and Waterlogging Stresses

KN Singh[1], Neeraj Kulshreshtha[1] and Ravish Chatrath[2]
1. *Central Soil Salinity research Institute, Karnal-132001*
2. *Directorate of Wheat research, Karnal-132001*

KRL 99, a salt and waterlogging tolerant genotype has been developed at Central Soil Salinity Research Institute, Karnal through recombination breeding involving the parentage KRL 3-4/CIMK 2//KRL 1-4. The genotype is unique with respect to amber oblong and medium size grain and very high level of tolerance to different stresses mentioned above. It has dark green foliage with medium waxiness and semi erect growth habit. The plant has medium height and long light brown ears.

All India Coordinated salinity / alkalinity tolerance varietal trial data for 2002-03, 2003-04 and 2004-05 indicated that KRL 99 was significantly superior to the best check over the years. Its performance was the best both under high sodic microplots (pH: 9.3) and under waterlogged (pH: 9.3) conditions in comparison to PBW 343, HD 2009, HD 4530, KRL 19 and Kharchia 65. The percent reduction in grain yield in KRL 99 was much less under stress (11%) in comparison to other tolerant varieties KRL 19 (34%) and Kharchia 65 (22%) (Table 1). The high yielding variety PBW 343 incurred much reduction (81%) and the other genotypes HD 2009 and HD 4530 could not even survive.

Table 1. Grain yield per plant of wheat genotypes under waterlogged sodic conditions in comparison to normal soil

Genotype	Grain yield per plant (gm)		% reduction from Normal
	Normal (pH: 8.1)	*Waterlogged sodic (pH: 9.3)*	
KRL 99	8.39	7.45	11
KH 65	8.67	6.75	22
KRL 19	8.83	5.86	34
PBW 343	8.90	1.71	81
HD 2009	5.23	0.67	87
HD 4530	4.71	0.10	98
C.D.	0.62	1.24	

Figure 1

45. HI 8591 (IC537351; INGR07045) a Durum Wheat (*Triticum durum*) Germplasm with High Yield, Resistance to Stem, Leaf and Stripe Rusts

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KRL 99 is much improved from Kharchia 65 (red grains), on account grain colour (amber), improved plant type, along with high level of sodicity and water logging tolerance. It gives its best expression under low sodic/ reclaimed sodic and normal sown conditions. However under high sodic conditions (pH more than 9.3), the genotype can provide much better yield than the prevalent variety PBW 343.

47. HD2819 (IC546938; INGR0704) a Wheat (*Triticum durum*) Germplasm with Resistance to Leaf and Stripe Rust, Karnal Bunt, Loose Smut, Root Aphids and High Protein Content

B Singh, SMS Tomar, Vinod, Rajendra Singh and Anil Kumar
Division of Genetics, Indian Agricultural Research Institute, New Delhi-110012

Wheat rust caused by *Puccinia* spp. inflicts heavy damage to wheat production world over. In India leaf rust is prevalent throughout the country. Stem rust *Puccinia graminis tritici* occurs in comparatively warmer areas of Central and Peninsular India, while stripe rust caused by *P. striiformis* is confined to cooler areas of northern hill zone, tarai regions of Himachal Pradesh, Uttarachal and Uttar Pradesh and occasionally in entire North Western Plains Zone when congenial environment prevails during the crop season. Karnal Bunt (*Neovossia indica*) is also an important disease of wheat which makes the grain unfit for human consumption, if incidence crosses the prescribed limit of 0.5 per cent. Similarly, Loose smut (*Ustilago nuda*) occurs in all wheat zones and reduces grain quality and yield by approximately 2 per cent in susceptible genotypes.

Development of resistant genetic stocks is an important pre-requisite for breeding disease resistant varieties with high protein content. HD2819 derived from CPAN 3004/WR447 (RL6043*[5]/NAC76) //HW2007 exhibited adult plant resistance to all the three rusts, Karnal bunt and Loose smut. Seedling test against leaf rust races indicated that HD2819 presumably carry *Lr*24, which is linked with *Sr*24. HD2819 also showed <10 per cent average coefficient of infection against all the three rusts at adult plant at multi-locations over the years. This novel stock also expressed resistance to root aphids. The multiple resistances to diseases and pests seem to be derived from exotic genotypes involved in its pedigree.

In general, protein content in commercially grown wheat varieties in India ranges from 9 to 11 per cent. HD2819 has 12.74 per cent grain protein content on average and its mixography characters indicate better mixing time along with suitably high loaf volume. This genetic stock also possesses high *Glu*-1 score that matches with a popular wheat variety C306 which possess very high chapati making characteristics. The observations with respect to disease resistance, pest resistance and quality characters recorded at multi locations over the years (2001-2004) indicated that HD2819 is a novel genetic stock. Since HD2819 having less than 100 cm plant height and performed favorably under rain fed and timely sown conditions, its novelty is enhanced. The use of such genotypes in breeding programmes will encourage the development of high quality wheat.

48. FRL282 (IC279125; INGR07048) a Pea (*Pisum sativum*) Germplasm with Bold Seed Size with 100 Seed Weight (50.14 gm)

JC Rana[1], OP Chaurasia[2], K Pradheep[1] and VD Verma[1]
National Bureau of Plant Genetic Resources, Regional Station, Shimla-171004
Field Research Laboratory, DRDO, Leh

IC279125, is an important dual purpose crop grown for vegetable as green pod and for grain. Majority of the varieties are small seeded. Accession IC279125 recorded highest 100-seed weight (50.14g) among all the pea germplasmm aintained at NBPGR. Generally, the bold seeded lines have less seeds/pod and short pod length, while this accession has good pod length (5.3 cm/pod) and seeds/pod (6.0), which is better than general average. It also showed moderate resistance to powdery mildew and *Ascochyta* blight. Owing to its good pod length and

KRL 99 is much improved from Kharchia 65 (red grains), on account grain colour (amber), improved plant type, along with high level of sodicity and water logging tolerance. It gives its best expression under low sodic/ reclaimed sodic and normal sown conditions. However under high sodic conditions (pH more than 9.3), the genotype can provide much better yield than the prevalent variety PBW 343.

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Table 1. Characteristic feature of the germplasm accessions IC279125

Characters	Mean value	Characters	Mean value
Plant height (cm)	86.5	Score for powdery mildew (0-5 scale)	2
Days to flowering	74.0	Score for *Ascochyta* blight (0-5 scale)	2
First flowering node height (cm)	32.00	Early plant vigor	V. good
No. of clusters/plant	17.0	Plant growth habit	Indeterminate
No. of pods/plant	36.0	Flower colour	White
Pod length (cm)	5.3	Flowering habit	Intermediate
No. of primary branches	4.0	Leaf size	Large
Day to maturity	126.0	Pod thickness	Medium
Seeds/pod	6.0	Pod shape	Straight
Seed yield/plant (g)	32.46	Leaf colour	Green
100-seed weight (g)	50.14	Seed shape	Round
		Seed surface	Smooth

seed size, it is good for vegetable purpose and can be used in breeding both vegetable and pulse type varieties. Interestingly, it has also given high yield compared to check varieties, hence being multiplied for testing in All India Coordinated Trials.

49. BN-RED (IC538546; INGR07049) a Cotton (*Gossypium hirsutum*) Germplasm with Resistance to Spotted, Pink and *Heliothis* Bollworms

SL Ahuja[1], SK Banerjee[2], Jagmail Singh[3], BM Khadi[2], SKVerma[1], VV Singh[2], D Monga[1], OP Tuteja[1] and LS Dhayal[1]

1. Central Institute for Cotton Research, Regional Station, Sirsa-125055, Haryana

2. Central Institute for Cotton Research, Nagpur-440010

3. Division of Genetics, Indian Agricultural Research Institute, New Delhi-110012

BN- Red is a semi naked seeded morphological diverse genetic stock line with red pigmented plant body. The genetic stock has been developed through back cross method (BC_8 generation) using germplasm line Mec Namara Wine Sap as non-recurrent parent and BN (Bikaneri Narma), a well adapted *G. hirsutum* cultivar as recurrent parent. Red pigmentation has effect on resistance to pests as reported by various workers (Lukefar *et al.* 1969, 1975; Ahuja *et al.* 1998). This has been reported that BN-Red has high amount of gossypol content in stem and squares, flavanol in leaves and squares and total phenol contents in squares and low amount of total sugars in squares (Ahuja *et al.*, 2001). Studies of other workers (Lulefer *et al.*, 1969; Deterline, 1975; Leigh, 1975; Agarwal *et al.* 1976) have indicated that high amount of gossypol, flavanol and phenols contents in plant parts account for lower bollworm infestation. The bollworms incidence (bollworm complex; spotted, pink and *Heliothis* bollworms) in BN-Red was considerably low as compared to Bikaneri Narma and its improved cultivar H-777 (Table 1).

Table 1. Distinctive morpho-agronomic characters of BN-Red

Character	BN-Red	Bikaneri Narma
Plant type	Spreding/Bushy	Lanky
Plant height(cm)	110	143.00
Number of monopodial branches/plant	5-6	2.67
Number of sympodial branches/plant	11.33	12.0
Stem hairiness	Dense hairy	Hairy
Colour	Red	Light pink
Leaf lobing	Small (3 lobed)	Narrow
Leaf colour	Upper red and lower green	Medium green
Nectary/leaf	1-3	1-2
Bolls/plant	50.67	45.0
Boll weight (gm)	2.40	2.58
Seed cotton yield/plant(g)	100.00	91.00
Ginning Out Turn (%)	31.0	33.00
Lint index (g)	3.60	3.49
Petal colour	Cream with red side margins	Cream
Shape and colour	Oval pointed small red boll	Oval and green
Seeds/locule	5-6	8

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Number of sympodial branches/plant	11.33	12.0
Stem hairiness	Dense hairy	Hairy
Colour	Red	Light pink
Leaf lobing	Small (3 lobed)	Narrow
Leaf colour	Upper red and lower green	Medium green
Nectary/leaf	1-3	1-2
Bolls/plant	50.67	45.0
Boll weight (gm)	2.40	2.58
Seed cotton yield/plant(g)	100.00	91.00
Ginning Out Turn (%)	31.0	33.00
Lint index (g)	3.60	3.49
Petal colour	Cream with red side margins	Cream
Shape and colour	Oval pointed small red boll	Oval and green
Seeds/locule	5-6	8

Seed index (g)	8.40	7.1
Fibre 2.5% span length (mm)	25.5	26.7
Fibre uniformity ratio (%)	49.0	45.0
Fibre micronaire value 10^{-6} g/in	4.4	4.3
Fibre maturity coefficient (%)	75	75
Fibre tenacity (g/tex) (3.2mm)	21.2	22.1
Biochemical attributes	*L ST SQ*	*L ST SQ*
Gossypol (mg/g)	2.29 6.92 4.01	2.91 4.03 2.72
Reducing sugar (mg/g)	3.62 2.26 1.40	2.56 1.91 4.81
Flavanol (mg/g)	1.98 2.18 1.40	1.58 2.33 0.92
Total phenol (%)	3.65 4.62 3.37	3.80 4.62 2.97
Total sugar (mg/g)	5.65 5.24 3.14	7.18 5.49 8.80
Bollworm incidence (%)	40.92*	71.02*

Where L=leaves, ST= stem and SQ= square; * Five years avareage

References

Agarwal RA, SK Banerjee, M Singh and KN Katiyar (1976) *Cotton Fibre Trop.* **31:** 217-221.

Deterling EC (1975) Progve. Fmg. **75:** 64.

Ahuja SL, SK Banerjee and Jagmail Singh (1998) Genotype x environment interaction of morphotypes in cotton (*Gossypium hirsutum*). *Indian J.Agric.Res.* **32(2):** 93-100.

Ahuja SL, OP Tuteja and SK Banerjee (2001) Biochemical basis of resistance to bollworms and Jassid in morphotypes of *Gossypium hirsutum* cotton. *J. Cotton Res. Dev.* **15(2):** 229-232.

Leigh TF (1975) Insect resistance in cotton. What for future? *Proc. 28th Cott. Insec. Res. Control Conf.* pp.140-141.

50. BN OKRA (IC538547 INGR07050) a Cotton (*Gossypium hirsutum*) Germplasm with Resistance to Spotted, Pink and *Heliothis* Bollworms

SL Ahuja[1], SK Banerjee[2], Jagmail Singh[3], BM Khadi[2], SK Verma[1], VV Singh[2], D Monga[1], OP Tuteja[1] and LS Dhayal[1]

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American cotton (*G hirsutum* L) cultivars have palmate (normal) leaf shape. BN-Okra is a morphological diverse genetic stock with lanceolate (super okra) leaf shape. It has been developed through backcross method (BC_8 generation) using germplasm line, Reba Okra Isogenic Line-3 (ROIL-3) and BN (Bikaneri Narma), a well adapted *G hirsutum* cultivar as recurrent parent. Super okra leaf shape has effect on resistance to pests as reported by various workers (Lukefar *et al.*, 1969; 1975 and Ahuja *et al.*, 1998). This has been reported that BN-Okra has high amount of gossypol in leaves and stem, flavanol in leaves, stem and squares and total phenol in leaves and squares and low amount of total sugars in stems (Ahuja *et al.*, 2001). Studies of other workers (Lulefer *et al.*, 1969; Leigh, 1975 and Agarwal *et al.*, 1976) indicate that high amount of gossypol, flavanol and phenols contents in plant parts account for lower bollworm infestation. The bollworms incidence (bollworm complex; spotted, pink and *Heliothis* bollworms) in BN-Okra was considerably low as compared to Bikaneri Narma and its improved cultivar H-777 (Table 1).

Table 1. Distinctive Morpho-agronomic characters of BN-Okra

Character	BN-Okra	Bikaneri Narma
Plant type	Spreading/Bushy	Lanky
Plant height(cm)	130-150	143.00
No. of sympodial branches/plant	8.67	12.0
Stem colour	Brown	Light pink
Leaf size	Large	Medium
Leaf shape	Lanceolate	Palmate
Lobing	Very deep	Narrow
Colour	Green	Medium green
Surface	Hairy	Margin hairy
Nectary/leaf	2-3	1-2
Bolls/plant	40.67	45.0
Boll weight (g)	2.50	2.58
Seed cotton yield/plant(g)	53.57	91.00
Ginning Out Turn (%)	33.0	33.00
Lint index (g)	3.50	3.49
Pollen colour	Yellow	Cream
Petal spot	Dirty yellow spot on petals	Absent
Fruit shape	Oval round with pointed tip	Oval
Seeds/locule	6-7	8
Fibre 2.5% span length (mm)	23.8	26.7
Fibre uniformity ratio (%)	4.9	45.0
Fibre micronaire value 10^{-6} g/in	52.0	4.3
Fibre maturity coefficient (%)		75
Fibre tenacity (g/tex) (3.2mm)	21.3	22.1

Seed index (g)	8.40	7.1
Fibre 2.5% span length (mm)	25.5	26.7
Fibre uniformity ratio (%)	49.0	45.0
Fibre micronaire value 10^{-6} g/in	4.4	4.3
Fibre maturity coefficient (%)	75	75
Fibre tenacity (g/tex) (3.2mm)	21.2	22.1
Biochemical attributes	*L ST SQ*	*L ST SQ*
Gossypol (mg/g)	2.29 6.92 4.01	2.91 4.03 2.72
Reducing sugar (mg/g)	3.62 2.26 1.40	2.56 1.91 4.81
Flavanol (mg/g)	1.98 2.18 1.40	1.58 2.33 0.92
Total phenol (%)	3.65 4.62 3.37	3.80 4.62 2.97
Total sugar (mg/g)	5.65 5.24 3.14	7.18 5.49 8.80
Bollworm incidence (%)	40.92*	71.02*

Where L=leaves, ST= stem and SQ= square; * Five years avareage

References

Agarwal RA, SK Banerjee, M Singh and KN Katiyar (1976) *Cotton Fibre Trop.* **31:** 217-221.

Deterling EC (1975) Progve. Fmg. **75:** 64.

Ahuja SL, SK Banerjee and Jagmail Singh (1998) Genotype x environment interaction of morphotypes in cotton (*Gossypium hirsutum*). *Indian J.Agric.Res.* **32(2):** 93-100.

Ahuja SL, OP Tuteja and SK Banerjee (2001) Biochemical basis of resistance to bollworms and Jassid in morphotypes of *Gossypium hirsutum* cotton. *J. Cotton Res. Dev.* **15(2):** 229-232.

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SL Ahuja[1], SK Banerjee[2], Jagmail Singh[3], BM Khadi[2], SK Verma[1], VV Singh[2], D Monga[1], OP Tuteja[1] and LS Dhayal[1]

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Reducing sugar (mg/g)	2.69 2.39 5.15	2.56 1.91 4.81
Flavanol (mg/g)	2.29 3.10 1.87	1.58 2.33 0.92
Total phenol (%)	6.00 4.25 3.02	3.80 4.62 2.97
Total sugar (mg/g)	7.81 5.00 7.25	7.18 5.49 8.80
Bollworm incidence (%)	39.36*	71.02*
Jassid resistance	1.31	1.30

Where L=leaves, ST= stem and SQ= square; * Five years average

References

Agarwal RA, SK Banerjee, M Singh and KN Katiyar (1976) *Cotton Fibre Crop* **31:** 217-221.

Ahuja SL, SK Banerjee and Jagmail Singh (1998) Genotype x environment interaction of morphotypes in cotton (*Gossypium hirsutum) . Indian J.Agric. Res.* 32(2): 93-100.

Ahuja SL, OP Tuteja and SK Banerjee (2001) Biochemical basis of resistance to bollworms and Jassid in morphotypes of *Gossypium hirsutum* cotton. *J. Cotton Res. Dev.* **15(2):** 229-232.

Leigh TF (1975) Insect resistance in cotton. What for future? *Proc. 28th Cott. Insec. Res. Control Conf.* pp.140-141.

Lukefar MJ, MJ Shaver and WL Parrot (1969) Sources and nature of resistance in *Gossypium hirsutum* to bollworms and tobacco budworms. *Proc. Cott. Improv. Ecen. conf.* pp. 81-82.

Lukefar MJ, JE Hougstalling and HM Grahm (1975) *J. Econ. Ent.* **68:** 743-48.