Plant Germplasm Registration Notice*

The Plant Germplasm Registration Committee of **ICAR in its XIIIth meeting held on 23rd December, 2004** at the National Bureau of Plant Genetic Resources, New Delhi approved the registration of following 42 germplasm lines out of 116 proposals considered.

Pusa T 3336 (INGR No. 04080; IC427824), Wheat (*Triticum aestivum* L.) germplasm with resistance to leaf blight

SMS Tomar[1], Bhanwar Singh[1], Vinod[1], MK Menon[2], M Sivasamy[2] and DV Singh[1]
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Spot blotch or leaf blight caused by *Drechslera sorokiniana* (Sacc.) Subram. & Jain (= *Helminthosporium sativum* = *Bipolaris sorokiniana*) has recently become a serious disease of wheat particularly in northeastern region of Indo-Gangetic plains. Resistance to leaf blight is low in commercial wheat cultivars (Singh *et al.*, 1995). Therefore, concerted efforts were made to generate genetic diversity for leaf blight resistance. Segregating generations of Lok Bharti x DARF (Derivative *Agropyron* Resistance Falcon, an exotic line carrying alien segment from *Lophopyrum elongatum*) were screened for leaf blight resistance at hot spot locations, such as Wellington (South India) and Pusa (Bihar). A selection Pusa T 3336 was identified and further screened at many locations. It exhibited high degree of resistance. The leaf surface of Pusa T 3336 is waxy, which was confirmed by scanning electron microscopy that revealed, leaf surface for the presence of platelet like wax particles distributed all over the leaf epidermis, but more condensed in the guard cells.

Qualitative and quantitative analysis through gas liquid chromatography (GLC) revealed the presence of eight C-atom homologues in Pusa T 3336, while three C-atom homologues were quantified in moderately resistant genotypes and two and one C-atom homologues in most susceptible genotypes (e.g. Agra Local). The germination of leaf blight fungus conidia on the leaf surface of Pusa T 3336 was very low and germ tube showed papillate structures compared to the susceptible check showing hyphal penetration through stomata (Das et al., 1999), confirming its resistant reaction. Pusa T 3336 produces bold grain with high thousand-kernel weight of 50 g. This genotype also showed resistance to all the three wheat rusts and powdery mildew.

References

Das Soma, R Agarwal, P Dureja and DV Singh (1999) Leaf surface waxes in relation to resistance against spot blotch (*Drechslera sorokiniana*) of wheat. *Acta Phytopathologica et Hungarica* **34:** 75-84.

Singh RV, AK Singh and SP Singh (1995) Progress of work under national centre on foliar diseases during 1994-95. Paper presented in 34th All India Wheat Research Workers' workshop, AICWIP, ICAR, UAS Dharwad, August 1995.

DW-1001 (INGR No. 04081; IC445070), Wheat (*Triticum durum* Desf.) Germplasm with Gamma Gliadin-45 Band

Bhudeva Singh Tyagi, Jag Shoran and RK Gupta
Directorate of Wheat Research, Karnal 132 001 (Haryana)

Durum wheat in India occupies more than 2 million ha area with the total production of 3.5 mt. However the end product quality of the varieties grown in India needs to be improved immediately. It is known that the presence or absence of low molecular weight glutenins (LMW-1 and LMW-2) are closely linked to Gamma-45 and Gamma-42 gliadins. To develop varieties with Gamma-45 gliadins, which have superior pasta quality,

* *Communicated by Dr. Anurudh Kumar Singh, Member Secretary, Plant Germplasm Registration Committee, National Bureau of Plant Genetic Resources, Indian Council of Agricultural Research, Pusa Campus, New Delhi*

Table 1. Mean yield of DW 1001

Year of Testing		DW 1001	*Checks*			C.D.
			PBW 34	WH 896	PDW 233	
Mean Yield (q/ha) National /Zonal	1st Year	48.9	–	–	43.0	2.8
	2nd Year	48.8	46.6	45.2	46.5	1.1
	3rd Year	53.3	52.3	50.9	51.9	1.0
	Mean	50.2	49.4	47.6	47.1	–

a program was initiated at the Directorate of Wheat Research, Karnal and DW 1001 with Gamma-45 gliadin, disease resistance and high yield was developed.

DW 1001 appeared 11/33 times in the first non-significant group of genotypes as compared to the checks PBW 34 (4/26 times) and PDW 233 (4/33 times). It showed better potential of producing more ears per unit area and ranked first in agronomic trials. It is also resistant to Karnal bunt. Some other salient features of DW 1001 are- presence of Gamma Gliadin-45 band, giving yield advantage of 2.3 q/ha over check (ranked first) at all levels of fertilizer doses, resistance to the most prevalent brown rust races 77-5 and 77-2 at adult plant stage, resistant to Karnal bunt, powdery mildew and foot rot diseases and high Beta-carotene (6.8 ppm), above international standards.

Morphologically, it has semi-erect growth habit with a height of 98 cm, dark green foliage, flowering in about 100 days and maturing in 144 days; ear are straw white coloured, tapering, dense, and amber grain with 47 g 1000-grain weight. It is also moderately resistant to leaf blight disease.

DBP-01-16 (INGR No. 04082; IC445071), Wheat (*Triticum durum* Desf.) Germplasm with High Beta-Carotene

Bhudeva Singh Tyagi, Jag Shoran and RK Gupta
Directorate of Wheat Research, Karnal 132 001 (Haryana)

India grows about 60 varieties of three species of wheat, namely *T. aestivum*, *T. durum* and *T. dicoccum* under different ecological conditions. For a good pasta product from durum wheat, high beta-carotene is a basic requirement. But in most Indian varieties the beta-carotene is very low (around 5-6 ppm). The Directorate of Wheat Research (DWR) has developed the genotype, DBP 01-16 with very high beta-carotene (9-10 ppm). This is a selection from cross, PBW 34 x DCB 25 produced at DWR, Karnal. The genotype is also better in protein content, grain size, height, heading days and yield than the best available varieties.

DBP 01-16 has plant height is 95 cm and leaves are green, waxy with medium width. It flowers in about 90 days, and matures in 140 days; ear are tapering and dense; grain amber, hard, angular with 1000-grain weight of 44g. It is resistant to all three rusts of wheat and leaf blight. The waxy nature of flag leaves and ears helps in performing better in hot and rain-fed conditions.

Table 1. Comparison of DBP 01-16 for beta-carotene and other traits with best checks

Characteristic	DBP01-16 (PBW34/DCB 25)	PBW 34 Check	PDW 233 Best check	Raj 1555 Check
Beta-carotene** (ppm)	9-10	4-4.6	6-6.7	4.3-4.8
Protein content*(%)	13.5	12.0	11.2	11.8
Thousand grain wt* (g)	44	45	44	45
Heading days*	90	92	95	89
Plant height*(cm)	95	95	97	95

* Mean values of the trait during last four years.
** Range values of the trait during last four years.

TL 2877 (INGR No. 04083; IC427816), Triticale (*Triticosecale*) Germplasm with Multiple Resistances to Pest and Diseases

GS Dhindsa, Indu Sharma, AS Grewal, SK Mann and GS Deol
Punjab Agricultural University, Ludhiana 141 005 (Punjab)

TL 2877 has amber grain and has shown multiple resistance to diseases, such as Karnal bunt, stem rust, yellow rust, brown rust, leaf blight, powdery mildew, flag smut and several pests, such as foliar aphid, wheat

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Morphologically, it has semi-erect growth habit with a height of 98 cm, dark green foliage, flowering in about 100 days and maturing in 144 days; ear are straw white coloured, tapering, dense, and amber grain with 47 g 1000-grain weight. It is also moderately resistant to leaf blight disease.

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Protein content*(%)	13.5	12.0	11.2	11.8
Thousand grain wt* (g)	44	45	44	45
Heading days*	90	92	95	89
Plant height*(cm)	95	95	97	95

* Mean values of the trait during last four years.
** Range values of the trait during last four years.

TL 2877 (INGR No. 04083; IC427816), Triticale (*Triticosecale*) Germplasm with Multiple Resistances to Pest and Diseases

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Beta-carotene** (ppm)	9-10	4-4.6	6-6.7	4.3-4.8
Protein content*(%)	13.5	12.0	11.2	11.8
Thousand grain wt* (g)	44	45	44	45
Heading days*	90	92	95	89
Plant height*(cm)	95	95	97	95

* Mean values of the trait during last four years.
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TL 2877 (INGR No. 04083; IC427816), Triticale (*Triticosecale*) Germplasm with Multiple Resistances to Pest and Diseases

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Table 1. Reaction of TL 2877 to disease under AICW & BIP (1996-2003)

Year	Karnal bunt	Stem rust *South*	Leaf rust HS/ACI South	Leaf rust HS/ACI North	Stripe rust North	Leaf blight	Powdery mildew	Flag smut	AICW& BIP reports page number
1996-97	0	10R/0.3	20MR/1.4TMS	TMS/0.1	0	33-55	R (cultures 4,5,6,7)	–	15,50,58,89-90,123, 128,129
1999-00	1.2	0	0	0	0	23	2	0	118
2000-01	2.8	0	0	10S/1.5	0	36	5	0	104
2001-02	Moderately resistant to leaf blight; resistant to Karnal bunt, powdery mildew, flag smut								95
2002-03	0	0	TR	0	0	46	0	0	120

brown mite, shoot fly and root aphid in multi-location trials conducted under the All India Coordinated Wheat and Barley Improvement Programme (AICW & BP). These results have been summarised in Table 1 and 2.

Table 2. Reaction of TL2877 to pests under AICW & BIP (2001-2003)

Year	Foliar aphid (1-5 scale)	Brown wheat mite (Mite population/10 cm^2)	Shoot fly (%)	Root aphid (No.)
2000-01	5	4	11	1
2001-02	5 (2 at Pant Nagar)	15.60	6.71	2
2002-03	5	4.45	3.71	3

DT-18 (INGR No. 04084; IC427825), Triticale (*Triticosecale*) Germplasm with Multiple Tolerances to Wheat Pest and Diseases

Bhanwar Singh, SMS Tomar, Vinod and Rajendra Singh
Indian Agricultural Research Institute, New Delhi 110 012

Triticale line DT 18, with multiple tolerances to wheat pest and diseases, derived from the cross, TL 68 x DT 940 was developed through pedigree method in the Division of Genetics, Indian Agricultural Research Institute, New Delhi. It was identified mainly for resistance /tolerance to wheat brown mite.

In all India co-ordinated wheat trials the average yield of DT 18 under rain-fed conditions of northern hill zone was 24.8 q/ha, which was significantly higher over three control varieties, namely, CPAN 1796, Sonalika and TL 2656 (Triticale). In addition, it is resistant to foliar diseases like rusts, and powdery mildew, ideally suited for cultivation in northern hill zone, which has cooler climate and light soils. Breeding for genetic resistance to wheat brown mite, to mitigate yield losses is the best approach. DT 18 consistently exhibited lower mite incidence for ten successive years under natural infestation conditions in multi-location trials under the entomological nurseries (Anon.1989-1994). This genotype has potential for better grain yield over controls in the northern hilly zone. Therefore, it can serve, as a useful germplasm in triticale and wheat breeding programme for development of wheat mite resistant genotypes. It is likely that the resistance is imparted to mite by the full complement of R genome from *Secale cereale* in triticale.

Reference

Anonymous (1989-1994) DWR Progress Report from 1989 to 1994. Entomological and Pathological Nurseries.

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1996-97	0	10R/0.3	20MR/1.4TMS	TMS/0.1	0	33-55	R (cultures 4,5,6,7)	–	15,50,58,89-90,123, 128,129
1999-00	1.2	0	0	0	0	23	2	0	118
2000-01	2.8	0	0	10S/1.5	0	36	5	0	104
2001-02	Moderately resistant to leaf blight; resistant to Karnal bunt, powdery mildew, flag smut								95
2002-03	0	0	TR	0	0	46	0	0	120

brown mite, shoot fly and root aphid in multi-location trials conducted under the All India Coordinated Wheat and Barley Improvement Programme (AICW & BP). These results have been summarised in Table 1 and 2.

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Reference

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Maize (*Zea mays* L.) Inbred Line With Resistance To Post Flowering Stock Rots

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Agricultural Research Station, Acharya NG Ranga Agricultural University, Amberpet, Hyderabad 500 013 (Andhra Pradesh)

BPPTI 32 (INGR No. 04085; IC396385)

Post Flowering Stalk Rot (PFSR) caused by a complex, comprising three fungi, namely, *Cephalosporium acremonium, Macrophomina phaseolina, Fusarium moniliforme* and one bacterium *Erwinia carotovora* var. *zeae* causes severe yield losses in India. BPTTI 32 is a new inbred line resistant to PFSR, derived from the resistant pool synthesized through full-sib recurrent selection method, adopted for improving this pool prior to derivation of the inbred lines by the standard ear-to-row method. Inbreeding was carried out with toothpick screening method in PFSR sick plot, *i.e.* selfing accompanied by toothpick inoculation with the causal organisms. The PFSR resistant pool included resistant hybrids, composite varieties and synthetics evaluated under All India Co-ordinated Maize Improvement Trials. It has better general combining ability compared to other sister inbred lines. Table 1 presents the morpho-agronomic characteristics of inbred lines BPTTI 32.

BPTTI 32 has semi-open tassel with light purple silk and produce orange yellow seed. The PFSR disease rating of 2.1 classifies this inbred line as highly resistant to this disease.

BPPTI 34 (INGR No. 04086; IC396387)

Post Flowering Stalk Rot (PFSR) caused by a complex, comprising three fungi, namely, *Cephalosporium acremonium, Macrophomina phaseolina, Fusarium moniliforme* and one bacterium *Erwinia carotovora* var. *zeae* causes severe yield losses in India. BPTTI 34 is a new inbred line resistant to PFSR, derived from the resistant pool synthesized through full-sib recurrent selection method, adopted for improving this pool prior to derivation of the inbred lines by the standard ear-to-row method. Inbreeding was carried out with toothpick screening in PFSR sick plot, i.e. selfing accompanied by toothpick inoculation with causal organisms. The PFSR resistant pool included resistant hybrids, composite varieties and synthetics evaluated under All India Co-ordinated Maize Improvement Trials. It has bold grains compared to other sister inbred lines. Table 2 presents the morpho-agronomic characteristics of inbred line BPTTI 34.

BPTTI 34 has open tassel with silk colour light purple and orange seeded. The PFSR disease rating of 2.4 classifies this inbred line as highly resistant to this disease.

Table 1. Morpho-agronomic characteristics of inbred line BPTTI 32**

Inbred Genotype	Days to silk	Pl. ht. (cm)	E.H. (cm)	E.L. (cm)	E.G (cm)	Kernel Rows/ear	Kernel/ row	100-kernel wt. (g)	Disease score*(1-9)
BPPTI 32-1-1-2-2-1-1 bulk	70(R)	126	35	9	10	14	14	18.5	2.1

*1=healthy, 9=highly susceptible: Disease rating of 5 and below is resistant
** Payak (1993)

Table 2. Morpho-agronomic characteristics of inbred line BPTTI 34**

Inbred Genotype	Days to silk	Pl. ht. (cm)	E.H. (cm)	E.L. (cm)	E.G (cm)	Kernel (rows/ear)	Kernel/ row	100-kernel wt. (g)	Disease score* (1-9)
BPPTI 34-1-2-1-1-1-2-bulk	70(R)	116	45	8	9	10	16	30	2.4

*1=healthy, 9=highly susceptible: Disease rating of 5 and below is resistant
** Payak (1993)

Reference

Payak, MM (1983) "Premature Drying in Maize" bulletin on "Techniques of Scoring for Resistance to Important Diseases of Maize". All India Co-ordinated Maize Improvement Project, New Delhi, 96-100.

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BML-6 (INGR No. 04119; IC 411282), Maize (*Zea mays* L.) Inbred Line with Maydis Leaf Blight, Turcicum Leaf Blight and Sorghum Downy Mildew Disease Tolerance and Good Combining Ability

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Agricultural Research Station, Acharya NG Ranga Agricultural University, Amberpet, Hyderabad 500 013 (Andhra Pradesh)

This maize inbred line was derived through pedigree selection from stalk rot resistant germplasm, screened at the pathology section of the Agricultural Research Station, Acharya NG Ranga Agricultural University, Amberpet, Hyderabad, through modification and improvement method by introgressing a series of elite materials and through the adoption of restricted pollination coupled with pedigree selection. It has anthocyanin pigmentation on leaf sheath, husk cover and culm. It is good both as female and male parent. Presence of specific purple colour dot at the tip of the glumes of the tassel is a typical characteristic. Plants are tall and sturdy with drooping medium side branches, tassel is of medium size, loose and green glumes and silk, husk tip cover is medium green. Cob is cylindrical and rigid, tip filled, straight row, yellow orange flint, slight dent, white. It is tolerant to Maydis leaf blight, Turcicum leaf blight and sorghum downy mildew disease and has good combining ability.

HKI-1332 (INGR No. 04120; IC 408329), Maize (*Zea mays* L.) Inbred Line with Dark Green Erect Leaves and Medium Maturity

Sain Dass, Kulbir Singh Dhanju and Pawan Arora
Regional Station Uchani, Chaudhary Charan Singh Haryana Agricultural University, Karnal 132 001 (Haryana)

HKI-1332 is a medium maturing, productive line developed at the Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station, Uchani, Karnal. The line is derived from Pool-32, CIMMYT, Mexico through selection and continuous selfing.

The important characters of the line are early to medium maturity, medium height (100-115 cm in *Kharif* and 65-70 cm in *Rabi*) sturdy, leaf broad, erect, dark green; stem green; tassel medium, erect with few secondary branches; anther green; glumes green; silk green; husk cover green and tight; ear cylindrical, medium (10.5-12.5 cm in different seasons), white heart, grain up to tip, irregular kernel rows; grain flint, light orange, round and medium bold. It takes 49-51 days and 129-130 days to 50 percent tasselling and 51-54 and 132-133 days to silking in *Kharif* and *Rabi* season, respectively. It yielded 22-25 q/ha in different seasons.

The line is responsive to high doses of fertilizer, productive and has wider adaptability, therefore can be utilized in breeding programme in both the season. It is a good general combiner both as seed parent and pollinator. Three years data revealed that the line is resistant to maydis leaf blight [(*Drechslera maydis* Nisik.) Subram and Jain] with a score of 2.0 to 3.5 (Table 1).

Table 1. Disease reaction of HKI-1332 against maydis leaf light under artificial inoculation conditions

Season-*Kharif*	HKI-1332	CM-600 (check)
2000	2.0	4.5
2001	2.0	4.5
2002	3.5	5.0
2003	2.5	5.0
Mean	2.5	4.7

References

Annual Report (1999-2001) Description of HAU Maize inbred lines, Directorate of Maize Research, Cummings Laboratory, Pusa Campus, New Delhi. pp 102-104

BML-6 (INGR No. 04119; IC 411282), Maize (*Zea mays* L.) Inbred Line with Maydis Leaf Blight, Turcicum Leaf Blight and Sorghum Downy Mildew Disease Tolerance and Good Combining Ability

Sai Kumar Ramanujam, E Satyanarayana, P Shanthi, P Mary Rekha, S Ravindra Babu and B Srinivas
Agricultural Research Station, Acharya NG Ranga Agricultural University, Amberpet, Hyderabad 500 013 (Andhra Pradesh)

This maize inbred line was derived through pedigree selection from stalk rot resistant germplasm, screened at the pathology section of the Agricultural Research Station, Acharya NG Ranga Agricultural University, Amberpet, Hyderabad, through modification and improvement method by introgressing a series of elite materials and through the adoption of restricted pollination coupled with pedigree selection. It has anthocyanin pigmentation on leaf sheath, husk cover and culm. It is good both as female and male parent. Presence of specific purple colour dot at the tip of the glumes of the tassel is a typical characteristic. Plants are tall and sturdy with drooping medium side branches, tassel is of medium size, loose and green glumes and silk, husk tip cover is medium green. Cob is cylindrical and rigid, tip filled, straight row, yellow orange flint, slight dent, white. It is tolerant to Maydis leaf blight, Turcicum leaf blight and sorghum downy mildew disease and has good combining ability.

HKI-1332 (INGR No. 04120; IC 408329), Maize (*Zea mays* L.) Inbred Line with Dark Green Erect Leaves and Medium Maturity

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Regional Station Uchani, Chaudhary Charan Singh Haryana Agricultural University, Karnal 132 001 (Haryana)

HKI-1332 is a medium maturing, productive line developed at the Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station, Uchani, Karnal. The line is derived from Pool-32, CIMMYT, Mexico through selection and continuous selfing.

The important characters of the line are early to medium maturity, medium height (100-115 cm in *Kharif* and 65-70 cm in *Rabi*) sturdy, leaf broad, erect, dark green; stem green; tassel medium, erect with few secondary branches; anther green; glumes green; silk green; husk cover green and tight; ear cylindrical, medium (10.5-12.5 cm in different seasons), white heart, grain up to tip, irregular kernel rows; grain flint, light orange, round and medium bold. It takes 49-51 days and 129-130 days to 50 percent tasselling and 51-54 and 132-133 days to silking in *Kharif* and *Rabi* season, respectively. It yielded 22-25 q/ha in different seasons.

The line is responsive to high doses of fertilizer, productive and has wider adaptability, therefore can be utilized in breeding programme in both the season. It is a good general combiner both as seed parent and pollinator. Three years data revealed that the line is resistant to maydis leaf blight [(*Drechslera maydis* Nisik.) Subram and Jain] with a score of 2.0 to 3.5 (Table 1).

Table 1. Disease reaction of HKI-1332 against maydis leaf light under artificial inoculation conditions

Season-*Kharif*	HKI-1332	CM-600 (check)
2000	2.0	4.5
2001	2.0	4.5
2002	3.5	5.0
2003	2.5	5.0
Mean	2.5	4.7

References

Annual Report (1999-2001) Description of HAU Maize inbred lines, Directorate of Maize Research, Cummings Laboratory, Pusa Campus, New Delhi. pp 102-104

Barley (*Hordeum Vulgare* Cv. Distichon) Germplasm with Better Malting Quality

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DWR37 (INGR No. 04087; IC443610)

DWR37 is a two-row better malting quality barley line developed through pedigree selection method of breeding at the Directorate of Wheat Research (DWR), Karnal. It was developed through hybridisation between two-row exotic barley varieties "Clipper" and six-row variety PL172, released in Punjab. The new genotype expressed very good malting quality with better individual values for low husk (9.9%) and low beta glucan (4.47%) content in the grain under the All India Coordinated Wheat and Barley Improvement Programme (AICW&BIP) Barley Network trials (Table 1). DWR37 has erect growth habit, medium plant height (93 cm), medium maturity duration, narrow erect green leaves, parallel ear with intermediate spike density, light yellow ear and awn at maturity. It has hard grain with bold size and oval shape, having average 30 grains/spike and is resistant to yellow rust (ACI 4.0) and leaf blight (DD score 12). It can be utilized as a source for improving malting quality.

DWR38 (INGR No. 04088; IC443611)

DWR38 is a new two-row genotype with better malting quality, especially high hectolitre weight (68 Kg/hl) (Table 2). This genotype was developed through hybridisation in a three way cross involving, BCU73, DL88 and Clipper followed by pedigree selection method. It is an erect plant type with medium height (88 cm), green foliage and waxy leaf sheath and ear. It flowers in 85-90 days and has intermediate ear density with 32-34 grains/ ear. The grains are light yellow oval shaped having mean thousand-grain weight of 50 g. This genotype is also resistant to leaf blight (12), and yellow rust (ACI 4.1). DWR38 can be used as a source of better grain quality (hectolitre weight), in breeding programme for development of superior malt quality barley.

DWR39 (INGR No. 04089; IC443612)

DWR39 is a better source for very important malting quality traits with low grain beta glucan content (4.29%) and low wort viscosity (1.454 m pas). This genotype was developed by three way cross involving BCU73, PL172 and ALFA93 followed by pedigree selection. BCU 73 and ALF 93 are two-row exotic varieties released in India as malt barley variety, PL 172 is a six-row feed barley variety released by PAU, Ludhiana. DWR39 is two-row barley and posses' high level of resistance against leaf blight. It has erect growth habit with green foliage at vegetative stage and usually takes 75–78 days to flower and is early in maturity. Flag leaf, leaf sheath and ear are non-waxy. The number of grains/ spike varies from 28–30. The grains are bold, oval shaped with 47 g. 1000-grain weight. The performance of quality attributes (beta glucan and wort viscosity) in comparison to the check DWR28 are given in Table 3.

Table 1. Quality traits of DWR37 and check (DWR28) in NWPZ*

Traits	DWR37			DWR28(check)		
	2000-01	2001-02	Mean	2000-01	2001-02	Mean
Husk (%)	10.50	9.30	**9.90**	11.50	10.30	**10.90**
Beta glucan content (%)	4.72	4.22	**4.47**	5.57	5.52	**5.55**

* = Mean values of two locations in 2000-01 and three locations in 2001-02

Table 2. Quality traits of DWR38 (Barley Network Nurseries/ Trials)

Traits	DWR38 (BK9907)			BCU73** /DWR28(C)		
	99-00*	00-01	Mean	99-00*	00-01	Mean
Hectolitre Weight (Kg/ hl)	68	68	68	66	61	63.5

* Malt Barley Observation Nursery (MBON) data for the year 1999-00
** Check BCU73 was used, as DWR28 was included later on in the trials as check.

Table 3. Quality traits of DWR39 and check (DWR28) in NWPZ*

Traits	DWR39			DWR28 (C)		
	00-01	01-02	Mean	00-01	01-02	Mean
Beta glucan content (%)	4.33	4.25	**4.29**	5.57	5.52	**5.545**
Wort Viscosity (m pas)	1.472	1.436	**1.454**	1.610	1.663	**1.6365**

* = Mean values of two locations in 2000-01 and three locations in 2001-02

Barley Genotypes with Resistance to Yellow Rust and Leaf Blight

RPS Verma, B Sarkar and DP Singh
Directorate of Wheat Research, PB No. 158, Agrasain Marg, Karnal 132 001 (Haryana)

DWR44 (INGR No. 04090; IC 443613)

DWR 44 is a two-row barley genotype highly resistant against yellow rust both at seedling and adult plant stages. It is resistant (at seedling stage) against all the races of yellow rust prevalent in India and complete resistance at adult plant stage at a number of hot spot locations under barley network testing of All India Coordinated Wheat and Barley Improvement Programme (Table 1). It was developed through hybridisation between two-row barley varieties Clipper with six-row variety BH 75, followed by pedigree method of selection. It is erect in growth habit, with plant height of 95 cm with medium maturity duration. The ear colour at maturity is light yellow, parallel in shape with 24-26-grains/spike. The grains are medium bold in size and elongated in shape with 46 g. 1000-grain weight. It can function as an important source of resistance against yellow rust (Table 1).

Table 1. Reaction of DWR44 to yellow (stripe) rust in coordinated disease screening nurseries

Year	SRT[1]			APR[2]
	Yellow	Brown	Black	Yellow
2000-01*	–	–	–	5MS(2.0)
2001-02	Resistant to all	Resistant to all	Resistant to all	00 (0.0)

* =tested as BK019 in MBON disease screening nursery during 2000-01 and as DWR44 in national barley diseases screening nursery (NBDSN) during 2001-02

1. Seedling resistance test against individual pathotypes of yellow, brown and black rusts
2. Reaction in plant pathological nurseries under artificial screening at hot spot locations

DWR47 (INGR No. 04091; IC 443614)

DWR 47 is barley genotype resistant against leaf blight in the two-row barley background. It was developed through hybridisation between two-row and six-row varieties, Clipper and K 508, followed by pedigree selection. The genotype has erect growth habit with medium tall plant and late in maturity. Number of grain/spike varies from 28-30 with 49 g. 1000-grain weight. Grain colour is yellow, medium bold and elongated in shape. This genotype showed minimum reaction to leaf blight amongst 112 entries tested under NBDSN at six hot spot locations (Table 1) under AICW&BIP. Most genotypes tested in the hot spot locations are susceptible to leaf blights, therefore DWR 47 can be used as source in breeding for leaf blight resistance.

Table 2: Reaction of DWR47 to leaf blight in coordinated disease screening nurseries

Year	Highest score	
	DWR47	Check
2001-02*	01	45
2002-03**	24	99

(The reactions up to 35 on double-digit system (reaction on the flag and next to flag leaf) are considered as resistant.) * = IBRSN data (BK104= DWR47); ** = NBDSN data

JCR/TRS-510 (INGR No. 04093; IC258253), Chenopod (*Chenopodium album* L.) Germplasm with Brown Seeds

JC Rana[1], VD Verma[1], K Pradheep[1] and TR Sharma[2]
1. National Bureau of Plant Genetic Resources, Regional Station, Shimla 171 004 Himachal Pradesh
2. Centre of Hill Bioresources and Biotechnology, CSK HP Krishi Vishwavidyalaya, Palampur 176 062, Himachal Pradesh.

The chenopod is extensively used as leafy vegetable in the hills and plains. However, the cultivation is decreasing because of low yield, seed shattering, small seed size and black seed colour. Generally, Chenopodium album seed is black in colour. The germplasm accession, 'IC258253' collected from Pangi subdivision of Chamba district in Himachal Pradesh was found to have brown seed colour. This is the only accession with brown seed among more than 100 accessions maintained at the station. Chenopod is generally consumed either as unleavened bread or flour mixed with wheat flour. Occasionally whole grain is cooked with rice. The black

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colour of seed is not preferred, as it gives black flour and releases black seed coat when cooked with rice. Therefore, brown or white seed colours are preferred. Hence, germplasm with brown or white seed colour can help increase area under cultivation. JCR/TRS-510 is high yielding with medium plant height, a desirable attribute and was therefore, included in the trials of AICRP on UC in 2004. Table 1 lists the characteristic features.

Table 1. Characteristic features of IC329457

Characters	Mean	Characters	Mean
Plant height (cm)	182.60	1000 seed wt. (g)	0.59
Leaf length (cm)	6.85	Seed yield/plant (g)	23.46
Leaf width (cm)	3.00	Early plant vigour	Very Good
No. of primary branches	7.00	Leaf shape	Ovate to lanceolate
Inflorescence length	36.7	Stem colour	Red
Petiole length	2.6	Seed shedding	Moderate
Days to 50% flowering	89	Stem branching	Very good
Days to 80% maturity	133	Seed shape	Round
Average seed length (mm)	1.28	Seed colour	Brown
Average seed thickness (mm)	0.66	Inflorescence colour	Pink
Average seed diameter (mm)	1.24	Inflorescence shape	Globose

1409A &B (INGR No. 04094; IC432861 and IC432862), Sorghum (*Sorghum bicolor* L.) Germplasm with Cytoplasmic Male Sterility

BN Narkhede[1], JV Patil[1], SB Chaudhary[1], SB Wandhekar[1], VM Kulkarni[1], BB Thombare[1], MS Shinde, UG Kachole and BK Katule[2]

1. *Mahatma Phule Krishi Vidyapeeth, Rahuri 413 722 (Maharashtra)*
2. *Agricultural Research Station, Solapur (Maharashtra)*

1409A is a male sterile line with *Rabi* base, possessing a plant type of early maturity and medium height, resistance to shoot-fly and charcoal rot, high yielding with good grain and fodder characters. The plant material for the present programme consisted of three tropical 'B' lines viz., 42B, 104 B and 116 B and four temperate 'B' lines ICSB 52B, 85 B, ICSB 36209 and 88010 B. The crossings of three tropical 'B' lines with each of four temperate 'B' lines were made by hand emasculation and pollination. The resulting 12 hybrids were evaluated during *Rabi* 1995 in medium black soils under the Sorghum Improvement Project at Rahuri in rain-fed conditions. The segregating generation of F_2 and onward were advanced by planting in off-season, and simultaneously backcrossing was carried out by selecting desirable segregants. At F_3 generation, 16 individual plant selections from the cross, 104 B x ICSB 36209 were grown and evaluated. Subsequently at BC_4 and BC_5 generations the promising lines were isolated on the basis of sterility performance and photo-insensitiveness. Counter part of this 'B' line nicks well. The morphological characteristics of newly developed CMS 1409 A, are listed below in Table 1.

Table 1. Characteristic features of CMS 1409 A

Characters	Value
Pedigree	104 B x ICSB 36209
Plant height (cm)	145-150
Days to 50 % flowering	62-68
Days to maturity	108-110
Plant pigmentation	Non-tan
Mid rib colour	White
Leaf colour	Dark green
Internodes cover	Full
Panicle compactness	Semi-compact, long ear-head
Glumes colour	Yellowish
Glumes covering	¼ covering
Threshability	Easy
Awn	Awned
Seed colour and shape	Pearly white and round
Test weight (g)	30
Grain yield (kg/ha)	1500-1800
Resistance to shoot-fly	Tolerant

colour of seed is not preferred, as it gives black flour and releases black seed coat when cooked with rice. Therefore, brown or white seed colours are preferred. Hence, germplasm with brown or white seed colour can help increase area under cultivation. JCR/TRS-510 is high yielding with medium plant height, a desirable attribute and was therefore, included in the trials of AICRP on UC in 2004. Table 1 lists the characteristic features.

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Leaf width (cm)	3.00	Early plant vigour	Very Good
No. of primary branches	7.00	Leaf shape	Ovate to lanceolate
Inflorescence length	36.7	Stem colour	Red
Petiole length	2.6	Seed shedding	Moderate
Days to 50% flowering	89	Stem branching	Very good
Days to 80% maturity	133	Seed shape	Round
Average seed length (mm)	1.28	Seed colour	Brown
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Average seed diameter (mm)	1.24	Inflorescence shape	Globose

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Characters	Value
Pedigree	104 B x ICSB 36209
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Days to 50 % flowering	62-68
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Plant pigmentation	Non-tan
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Leaf colour	Dark green
Internodes cover	Full
Panicle compactness	Semi-compact, long ear-head
Glumes colour	Yellowish
Glumes covering	¼ covering
Threshability	Easy
Awn	Awned
Seed colour and shape	Pearly white and round
Test weight (g)	30
Grain yield (kg/ha)	1500-1800
Resistance to shoot-fly	Tolerant

RMM-12 (INGR No. 04095; IC432859), Moth Bean [*Vigna aconitifolia* (Jacq) Marechal] Germplasm with Single Stem and Early Maturity

D Kumar
Central Arid Zone Research Institute, Jodhpur 342 003 (Rajasthan)

Moth bean (*Vigna aconitifolia* Jacq. Marechal) is one of the favoured crops of arid zone. The un-branched mutant RMM-12, having cluster of pods at the main stem was isolated in M_2 generation (1997) from seeds irradiated with 30 kR at the Central Arid Zone Research Institute, Jodhpur. It was stabilized through M_3 and M_4 generations and evaluated for various traits. The distinguishing features of the mutant are, its upright, straight growth habit having only main stem and complete lack of branches. In a replicated yield trial during *Kharif* 2001 (327.6 mm rainfall through 15 days), this mutant yielded 600 kg ha^{-1}, registering 24.1% yield increase over the parental variety. Probably, it was due to high harvest index and synchronous maturity suited for mechanical harvesting. The erect habit makes it suitable for inter cropping and mix cropping.

During *Kharif* 1999, nutrient movements of this mutant were compared with some of the genotypes at the critical growth period following Roemer and Schenk (1998) method. The mutant showed maximum influx of Na ions to the tune of 0.14 mol/ cm root/ second x 10^{-15}, whereas other genotypes barring RMO-257 showed the influx of Na ions in range of 0.07 to 0.10 mol/ cm root/ second x 10^{-15} (Kumar *et al.* 2001). Higher influx or uptake rate of Na ions may contribute to salt tolerance potential. However, further studies are required on genetics of branching habits, salt tolerance and to evaluate its performance under intercropping and mix cropping systems.

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Roemer W and Schenk H (1998) Influence of genotype on phosphate uptake and utilization efficiencies in spring barley. *European Journal of Agronomy* **8**: 215-224.

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Imparipinnate Mutant (INGR No. 04097; IC 323372), Groundnut (*Arachis hypogaea* L.) Germplasm with Imparipinnate Leaves and Small Leaflet

SH Patil
Bhabha Atomic Research Centre, Trombay, Mumbai 400 085 (Maharashtra)

Many mutants induced by X-rays were produced in groundnut at the Bhabha Atomic Research Centre, Trombay (Patil, 1966). Of the several mutants generated under this programme there was a mutant with imparipinnate leaves. It has as many as eight accessory leaflets unlike two in the parent. About 25 percent of the leaves were imparipinnate and had smaller leaflets. Occasionally, funnel shaped leaflets were also observed. The height of the mutant and its sibs was shorter than the parents. It has smaller pods with shallow constrictions and prominent beak. Kernel colour was fleshy unlike rosy in the control/ parents.

Genetic studies showed a wide range of phenotypic ratios (3:1 to 40:1) with an average of 6.5:1. The genotypic segregation over 200 progenies indicated an apparent preferential segregation for dominant type that is 109:101:30. According to Cadman (1942) 50 percent of the non-segregants are expected in duplex progeny. Occasional reversions to heterozygous states have been observed in one to two mutant progenies

References

Cadman CH (1942) Autotetraploid inheritance in the potato: some new evidence. *J Genet* **44**: 33-52.

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References

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Suppressed Branch Mutant (INGR No. 04098; IC 323373), Groundnut (*Arachis hypogaea* L.) Germplasm

SH Patil and Chandra Mouli
Bhabha Atomic Research Centre, Trombay, Mumbai 400 085 (Maharashtra)

A new mutant with suppressed branches was isolated in groundnut after gamma-irradiation at the Bhabha Atomic Research Centre, Trombay, Mumbai (Mouli and Patil, 1976). The mutant is characterised by suppressed primary branches that can usually be identified after six weeks of sowing. In addition, the mutant leaves are larger than those of parent variety, because of suppressed vegetative growth of the branches. Concurrently there is a gradual reduction in size of the leaves on the suppressed branches from the basal nodes to the tip, where they are very small. The flowering pattern is also altered in the mutant. The basal three to four nodes are vegetative like in the parent TG-2; subsequently, however, the development of vegetative and reproductive buds in the leaf axils of the mutant stem is unique. It has one to three reproductive nodes, which alternate with six to eight vegetative nodes. Beyond 13 or 14 nodes the axils generally have reproductive buds and the top eight to ten nodes have highly suppressed buds. Pods in the mutants are extremely reduced in autumn growing season compared to almost normal in the spring (Table 1). The mutant's pods are similar to those of TG-2, but their shells are thicker and kernel smaller thereby reducing the shelling percentage. The genetic study revealed that a pair of recessive genes, *bsp/bsp* governs the suppressed branching character.

Table 1. Comparative characteristics of normal and mutant plants in autumn and spring growing seasons

Characteristics	Autumn		Spring	
	TG-2	Mutant	TG-2	Mutant
Germination (%)	96	98	95	95
Plant height (cm)	70 ± 1.5	60 ± 0.8	43 ± 2.0	45 ± 1.2
Branch length (cm)	84 ± 2.3	10 ± 1.2	45 ± 3.5	25 ± 2.8
Leaflet size (cm) (length x width)	6.5 x 3.3	7.8 x 4.1	5.8 x 3.3	6.3 x 3.6
Number of branches (n+1) + (n+2)	8 + 12	7 + 0	6 + 7	6 + 0
Mutant (days)	100	100	100	100
Number of pods (1+2 seeded)	8 + 50	2 + 5	5 + 47	4 + 38
Shelling (%)	84	75	Go	71
10 kernel wt (gm)	36 0.5±	32 ± 0.4	41 ± 0.5	36 ± 0.5
Flowering pattern on stem	Sequential	Altered	Sequential	Altered

References

Mouli C and Patil SH (1976) Gamma-ray-induced mutant with suppressed branches in the peanut. *The Journal of Heredity* **67**: 322-324.

BIO-YSR (INGR No. 04099; IC 443623), Mustard (*Brassica juncea* L.) Germplasm with White Rust Resistance, Yellow Seed and High Yield and Oil Content

RK Katiyar and R Chamola
National Research Centre on Plant Biotechnology, Indian Agricultural Research Institute, New Delhi 110 012

White rust caused by *Albugo candida* is the second most serious fungal disease of *Brassicas'*, occurring in the form of white pustules (spots) on the lower surface of older leaves. This results in distortion of floral and growing parts of branches (hypertrophy or stag-head), leading to substantial yield losses. The National Research Centre on Plant Biotechnology, New Delhi has developed a highly resistant strain, BIO-YSR, using somaclonal variation followed by selection. The hypocotyl region of early seedling of an exotic *Brassica juncea* germplasm, BEC-286, was used as the ex-plant for tissue culture. The soma-clone (BIO-YSR) showed high degree of resistance to white rust when tested under natural and artificial conditions in the national disease nursery trial by the All India Co-ordinated Research Project on Rapeseed & Mustard (Table 1) over the years.

BIO-YSR possesses yellow, bold seeds (5.0g/1000 seeds) with nearly 3 to 4% more oil (43 to 44%) than most of the present day commercially released varieties (38–40%). The plant grows up to a height of 200 cm in the north and northwest parts of the country. It has strong, lodging resistant pods. The cup shaped leaves and the pale green colour of this genotype can function

Suppressed Branch Mutant (INGR No. 04098; IC 323373), Groundnut (*Arachis hypogaea* L.) Germplasm

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Bhabha Atomic Research Centre, Trombay, Mumbai 400 085 (Maharashtra)

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Branch length (cm)	84 ± 2.3	10 ± 1.2	45 ± 3.5	25 ± 2.8
Leaflet size (cm) (length x width)	6.5 x 3.3	7.8 x 4.1	5.8 x 3.3	6.3 x 3.6
Number of branches (n+1) + (n+2)	8 + 12	7 + 0	6 + 7	6 + 0
Mutant (days)	100	100	100	100
Number of pods (1+2 seeded)	8 + 50	2 + 5	5 + 47	4 + 38
Shelling (%)	84	75	Go	71
10 kernel wt (gm)	36 0.5±	32 ± 0.4	41 ± 0.5	36 ± 0.5
Flowering pattern on stem	Sequential	Altered	Sequential	Altered

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as phenotypic markers for identification. It matures about 3 weeks earlier than its parent (BEC-286), fitting well into Indian cropping patterns. It out-yielded the best commercial variety (Varuna) by 8.3 to 17.3% in the all India co-ordinated varietal trial, in 1993-94. It is being used as source of white rust resistance, yellow seed and high oil content coupled with reasonably higher productivity.

Table 1. Comparative performance of BIO-YSR, against white rust over different years in National Disease Nursery Trial (AICRP)

Strain	White rust infection score			Av. Score	Yield (Kg/Ha)		Oil (%)	1000-seed wt
	99-2000	2000-01	2001-02		Zone-II	Zone-III		
BIO-YSR	0.35	0.7	0.4	0.48	2154	2000	42.0	4.7
	–	0.0	0.9	0.45				
Varuna (Check)	1.94	0.9	2.1	1.65	1741	1710	38.6	4.2
	–	1.0	5.0	3.00				

Fasciation Mutant (INGR No. 04100; IC436078), Sunflower (*Helianthus annuus* L.) Germplasm

Sanjay J Jambhulkar
Bhabha Atomic Research Centre, Trombay, Mumbai 400 085 (Maharashtra)

To induce variability, seeds of sunflower variety 'Surya' were treated with Gamma rays and a fasciation mutant was isolated from the 200Gy dose treatment at the Nuclear Agriculture & Biotechnology Division, Bhabha Atomic Research Centre, Mumbai. The fasciation mutation looks like fusion of 3-4 sunflower plants. It bears small and large number of leaves (~120) on flattened stem with disrupted phyllotaxy, more leaf area (6850 cm^2), and more fresh leaf biomass (203g/plant) than control parent. The flower head also looks like fusion of 3-4 flower heads without round boundaries for ray and disc florets. Fasciation is controlled by single recessive nuclear gene denoted as *sf* (sunflower fasciation one). It could be exploited in basic studies to understand the mechanism of fasciation .

Reference

Jambhulkar SJ (2002) Growth morphology and inheritance of fasciation mutation in sunflower. *J Genet & Breed* **56**: 327-330.

ARG CMS and ARG CMS (maintainer) (INGR No. 04101; IC438345 & IC438346): a Sunflower (*Helianthus annuus* L.) Cytoplasmic Male Sterile Line Involving *Helianthus argophyllus*

AJ Prabhakaran and M Sujatha
Directorate of Oilseed Research, Rajendranagar, Hyderabad 500 030 (Andhra Pradesh)

ARG CMS is a new cytoplasmic male sterile (CMS) in sunflower derived from interspecific hybridisation between *H. argophyllus* x cv. Morden and backcrossing with cultivated parent at the Directorate of Oilseed Research, Rajendranagar, Hyderabad. It has short stature (85 cm) and is un-branched with medium size leaves. Ray and disc florets are yellow. Capitulum is of medium size (12.5 cm). It is an early duration type with 50% flowering in 45-50 days and maturity in 85-90 days. Seeds are medium sized, well-filled and dark black in colour. This CMS source is being used in the hybrid-breeding programme for conversion of promising inbreds for good combining ability.

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White Pollen Sunflower (INGR No. 04102; IC443609) Interspecific Derivative (*Helianthus annuus* x *H. divaricatus* L)

M Sujatha and AJ Prabakaran
Directorate of Oilseed Research, Rajendranagar, Hyderabad 500 030 (Andhra Pradesh)

The new genotype with white pollen sunflower is derived from interspecific hybridisation between cultivated sunflower and *H. divaricatus* followed by backcrossing. In the BC_4F_2 population of this cross, it was selected at the Directorate of Oilseed Research, Rajendranagar, Hyderabad. The pollen produced are pure white and in abundance, turning creamy after drying. Invariably, the white pollen producing plants possessed lemon yellow coloured ray florets and distinct cup shaped leaves unlike the plants that segregated for yellow pollen, which had normal yellow ray florets. The white pollens are viable, highly fertile, functional and germinate readily *in vivo*. Sister plant mating and selfing of white pollen producing plants resulted in the development of lines breeding true for this trait. Genetic studies indicated that the trait is under the control of monogenic recessive genes. The white pollen could serves as a genetic marker and also as a useful model in studies on gene regulation with regard to flavonoid biosynthetic pathway.

RG 2722 (INGR No. 04103; IC306138), Castor (*Ricinus communis* L.) Germplasm with Resistance to *Macrophomina* Root Rot

K Anjani
Directorate of Oilseed Research, Rajendranagar, Hyderabad 500 030 (Andhra Pradesh)

RG 2722 is a *Macrophomina* root rot resistant wild castor germplasm accession collected from Andaman and Nicobar islands in the year 2000 and characterised, evaluated and screened at the Directorate of Oilseeds Research Rajendranagar, Hyderabad. The screening against root rot in root rot sick plot in 2001-02, 2002-03 and 2003-04 showed that it has stable resistance to root rot in all the years under root rot sick conditions. It has purple stem, no bloom on plant, high node number and medium size spiny capsules.

RG 1608 (INGR No. 04104; IC373978), Castor (*Ricinus communis* L) Germplasm with Resistance to *Fusarium* Wilt

K Anjani
Directorate of Oilseed Research, Rajendranagar, Hyderabad 500 030 (Andhra Pradesh)

RG 1608 is a wilt (*Fusarium ricini*) resistant wild castor germplasm accession collected from Bihar in 1992 and characterised, evaluated and screened at the Directorate of Oilseeds Research, Rajendranagar, Hyderabad. With an objective of producing uniform line, selections were made in the initial segregating progenies of RG 1608. Selected progenies were subjected to selfing to bring in reasonable uniformity. This line was screened against wilt in wilt sick plots at two locations under the All India Coordinated Research Project on Castor in 1997-98 and 2002-03. It showed stable resistance to wilt in both the years. Its resistance was reconfirmed using root-tip dip technique under very high disease pressure, in pots. It has red stem, bloom on stem and lower surface of the leaf, very high node number and medium size spiny capsules.

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MCP 1-1 (INGR No. 04121; IC296551), Castor (*Ricinus communis* L.) Germplasm with Diverse Stable Pistillate Nature

Shambhoo Singh Solanki
Agricultural Research Station Mandor, Rajasthan Agricultural University, Jodhpur 342 304 (Rajasthan)

Inflorescence of castor is raceme and basically monoecious in nature. Lower part of raceme bears staminate flowers and upper, pistillate flowers. Castor lines, with only pistillate flowers are also available. Pistillate stock MCP-1-1 was isolated by selection from existing pistillate line MCP-1. The MCP-1 had unstable sex nature. The promising line was planted in summer season and normal season at the Agriculture Research Station, Mandor (Rajasthan Agriculture University), Jodhpur. In summer plants expressing optimum interspersed staminate flowers under high temperature were selected and planted in normal season. These were observed for the pistillateness and other yield contributing characters. MCP-1-1 is a diverse, good general combiner for seed yield and 100 seed weight (Anonymous 2003, Solanki, *et al.*, 2004) and a new source of pistillate flowers for heterosis breeding.

MCP-1-1 is characterized by mahogany colour stem and petiole, condensed nodes, deep cup shaped leaves, medium size spiny capsules and long primary raceme (60-65 cm) and 16-18 nodes up to primary raceme. It is waxy on dorsal as well as ventral sides of leaves, stem and other parts of plant; triple bloom; spike semi compact. This line also expressed high degree of pistillateness at S.K.Nagar, Sri Krashi Nagar Dhantiwada Unversity and Directorate of Oilseeds Research, Hyderabad indicating its wider adaptability and sex stability.

MCP-1-1 shows high degree of femaleness up to fifth/ sixth order of raceme development under summer season without monoeciousism and reversion in normal season making it ideal for castor hybrid development. It can be maintained by planting in summer season (last week of February to first week of March), the favourable temperature for expression of interspersed staminate flowers is around 31-34 °C. To grow crop, adoption of common production technology and irrigation at an interval of 8-12 days is recommended. Minimum isolation distance of 1000 m is required for production of breeder and foundation seeds during summer season.

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Solanki SS, VS Deora and DP Singh (2004). Combining ability of new castor, *Ricinus communis* L. pistillate line: MCP-1-1. *J. Oilseeds Res.*, **21**: 274-276.

IS-244/2/1 (INGR No. 04105; IC427812), Cotton (*Gossypium* Interspecific Hybrid) Apomictic Germplasm

AS Ansingkar[1], AW More[1], SS More[1] and PR Khdake[2]
1. Marathwada Agricultural University, Parbhani (Maharashtra)
2. Cotton Research Station, Nanded 431 604 (Maharashtra)

In BC_1 F_6 generation of interspecific cross involving (*G hirsutum* x *G barbadense*) x *G arboreum* (colchiploid) backcrossed to *G arboreum*, one of the segregant, IS-244/4/1 showed apomictic behaviour. Such kind of phenomenon is rarely reported in cotton, though it is common in polyploid species of Graminae, Rosaceae, Astraceae and in some intergeneric and interspecific crosses. The suspected apomictic line showed peculiar morphological features, such as dwarf stature, smaller leaf size, smaller boll size, round seeds, reduced stomata number and style length, flower size as compared to the tetraploid cultivars. Following observations confirmed the apomictic nature- progenies remained identical to respective mother plant without genetical variation, from BC_1 F_6 to BC_1 F_{14} generation, boll setting was observed, even when buds were emasculated before anthesis and selfed, and even after cutting of stigma and style, F_1 progenies from crosses between apomictic line and other lines having marker characters (petal spot, pigmented style) showed neither the marker nor the intermediate

MCP 1-1 (INGR No. 04121; IC296551), Castor (*Ricinus communis* L.) Germplasm with Diverse Stable Pistillate Nature

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MCP-1-1 is characterized by mahogany colour stem and petiole, condensed nodes, deep cup shaped leaves, medium size spiny capsules and long primary raceme (60-65 cm) and 16-18 nodes up to primary raceme. It is waxy on dorsal as well as ventral sides of leaves, stem and other parts of plant; triple bloom; spike semi compact. This line also expressed high degree of pistillateness at S.K.Nagar, Sri Krashi Nagar Dhantiwada Unversity and Directorate of Oilseeds Research, Hyderabad indicating its wider adaptability and sex stability.

MCP-1-1 shows high degree of femaleness up to fifth/ sixth order of raceme development under summer season without monoeciousism and reversion in normal season making it ideal for castor hybrid development. It can be maintained by planting in summer season (last week of February to first week of March), the favourable temperature for expression of interspersed staminate flowers is around 31-34 °C. To grow crop, adoption of common production technology and irrigation at an interval of 8-12 days is recommended. Minimum isolation distance of 1000 m is required for production of breeder and foundation seeds during summer season.

References

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IS-244/2/1 (INGR No. 04105; IC427812), Cotton (*Gossypium* Interspecific Hybrid) Apomictic Germplasm

AS Ansingkar[1], AW More[1], SS More[1] and PR Khdake[2]
1. Marathwada Agricultural University, Parbhani (Maharashtra)
2. Cotton Research Station, Nanded 431 604 (Maharashtra)

In BC_1 F_6 generation of interspecific cross involving (*G hirsutum* x *G barbadense*) x *G arboreum* (colchiploid) backcrossed to *G arboreum*, one of the segregant, IS-244/4/1 showed apomictic behaviour. Such kind of phenomenon is rarely reported in cotton, though it is common in polyploid species of Graminae, Rosaceae, Astraceae and in some intergeneric and interspecific crosses. The suspected apomictic line showed peculiar morphological features, such as dwarf stature, smaller leaf size, smaller boll size, round seeds, reduced stomata number and style length, flower size as compared to the tetraploid cultivars. Following observations confirmed the apomictic nature- progenies remained identical to respective mother plant without genetical variation, from BC_1 F_6 to BC_1 F_{14} generation, boll setting was observed, even when buds were emasculated before anthesis and selfed, and even after cutting of stigma and style, F_1 progenies from crosses between apomictic line and other lines having marker characters (petal spot, pigmented style) showed neither the marker nor the intermediate

characters, but features identical to apomictic parent, In F_1 progenies, developed by crossing CMS 'A' line with apomictic genotype, despite selfing setting bolls took place, which is possible due to transfer of apomictic gene in CMS 'A' line, cytological investigation revealed aneuploidy nature of apomictic line with chromosome number varying form 26 to 45, because of cytological instability very less pollen sterility (35%) was recorded and that RAPD analysis of apomictic line showed identical banding pattern similar to their F_1.

IS-376/14/21 (INGR No. 04106; IC427815), Cotton (*Gossypium* Interspecific Hybrid) Germplasm with Resistance to Sucking Pest

AS Ansingkar[1], AW More[1], SS More[1] and PK Khdake[2]
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dlpf (CMU 013) (INGR No. 04107; IC427817), Jute (*Corchorus capsularis* L.) Germplasm with Low Lignin, GA_3 (7 times lower than JRC 212) and Cellulose Fibre

Pratip Kumar Palit
Central Research Institute for Jute and Allied Fibres, Barrackpore, Kolkata 700 120 (West Bengal)

High lignin content of ligno-cellulose jute fibre does not allow making of fine fabric and other value added products. To develop low lignin jute fibre, an X-ray induced mutant line of jute (*Corchorus capsularis* L.) was produced and evaluated at the Central Research Institute for Jute and Allied Fibres, Barrackpore, resulting in identification of the CMU 013, one of the most undulated phenotype compared to its normal parent, JRC 212 for its growth, secondary fibre development and lignification of the fibre.

The mutant grew slower, had shorter internodes and yielded much less fibre after retting. The fibre of the mutant contains 50 percent less lignin and comparatively more cellulose then the normal type. Differentiation of primary and secondary vascular tissues through out the CMU 013 stem was regular and did not have secondary phloem fibre bundles as in JRC 212. Instead, a few thin-walled, less lignified fibre cells formed uni-or biseriate radial rows with in the phloem wedges of the middle stem. The lower and earliest developed part of the mutant stem had no lignified fibre cells. This developmental deficiency in lignification of fibre cells was correlated to a similar deficiency in phenyl-alanine ammonia lyase activity, but not peroxidase activity, in the bark tissue along the stem axis. In spite of severe reduction in lignin synthesis in the phloem cells this mutant functioned normally and bred true. This mutant, it has been designated as deficient lignified phloem fibre (*dlpf*) mutant. It can be used as a source to developed low lignin fibre jute varieties.

MCP 1-1 (INGR No. 04121; IC296551), Castor (*Ricinus communis* L.) Germplasm with Diverse Stable Pistillate Nature

Shambhoo Singh Solanki
Agricultural Research Station Mandor, Rajasthan Agricultural University, Jodhpur 342 304 (Rajasthan)

Inflorescence of castor is raceme and basically monoecious in nature. Lower part of raceme bears staminate flowers and upper, pistillate flowers. Castor lines, with only pistillate flowers are also available. Pistillate stock MCP-1-1 was isolated by selection from existing pistillate line MCP-1. The MCP-1 had unstable sex nature. The promising line was planted in summer season and normal season at the Agriculture Research Station, Mandor (Rajasthan Agriculture University), Jodhpur. In summer plants expressing optimum interspersed staminate flowers under high temperature were selected and planted in normal season. These were observed for the pistillateness and other yield contributing characters. MCP-1-1 is a diverse, good general combiner for seed yield and 100 seed weight (Anonymous 2003, Solanki, *et al.*, 2004) and a new source of pistillate flowers for heterosis breeding.

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IS-376/14/21 (INGR No. 04106; IC427815), Cotton (*Gossypium* Interspecific Hybrid) Germplasm with Resistance to Sucking Pest

AS Ansingkar[1], AW More[1], SS More[1] and PK Khdake[2]
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dlpf (CMU 013) (INGR No. 04107; IC427817), Jute (*Corchorus capsularis* L.) Germplasm with Low Lignin, GA_3 (7 times lower than JRC 212) and Cellulose Fibre

Pratip Kumar Palit
Central Research Institute for Jute and Allied Fibres, Barrackpore, Kolkata 700 120 (West Bengal)

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The mutant grew slower, had shorter internodes and yielded much less fibre after retting. The fibre of the mutant contains 50 percent less lignin and comparatively more cellulose then the normal type. Differentiation of primary and secondary vascular tissues through out the CMU 013 stem was regular and did not have secondary phloem fibre bundles as in JRC 212. Instead, a few thin-walled, less lignified fibre cells formed uni-or biseriate radial rows with in the phloem wedges of the middle stem. The lower and earliest developed part of the mutant stem had no lignified fibre cells. This developmental deficiency in lignification of fibre cells was correlated to a similar deficiency in phenyl-alanine ammonia lyase activity, but not peroxidase activity, in the bark tissue along the stem axis. In spite of severe reduction in lignin synthesis in the phloem cells this mutant functioned normally and bred true. This mutant, it has been designated as deficient lignified phloem fibre (*dlpf*) mutant. It can be used as a source to developed low lignin fibre jute varieties.

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CSD 137 (INGR No. 04108; IC427827), Sesbania (*Sesbania aculeata* Pers.) Germplasm with High Foliage and Sodicity Tolerance

RK Singh[1], RK Gautam[1] and B Mishra[2]
1. Central Soil Salinity Research Institute, Kachhwa Road, Karnal 132 001 (Haryana)
2. Directorate of Rice Research, Rajendranagar, Hyderabad 500 030 (Andhra Pradesh)

Sesbania aculeata commonly called as 'Dhaincha' is an ideal and cheap biological resource to improve the physico-chemical properties of salt affected soils. Its incorporation in sodic soils not only increases the fertility through green manuring, but also hastens the reclamation process of sodic soils and is considered an effective supplement to chemical amendments. Screening of 140 collections of *Sesbania aculeata* and *S. rostrata* collected from various parts of the country at the Central Soil Salinity Research Institute led to the identification of a *S. aculeata* genotype, CSD 137, which consistently gives high fresh foliage yield in sodic soils. CSD137 is a local collection made from village Birharu, tehsil, Kheragarh, district Agra.

CSD 137 has shown consistent foliage yield superiority under different sodicity stress level (from pH_2 9.2 to 9.7) in Haryana and U.P. Across sodicity stress levels it recorded 52, 70, 72, 99 and 123 gram of fresh foliage yield/ plant respectively at 40, 45, 55, and 60 days after sowing (Table 1). It attains a plant height of about 220 cm with 10 primary branches, 30 secondary branches, 180 pods/ plant, and 20.0 g test weight, and takes about 110 days for pod bearing. Thus 1.5 to 2 times more foliage yield could be incorporated in sodic soils for their fast reclamation and utilization.

Table 1. Green foliage yield (g/plant) of CSD 137 in sodic soils

Days after sowing	Sodic environments			
	L1 (pH_2~9.2)	L1 (pH_2~9.5)	L1 (pH_2~9.7)	Average
40	114 (70) *	37 (20)	4 (1)	52 (33.0)
45	151 (74)	41 (22)	17 (6)	70 (34.0)
50	155 (76)	44 (32)	18 (11)	72 (40.0)
55	156 (88)	96 (47)	46 (13)	99 (49.0)
60	161 (109)	154(71)	55 (47)	123 (76.0)
Average	147 (83)	74 (38)	28 (16)	

*The values within parenthesis are of lowest yielding genotype at each level.

MP/99-322 (INGR No. 04109; IC445068), Potato (*Solanum tuberosum* L.) Germplasm with High Starch and Dry Matter, Low Amylose, and Resistance to Late Blight

SK Pandey, P Manivel, SV Singh and Dinesh Kumar
Central Potato Research Institute, Shimla 171 001 (Himachal Pradesh)

MP/99-322 is the first Indian potato (*Solanum tuberosum* ssp. *tuberosum*) hybrid with higher starch content (> 17%), higher dry matter (>23%), low amylose content (< 27.3%), high amylopectin (>72.7%) and resistance to late blight. This hybrid was identified from the F_1 progeny of a cross MP/91-76 x MP/92-35 following the recurrent breeding selection method at the Central Potato Research Institute campus, Modipuram, Uttar Pradesh.

Morphologically, MP/99-322 is of medium height with open canopy; stem medium thick, green, and wings feebly developed and straight; leaflet width narrow, leaflet coalescence frequency low, rachis and midrib pigmentation absent; flowering profuse, floral stalk light purple, floral stalk-pedicel articulation poorly visible and located above the middle, calyx partially pigmented, bud green to light purple, corolla purple, corolla shape semi-stellate, anther yellow and cone normally developed, stylar length longer than stamen column and stigma bi-lobed; tuber oval/oblong, skin yellow, eyes shallow, eyebrows slightly raised, and flesh cream/pale yellow. Sprout purple/red-purple, shape conical, pubescence and tip closed. It yields between 26-30 t/ha in a crop of 90 days with 87-95% processing grade (>45 mm diameter) tubers and between 31-34 t/ha in a crop of 105 days with 90-95% processing grade tubers in West-Central plains at Modipuram. The hybrid has very high tuber dry matter vis-à-vis starch content at Modipuram in West-Central plains an area known for producing low dry matter potatoes (Table 1). Further, it has lower

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Central Potato Research Institute, Shimla 171 001 (Himachal Pradesh)

MP/99-322 is the first Indian potato (*Solanum tuberosum* ssp. *tuberosum*) hybrid with higher starch content (> 17%), higher dry matter (>23%), low amylose content (< 27.3%), high amylopectin (>72.7%) and resistance to late blight. This hybrid was identified from the F_1 progeny of a cross MP/91-76 x MP/92-35 following the recurrent breeding selection method at the Central Potato Research Institute campus, Modipuram, Uttar Pradesh.

Morphologically, MP/99-322 is of medium height with open canopy; stem medium thick, green, and wings feebly developed and straight; leaflet width narrow, leaflet coalescence frequency low, rachis and midrib pigmentation absent; flowering profuse, floral stalk light purple, floral stalk-pedicel articulation poorly visible and located above the middle, calyx partially pigmented, bud green to light purple, corolla purple, corolla shape semi-stellate, anther yellow and cone normally developed, stylar length longer than stamen column and stigma bi-lobed; tuber oval/oblong, skin yellow, eyes shallow, eyebrows slightly raised, and flesh cream/pale yellow. Sprout purple/red-purple, shape conical, pubescence and tip closed. It yields between 26-30 t/ha in a crop of 90 days with 87-95% processing grade (>45 mm diameter) tubers and between 31-34 t/ha in a crop of 105 days with 90-95% processing grade tubers in West-Central plains at Modipuram. The hybrid has very high tuber dry matter vis-à-vis starch content at Modipuram in West-Central plains an area known for producing low dry matter potatoes (Table 1). Further, it has lower

Table 1. Percent dry matter, starch, amylose and amylopectin in high dry matter hybrid MP/99-322

Hybrid/variety	Dry matter (%)	Starch (%)	Amylose (%)	Amylopectin (%)	Swelling* volume
MP/99-322	24.18	17.55	27.30	72.70	95.67
K. Chipsona-1	23.20	16.68	27.98	72.02	109.59
Atlantic	22.04	15.64	33.14	66.86	106.67

* mg/g of starch on moisture free basis

amylose content compared to the best control varieties and may be more useful for industrial use. It is resistant to late blight and yields between 22-25 t/ha in North-western hills at Kufri (H.P.) with very high dry matter (27-29%). West-Central plains are endowed with a long potato growing season and this medium maturing, high starch containing hybrid can, therefore, be grown in autumn for production of starch. It can be a good source in the breeding hybrid for high starch/dry matter content.

IISR-G-246 (Coll. No. 3513) (INGR No. 04110; IC432866), a Dwarf Ginger (*Zingiber officinale* Rosc.) Germplasm

B Sasikumar, K Johnson George and KV Saji
Indian Institute of Spices Research, P.O. Marikunnu, Kozhikode 673 012 (Kerala)

Ginger (*Z. officinale* R.) is an important spice and medicinal plant of export value. India is one of the major centres of diversity and has wide variability for yield and quality (Sasikumar *et al.*, 1999). The Indian Institute of Spices Research, Kozhikode maintains 756 accessions of *Zingiber* in its *ex situ* repository comprising landraces, improved varieties, putative wild relatives and the related species. IISR-G-246, is a putative wild type *Z. officinale* with dwarf plant type collected from Sabarimala hills, Pathanamthitta district, in the Western Ghats of Kerala. The accession has characteristic small rhizomes, dwarf plant stature, more tillers, small leaves, early maturity and high oil (Sasikumar *et al.*, 1995). The details of morpho-agronomic feature are listed in Table 1.

Table 1. Morpho-agronmic traits of IISR-G-246

Character	Value
Plant height (cm)	45.56
Tiller (no.)	11.20
Leaf number	19.60
Leaf length (cm)	24.68
Leaf width (cm)	2.58
Maturity (days)	198
Fresh yield (per 3 m^2 bed, kg)	7.08
Dry recovery (%)	19.6
Essential oil (%)	3.5
Fibre (%)	5.0
Oleoresin (%)	7.0

References

Sasikumar B, Krishnamoorthy B, Saji KV, Johnson K George, Peter KV and Ravindran PN (1999) Spices diversity and conservation of plants that yield major spices in India. *Plant Genetic Resources Newsletter* **118**: 19–26.

Sasikumar B, Johnson George K and John Zachariah T (1995) A note on a ginger type (*Z. officinale* R.) collected from Western Ghats. *J Spices & Aromatic Crops* **4**: 160–161.

Coll. No. 5455 (INGR No. 04111; IC370011), Black Pepper (*Piper nigrum* L.) Germplasm with High Oleoresin Content and Bold Berries

KV Saji, K Johnson George, B Sasikumar, John Zacharia and VA Parthasarathy
Indian Institute of Spices Research, P.O. Marikunnu, Kozhikode 673 012 (Kerala)

The genus *Piper* includes important cultivated species like *Piper nigrum* L. the black pepper and betel vine *P. betle* L. *Piper nigrum* is a native of Western Ghats. It is considered as the world's most important spice and rightly known as the "King of spices". Oleoresin is the major valuable product from pepper. It is a blend of volatile oil wax, pungent principle resinoids etc. It is used in food and pharmaceutical industry (Zachariah, 2000).

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Among the 68 wild accessions collected from the silent valley and Nelliampathy forests of Western Ghats, those with the berries available in sufficient quantity were used for quality analysis. Oleoresin was extracted by acetone following ASTA (1968) and piperine by using HPLC- ISO (International Standards Organisation) (1993). Quantitative analysis revealed that accession 5455 (IC370011), collected form the Elam estate of Nelliampathy has significantly high oleoresin content (Table 1).

The Table 2 below summarises the morpho-agronomic characteristics of the accession 5455. The accession can be assessed for its direct utility as a planting material for high altitude areas or can be used in the black pepper improvement programme.

Table 1. Quality attributes of wild *Piper nigrum* from Silent Valley and Nelliampathy

Coll. No.	IC No.	Locality	Place	Piperine (%)	Oleoresin (%)
5616	369961	Sairandri	Silent Valley	1.27	10.7
5419	369916	Kummatanthodu	Silent Valley	2.58	13.79
5434	369985	Pathenthodu	Silent Valley	2.04	15.9
5441	369995	Panthenthodu	Silent Valley	5.56	17.57
5442	369996	Panthenthodu	Silent Valley	6.06	21.6
5455	370011	Elam Estate	Nelliampathy	0.1	28.15

Table 2. Morpho agronomic characteristics of collection 5455

Characters	Value
Orthotropic shoot tip colour	Dark Purple
Pubescence on stem	Absent
Leaf petiole	Grooved.
Leaf petiole length (cm)	6.6 0 (Range 4.0 to 8.0 cm).
Leaf length (cm)	13. 0 (Range 11.0 to 15.0 cm).
Leaf width (cm)	9.0 (Range 7.0 to 11.5 cm).
Leaf lamina shape	Cordate
Leaf base shape	Round
Leaf tip	Acuminate
Leaf margin	Even
Leaf venation	Acrodromous
Leaf texture	Glabrous- coreaceous
Leaf hairs	Absent
Berry size	Bold
Piperine (%)	0.10
Oleoresin (%) 28.15*	

* Oleoresin content in Piper generally ranges from 8-15%.

References

Zacharia JT (2000) On-farm processing of black pepper. In: Black Pepper (ed) PN Ravindran. *Harwoo Academic Publishers*, Netherlands p. 335-354.

International Standards Organisation (ISO) bulletin 11027. (1993) Determination of Piperine content-method using High Performance Liquid chromatography.

American Spice Trade Association (ASTA) (1968) *Official Analytical Methods* 2nd Ed. American Spice Trade Association, New York p. 21.

Coll. No. 197 (INGR No. 04112; IC438344), a Dwarf Clove (*Syzygium aromaticum* (L.) Merr. & Perry) Germplasm

B Krishnamoorthy, J Rema and PA Mathew
Indian Institute of Spices Research, P.O. Marikkunnu., Kozhikode 673 012 (Kerala)

Clove, *Syzygium aromaticum* (L.) Merr. & Perry belonging to family Myrtaceae, is an important tree-spice. It is indigenous to Moluccas Islands in Indonesia, and was introduced into India during the eighteenth century by the colonial rulers. Dried, aromatic and fully-grown unopened flower-bud of clove tree is the clove of commerce.

The Indian Institute of Spices Research, Calicut, Kerala has the mandate to collect, conserve, catalogue and evaluate clove germplasm and a total of 233 accessions has been collected and conserved in the field repository at the experimental farm of the Institute. Two 16 year old clove trees were located at Black Rock Estate, Kanyakumari district, Tamil Nadu, during a collection survey (Krishnamoorthy and Rema, 1995). These trees are dwarf, bushy and about 2 m tall with a canopy width of 5 m. The main trunk is only 0.6 m in height, with profuse branches. Branching starts just 60 cm above the ground level. Each tree yields about 3 kg dry clove per year. The fruits are reddish brown and smaller than normal type. The leaves are arranged in cluster and are longer, broader and thicker with very short internodes, as compared to ordinary clove. A mean of 33.3 leaves could be observed in 12 cm shoot length. The base of the petiole is purplish. The seeds from these trees were collected during the survey and seedlings raised at the institute. The seedlings also exhibited dwarf nature and are conserved at the Institute as acc.197. The morphological characters of the dwarf clove is presented in Table 1.

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Table 1. Morphological characters of dwarf clove

Character	Value
Age	8 years
Habit	Shrub
Height	52.62 cm at 8th year (range: 35.0 cm to 67.0 cm)
Shape of tree	Bushy
Canopy	50 cm (range: 24.0 cm to 60.0 cm)
Petiole colour	Purple
Petiole length	2.3 cm (range 2.1 cm to 2.4 cm)
Leaf shape	Lanceolate
Leaf length	10.9 cm (range 8.9 cm to 11.2 cm)
Leaf margin	Wavy
Leaf texture	Glabrous

Reference

Krishnamoorthy B and J Rema (1995) Three promising morphological variants in clove (*Syzygium aromaticum* (L.) Merr. & Perry) from Tamil Nadu, *Indian J Spices and Aromatic Crops* 3: 168.

Safed Musli (*Chlorophytum Borivilianum* Sant. & Fern) Germplasm with Fleshy Roots

KA Geetha, Satyabrata Maiti and Narendra Gajbhiye
National Research Centre for Medicinal and Aromatic Plants, Boriavi, Anand 387 310 (Gujarat)

NRCCB-1 (INGR No. 04113; IC 323367)

Safed musli (*Chlorophytum borivilianum* Sant. & Fern) is widely distributed in forests of Maharashtra, Gujarat, Rajasthan & Madhya Pradesh. It is being used as a raw material for preparation of many ayurvedic tonics and therefore it is in high demand. Under the research programme on development of superior varieties a large number of collections have been assembled at the National Research Centre on Medicinal & Aromatic Plant, Anand. Evaluation of these collections for various important traits resulted in identification of NRCCB-1 as one of the superior distinct genotype. It has fleshy long, blunt ended, dark coloured and compact bunch type roots and excellent storage quality. The other characters of this line are listed in Table 1.

Table 1. Morpho-agronomic characteristics of NRCCB-1

Characters	Value
Number of leaves / plant	33.00 +/-11.00
Leaf length (cm)	33.20 +/-2.72
Leaf breadth (cm)	2.22 +/- 0.18
Leaf base (cm)	1.15 +/- 0.13
Fleshy root yield/plant	54.90 +/-4.31
Fleshy root length (cm)	12.34 +/-1.63
Dry matter content (%)	25.63 +/-2.80
Number of fleshy root/ plant	15.63 +/-4.27
Fleshy root diameter (cm)	0.91 +/-0.05
Single fleshy root weight (g)	3.55 +/-0.50

NRCCB-2 (INGR No. 04114; IC323368)

The evaluation of collections assembled at the National Research Centre on Medicinal & Aromatic Plant, Anand for various important traits resulted in identification of another distinct superior genotype NRCCB-2. This genotype of safed musli (*Chlorophytum borivilianum* Sant. & Fern) has fleshy, short, blunt ended, light coloured and diverged type roots, and has excellent storage quality. The other relevant morphological traits recorded are listed below in Table 1.

Table 1. Morpho-agronomic characteristics of NRCCB-2

Characters	Value
Number of leaves/ plant	25.33 +/- 8.02
Leaf length (cm)	22.25 +/- 0.29
Leaf breadth (cm)	1.80 +/- 0.41
Leaf base (cm)	1.01 +/- 0.20
Fleshy root yield / plant (g)	46.61 +/- 20.41
Fleshy root length (cm)	7.76 +/- 0.75
Dry matter content (%)	24.28 +/-1.28
Number of fleshy root / plant	28.83 +/-14.44
Fleshy root diameter (cm)	0.80 +/- 0.05
Single fleshy root weight (g)	1.79 +/- 0.37

Table 1. Morphological characters of dwarf clove

Character	Value
Age	8 years
Habit	Shrub
Height	52.62 cm at 8th year (range: 35.0 cm to 67.0 cm)
Shape of tree	Bushy
Canopy	50 cm (range: 24.0 cm to 60.0 cm)
Petiole colour	Purple
Petiole length	2.3 cm (range 2.1 cm to 2.4 cm)
Leaf shape	Lanceolate
Leaf length	10.9 cm (range 8.9 cm to 11.2 cm)
Leaf margin	Wavy
Leaf texture	Glabrous

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Table 1. Morpho-agronomic characteristics of NRCCB-1

Characters	Value
Number of leaves / plant	33.00 +/-11.00
Leaf length (cm)	33.20 +/-2.72
Leaf breadth (cm)	2.22 +/- 0.18
Leaf base (cm)	1.15 +/- 0.13
Fleshy root yield/plant	54.90 +/-4.31
Fleshy root length (cm)	12.34 +/-1.63
Dry matter content (%)	25.63 +/-2.80
Number of fleshy root/ plant	15.63 +/-4.27
Fleshy root diameter (cm)	0.91 +/-0.05
Single fleshy root weight (g)	3.55 +/-0.50

NRCCB-2 (INGR No. 04114; IC323368)

The evaluation of collections assembled at the National Research Centre on Medicinal & Aromatic Plant, Anand for various important traits resulted in identification of another distinct superior genotype NRCCB-2. This genotype of safed musli (*Chlorophytum borivilianum* Sant. & Fern) has fleshy, short, blunt ended, light coloured and diverged type roots, and has excellent storage quality. The other relevant morphological traits recorded are listed below in Table 1.

Table 1. Morpho-agronomic characteristics of NRCCB-2

Characters	Value
Number of leaves/ plant	25.33 +/- 8.02
Leaf length (cm)	22.25 +/- 0.29
Leaf breadth (cm)	1.80 +/- 0.41
Leaf base (cm)	1.01 +/- 0.20
Fleshy root yield / plant (g)	46.61 +/- 20.41
Fleshy root length (cm)	7.76 +/- 0.75
Dry matter content (%)	24.28 +/-1.28
Number of fleshy root / plant	28.83 +/-14.44
Fleshy root diameter (cm)	0.80 +/- 0.05
Single fleshy root weight (g)	1.79 +/- 0.37

Elaichi (INGR No. 04115; IC427821), a Mango (*Mangifera indica* L.) Germplasm with Tolerance to Floral Malformation

S Rajan, Ram Kumar, SS Negi, AK Mishra, GC Sinha and IS Yadav
Central Institute for Subtropical Horticulture, Lucknow 227 107 (Uttar Pradesh)

Mango malformation is the most important disease of mango (*Mangifera indica* L.) causing considerable yield losses to mango production. Development or identification of genetic resistance to malformation is the only practical approach. A large number of mango germplasm has been assemble at the Central Institute for Subtropical Horticulture, Lucknow and was screened against malformation on a scale of 0-5 between 1994 & 1997. During the screening the cultivar, Elaichi was found completely free form floral and vegetative malformation. Elaichi, though has small (4.5 x 4.5 cm) fruit size, possesses several good characters , such as large number of fruits, high yield and regulated bearing with semi-dwarf canopy. The pulp, skin and stone ratio is about 8:1:1. This cultivar is being used in breeding programme to develop mango varieties resistant/ tolerant to malformation at the Central Institute for Subtropical Horticulture, Lucknow.

Wild Mango (INGR No. 04122; IC409079), a Natural Wild Germplasm of Mango (*Mangifera andamanica* King.) from Andaman Islands with Regular Bearing, Disease Resistance and Wood Value

DR Singh and RP Medhi
Central Agricultural Research Institute, Port Blair 744 101 (Andaman and Nicobar Islands)

The genus *Mangifera* belongs to the order Sapindales in the family Anacardiaceae. The genus *Mangifera* consists of 69 species, mostly restricted to tropical Asia. Wild mangoes occur in India, Sri Lanka, Bangladesh, Myanmar, India (Sikkim), Thailand, Korea, Vietnam, Laos, southern China, Malaysia, Singapore, Indonesia, Brunei, the Philippines, Papua New Guinea and the Solomon and Caroline Islands. In India, this genus was earlier known by six species, of which four, viz; *M andamanica, M. camptosperns, M. indica* and *M. nicobarica* were reported from the Andaman and Nicobar islands. *M. andamanica* is endemic and rare, distributed in the Andaman forest. It is found wild in south Andaman (Chouldari and Chidyatapu, as cited by Singh *et al.*, 2002). The species has been collected, conserved and multiplied at the Central Agricultural Research Institute, Port Blair.

It is a large tree of 30- 40 m height, leaves are 3-5 inch long, obovate to broadly oblanceolate or elliptic, lateral nerves 10-12 pairs, curving upwards, petioles 0.5-1 inch long, channelled, flowers ¼ inch in diameter; petals twice as long as the lanceolate sepals and drupe 1-1.5 inch long (Table 1). Fruits are small, yellowish orange in colour and ripen in March-April. The fruits are free from pests and diseases (Medhi and Singh, 2004). The fruits are good source of vitamin A and C (98.50 mg/ 100g) with TSS 8.60 percent. The total sugar and reducing sugars in the fruit was 3.47 and 1.51 percent respectively (Singh *et al.*, 2005). The tree has a long straight bole with maximum canopy located at the top. The rootstock can be used in resistance breeding (Singh *et al.*, 2002-03) and wood for timber purpose.

Table 1. Some salient features of *Mangifera andamanica* King

Features	Value
Fruit Shape	Plum shaped
Fruit Surface	Smooth
Fruit weight (g)	18.30
Colour of the fruit	Yellowish Orange
Length/ Breadth of the fruit	3.62/ 2.76
Colour of the cotyledon	Lavender
Surface of the stone	Hairy
Weight of the stone	4.02
Pulp (%)	57.05
Juice (%)	42.73
TSS (%)	8.6
Acidity	0.37
Total Sugar (%)	3.47
Reducing Sugar (%)	1.51
Vitamin C mg/100g	98.50

Elaichi (INGR No. 04115; IC427821), a Mango (*Mangifera indica* L.) Germplasm with Tolerance to Floral Malformation

S Rajan, Ram Kumar, SS Negi, AK Mishra, GC Sinha and IS Yadav
Central Institute for Subtropical Horticulture, Lucknow 227 107 (Uttar Pradesh)

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Pulp (%)	57.05
Juice (%)	42.73
TSS (%)	8.6
Acidity	0.37
Total Sugar (%)	3.47
Reducing Sugar (%)	1.51
Vitamin C mg/100g	98.50

References

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Singh DR, BL Attri, RP Medhi, Kissan Swaroop and VB Pandey (2002-03) *"Andaman Nicobar mein phal utpadan ka bhavishya" Krishika*. Published by Director, CARI Port Blair, p-29

Hybrid Guava, *Psidium molle* x *P guajava* (INGR No. 04116; IC427822), with Resistance to Guava Wilt

S Rajan, Ram Kumar, AK Mishra and SS Negi

Central Institute for Subtropical Horticulture, Lucknow 227 107 (Uttar Pradesh)

All varieties of *Psidium guajava* are susceptible to wilt diseases. *Psidium molle* has field resistance against the guava wilt, because of having tough textured plant. It can be used as a rootstock, but its poor rooting habit interferes in it multiplication. Therefore, a hybrid population was raised from a cross, *Psidium molle* x *P guajava* and was screened against the guava wilt at the Central Institute for Subtropical Horticulture, Lucknow. It was screened against guava wilt by growing the F_1 population in wilt sick plot and repeated inoculation with standardised stem hole inoculation technique with potent guava wilt pathogen *viz., Gliocladium roseum, Fusarium oxysporum* and *F. solani*. None of the plant of the F_1 hybrid showed wilting and therefore were considered resistance. Thus *Psidium molle* and F_1 hybrid between *Psidium molle* x *P guajava* can be used a source of guava wilt resistance.

Ornamental Jatropha Interspecific Hybrids (*Jatropha curcas* x *J. integerrima*)

M Sujatha and AJ Prabakaran

Directorate of Oilseed Research, Rajendranagar, Hyderabad 500 030 (Andhra Pradesh)

Soumya (INGR No. 04117; IC427819)

Soumya is an ornamental Jatropha interspecific hybrid (*Jatropha curcas* x *J. integerrima*) with pink flower and continuous flowering. The Directorate of Oilseed Research, Hyderabad developed it through interspecific hybridisation. *J. curcas* and *J. integerrima* are two economically important species. The F_1 hybrids are vigorous, freely flowering, luxuriant and morphologically intermediate between the two parents. The distinctness of the hybrids lies in the petal colour and the continuous flower bearing character. Unlike the parents, bearing yellowish-green and crimson-red, flowers Soumya has pink flowers. The robust and attractive plant type and pink colours are added advantages as an ornamental plant compared to *J. integerrima*, which has sparse branching and relatively few flowers. The hybrids can be easily propagated through stem cuttings. Backcrossing of the hybrids with *J. curcas* resulted in progeny with improved fruit and seed characteristics and hence, offers promise in improvement of *J. curcas*. The hybrids are adaptable for diverse situations including poor soils.

Swetha (INGR No. 04118; IC427820)

Swetha is another ornamental Jatropha interspecific hybrid (*Jatropha curcas* x *J. integerrima*) with white flower and continuous flowering. It is a sister line developed through interspecific hybridisation between two economically important species viz., *J. curcas* and *J. integerrima*. The F_1 hybrids are vigorous, freely flowering, luxuriant and morphologically intermediate. Unlike the parents they have white flowers. The more robust and attractive plant type of the hybrid white flowers adds to ornamental value compared to parents. The hybrids can be easily propagated through stem cuttings. Backcrossing of the hybrids with *J. curcas* resulted in progeny with improved fruit and seed characteristics and hence, offers promise for improvement of *J. curcas* per se. The hybrids are adaptable for diverse situations including poor soils.

References

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Plant Germplasm Registration Notice*

The Plant Germplasm Registration Committee of **ICAR in its XIVth meeting held on 11th August 2005** at the National Bureau of Plant Genetic Resources, New Delhi approved the registration of following 34 germplasm lines out of the 105 proposals considered.

T 1471 (Kodiyan) (INGR No. 05001; IC471839), Rice (*Oryza sativa*) Germplasm with Anaerobic Respiration Tolerant Seedling

BC Patra and RK Sarkar
Central Rice Research Institute, Cuttack 753 006 (Orissa)

The rice germplasm, namely, T-1471 (Ac. No. 1631, Kodiyan, INGR No. 05001, IC471839), a photosensitive cultivar was collected from the farmer's field in Malabar region of erstwhile Madras Presidency and identified at the Central Rice Research Institute, Cuttack. This germplasm line provides a new source of anaerobic seedling tolerance. In the rain-fed lowland rice ecosystem, direct seeding is common as the land gets submerged after the first monsoon showers. Direct seeding induces robustness so that the seedlings can avoid complete submergence in the peak monsoon months of July-August. However, there is substantial and heavy loss when there is torrential rain followed by early flooding. Kodiyan is a potentially valuable germplasm line, which sustains early flooding even after 5 days of sowing/ planting and also grows well under anaerobic condition (Sarkar and Das, 2003). Besides, this germplasm would be of immense use as a valuable gene source in irrigated rice where wet direct seeding is practiced instead of transplanting. Although wet sowing is more economical than transplanting, 3 major constraints, viz. inconsistent seedling establishment, greater weed infestation and higher lodging incidence create hindrances in adopting this technology. Anaerobic seedling establishment can solve these problems (Sarkar *et al.*, 1999). The morpho-agronomic traits of the germplasm are described in Table 1.

Table 1. Chief descriptive morphological characteristics of rice germplasm T-1471 (Kodiyan, AC-1631)

Characteristics	T-1471(Kodiyan)
Height of 21 days old seedling (cm)	34
Leaf length(cm)	44.8
Leaf width(cm)	1.1
Ligule length (cm)	2.2
Culm length (cm)	116.8
Culm number	7.6
Culm strength	Strong
Stigma colour	White
Awn	Absent
Panicle length(cm)	27.4
Grain length(mm)	9.4
Grain breadth(mm)	4.0
l/b ratio	2.35
1000 grain weight(gm)	26.2
Grain shape	Medium
Maturity duration(days)	143
Aroma	Absent
Coleoptile, basal leaf sheath & ligule colour	Green
Panicle exertion	Partly exerted
Panicle type	Intermediate

References

Sarkar RK and S Das (2003) Yield of rain-fed lowland rice with medium water depth under anaerobic direct seeding and transplanting. *Trop Agric* **43**: 192-198.

Sarkar RK, SK Bera and RN De (1999) Rice (*Oryza sativa*) cultivars for anaerobic seeding *Indian J of Agric Sci* **69**: 73-76.

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Pusa 1460-01-32-6-7-67 (IET-18990) (INGR No. 05002; IC522199), Basmati Rice (*Oryza sativa*) Germplasm with more Aroma, Free from Grain Chalkiness and Resistance to Bacterial Blight

VP Singh, AK Singh, SS Atwal, T Mohapatra, Minu Joseph, S Gopala Krishnan, KR Pandey and Jayshree Gopalakrishna
Division of Genetics, Indian Agricultural Research Institute, New Delhi 110 012

Pusa Basmati-1 the first semi dwarf high yielding, early maturing variety having key Basmati quality characteristics, released in 1989 is very popular with the cultivators, traders, exporters and consumers. However, it is highly susceptible to bacterial blight (BB) caused by *Xanthomonas oryzae* pv *oryzae* resulting into loss of yield and quality. Pusa 1460 has been developed at the Indian Agricultural Research Institute, New Delhi through marker assisted pyramiding of xa13 and Xa21 in the background of Pusa Basmati-1 through backcross pedigree method using IRBB55 as the donor for resistance (Joseph *et al.*, 2004). Based on molecular marker analysis Pusa 1460 is 96% similar to Pusa Basmati-1, combining excellent grain and cooking quality characteristics with high yield. It has been registered for BB resistance, more aroma and non-chalky grains.

It is semi dwarf (90-95cm) with sturdy stem, semi erect flag leaf and penultimate leaf with dark green foliage and free from purple pigmentation on any plant part. Grains are long slender with short awns. Panicles remain below the flag leaf. It was entered in Initial Varietal Trial Basmati in *Kharif* 2004. It gave 18% higher yield then Taraori Basmati in the Basmati growing region. In Haryana, which has the largest area under Pusa Basmati-1, it has given 28.3% and 95.55% more yield over Pusa Basmati-1 and Taraori Basmati respectively. Pusa 1460 was tested at 12 locations for bacterial blight and found resistant (Table 1). It can be successfully grown like any other semi-dwarf high yielding basmati varieties.

Table 1. Bacterial blight score in promising Basmati nominations in Initial Varietal Trials (Basmati) (*Kharif* 2004)

Locations	IET 18990	IET 18973	IET 18983	IET 18993	Ajaya*	PB1+
Chiplima	7	3	5	7	5	5
Faizabad	9	7	5	7	7	3
Martuteru	3	9	9	9	5	9
Raipur	3	7	7	7	7	7
Varanasi	1	1	3	1	3	5
Ludhiana I	3	NA	9	9	3	9
Ludhiana III	3	9	9	9	3	9
Ludhiana VI	3	5	9	9	3	9
DRR	9	9	9	9	3	7
Karjat	3	3	3	3	2	8
Patna	5	5	3	9	3	7
Nellore	5	9	5	3	5	5
AV. SI	4.5	5.5	6.3	6.8	4.0	6.9

Source: Screening Nurseries 2004, Insect Pest and Diseases, AICRIP, Directorate of Rice Research, Rajendranagar, Hyderabad 500 030 A.P. India.
* Resistant Check, + Susceptible Check

References

Joseph M, S Gopalakrishnan, RK Sharma, VP Singh, AK Singh, NK Singh, T Mohapatra (2004) Combining bacterial blight resistance and Basmati quality characteristics by phenotypic and molecular marker-assisted selection in rice. *Molecular Breeding* **13**: 377-387.

Wheat Genetic Stocks with Multiple Resistances

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

FLW 11 (INGR No. 05003; IC470825), Wheat (*Triticum aestivum*) germplasm with Multiple Rust Resistances

FLW11 was derived from the cross between WH542 and Hobbit at the Directorate of Wheat Research, Regional Station, Flowerdale. In addition to resistance gene from the winter wheat Hobbit, it also carries *Lr26, Sr31* and *Yr9* from WH542. This stock is completely resistant to yellow and black rusts. This stock has amber seed with test weight of 40 g, average plant height of 88 cm, and matures in about 120 days. This stock has good agronomic characteristics and high yield potential.

FLW 12 (INGR No. 05004; IC470826), Wheat (*Triticum aestivum*) Germplasm with Multiple Rust Resistances

FLW12 was derived from the cross between UP2338 and Mega at the Directorate of Wheat Research, Regional

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VP Singh, AK Singh, SS Atwal, T Mohapatra, Minu Joseph, S Gopala Krishnan, KR Pandey and Jayshree Gopalakrishna
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Pusa Basmati-1 the first semi dwarf high yielding, early maturing variety having key Basmati quality characteristics, released in 1989 is very popular with the cultivators, traders, exporters and consumers. However, it is highly susceptible to bacterial blight (BB) caused by *Xanthomonas oryzae* pv *oryzae* resulting into loss of yield and quality. Pusa 1460 has been developed at the Indian Agricultural Research Institute, New Delhi through marker assisted pyramiding of xa13 and Xa21 in the background of Pusa Basmati-1 through backcross pedigree method using IRBB55 as the donor for resistance (Joseph *et al.*, 2004). Based on molecular marker analysis Pusa 1460 is 96% similar to Pusa Basmati-1, combining excellent grain and cooking quality characteristics with high yield. It has been registered for BB resistance, more aroma and non-chalky grains.

It is semi dwarf (90-95cm) with sturdy stem, semi erect flag leaf and penultimate leaf with dark green foliage and free from purple pigmentation on any plant part. Grains are long slender with short awns. Panicles remain below the flag leaf. It was entered in Initial Varietal Trial Basmati in *Kharif* 2004. It gave 18% higher yield then Taraori Basmati in the Basmati growing region. In Haryana, which has the largest area under Pusa Basmati-1, it has given 28.3% and 95.55% more yield over Pusa Basmati-1 and Taraori Basmati respectively. Pusa 1460 was tested at 12 locations for bacterial blight and found resistant (Table 1). It can be successfully grown like any other semi-dwarf high yielding basmati varieties.

Table 1. Bacterial blight score in promising Basmati nominations in Initial Varietal Trials (Basmati) (*Kharif* 2004)

Locations	IET 18990	IET 18973	IET 18983	IET 18993	Ajaya*	PB1+
Chiplima	7	3	5	7	5	5
Faizabad	9	7	5	7	7	3
Martuteru	3	9	9	9	5	9
Raipur	3	7	7	7	7	7
Varanasi	1	1	3	1	3	5
Ludhiana I	3	NA	9	9	3	9
Ludhiana III	3	9	9	9	3	9
Ludhiana VI	3	5	9	9	3	9
DRR	9	9	9	9	3	7
Karjat	3	3	3	3	2	8
Patna	5	5	3	9	3	7
Nellore	5	9	5	3	5	5
AV. SI	4.5	5.5	6.3	6.8	4.0	6.9

Source: Screening Nurseries 2004, Insect Pest and Diseases, AICRIP, Directorate of Rice Research, Rajendranagar, Hyderabad 500 030 A.P. India.
* Resistant Check, + Susceptible Check

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Wheat Genetic Stocks with Multiple Resistances

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Directorate of Wheat Research, Regional Station, Flowerdale, Shimla (Himachal Pradesh)

FLW 11 (INGR No. 05003; IC470825), Wheat (*Triticum aestivum*) germplasm with Multiple Rust Resistances

FLW11 was derived from the cross between WH542 and Hobbit at the Directorate of Wheat Research, Regional Station, Flowerdale. In addition to resistance gene from the winter wheat Hobbit, it also carries *Lr26, Sr31* and *Yr9* from WH542. This stock is completely resistant to yellow and black rusts. This stock has amber seed with test weight of 40 g, average plant height of 88 cm, and matures in about 120 days. This stock has good agronomic characteristics and high yield potential.

FLW 12 (INGR No. 05004; IC470826), Wheat (*Triticum aestivum*) Germplasm with Multiple Rust Resistances

FLW12 was derived from the cross between UP2338 and Mega at the Directorate of Wheat Research, Regional

Station, Flowerdale. Yellow rust resistance from exotic winter wheat Mega was incorporated in to UP2338. This stock was completely resistant to yellow rust and black rust. In addition to yellow rust resistance genes from Mega, it also carries *Lr26, Sr31* and *Yr9* from UP2338. It has non-amber seed with long spikes and test weight of 43 g, average plant height about 125cm and matures in about 125 days. Yield per meter row was less than the check PBW343.

FLW 13 (INGR No. 05005; IC470827), Wheat (*Triticum aestivum*) Germplasm with Multiple Rust Resistances

FLW13 was derived from the cross between WH542 and *Yr15*(CN25087) at the Directorate of Wheat Research, Regional Station, Flowerdale. Yellow rust resistance gene derived from *Triticum turgidum* var. *dicoccoides* conferring complete seedling resistance to all stripe rust pathotypes. This stock is resistant to yellow rust. It has amber seed with test weight of 50 g and average plant height of about 100cm. It matures in about 115 days. Yield per meter row was good.

FLW 15 (INGR No. 05006; IC470828), Wheat (*Triticum aestivum*) Germplasm with Multiple Rust Resistances

FLW15 was derived through pedigree selection from the cross between PBW343 and Tc+*Lr32* at the Directorate of Wheat Research, Regional Station, Flowerdale. The average height of this stock was about 90cm and it matures in 120 days. It was completely resistant to brown and black rusts and to predominant pathotypes of yellow rust. It has amber seed with test weight of 45 g with good yield potential.

RNB 1001 (INGR No. 05007; IC470829), Wheat (*Triticum aestivum*) Germplasm with Novel Genes for Resistance to Brown, Black and Yellow Rust

RN Brahma, Bendu Dutta, M Prashar, SC Bhardwaj, M Siwaswamy and Aloka Saikia
Directorate of Wheat Research, Regional Station, Flowerdale, Shimla (Himachal Pradesh)

RNB1001 was derived from the cross between WH542 and Hobbit at the Indian Agricultural Research Institute, Regional Station, Wellington. RNB1001 is completely resistant to brown rust and is likely to carry new/novel rust resistance gene. It is also resistant to black and yellow rusts. This line is agronomically superior with good grain and yield attributes. This stock has amber seed with test weight of 40 g and average height about 100 cm. It matures very early.

Male Sterile Line in Wheat

SMS Tomar, Bhanwar Singh, Vinod and Rajendra Singh
Indian Agricultural Research Institute, New Delhi 110 012

Work carried out in some countries (Bruns and Peterson, 1998) has shown that the wheat hybrids out yield pure lines by 10-15 per cent under narrow row spacing and low seed rates. In India, hybrids have been developed by private sector and are being cultivated in small area under marginal environments. Out of many pollination control systems, the cytoplasmic genic male sterility system though cumbersome, provide useful and ecofriendly approach for hybrid seed production. However, significant effect of cytoplasmic x nuclear interaction on some traits in positive or negative direction has been observed (Ekiz and Konzak, 1991). Therefore, heterosis breeding through cytoplasmic male sterility-fertility restorer system needs to be explored (Tomar and Anbalagan, 2004). The availability of stable cytoplasmic male sterile lines and effective restorers is an essential pre-requisite for hybrid wheat breeding programme. All the three A (male sterile) B (maintainer) and R (restorer) lines are needed for successful hybrid seed production. Therefore, a programme for development of cytoplasmic male sterile lines at the Indian Agricultural Research Institute, New Delhi was initiated resulting in identification of following distinct lines in combination of other desirable traits.

Station, Flowerdale. Yellow rust resistance from exotic winter wheat Mega was incorporated in to UP2338. This stock was completely resistant to yellow rust and black rust. In addition to yellow rust resistance genes from Mega, it also carries *Lr26, Sr31* and *Yr9* from UP2338. It has non-amber seed with long spikes and test weight of 43 g, average plant height about 125cm and matures in about 125 days. Yield per meter row was less than the check PBW343.

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Pusa 2022A & HW 2022 (B line) (INGR No. 05008; IC524013 & IC524282), Wheat (*Triticum aestivum*) Germplasm with Cytoplasmic Male Sterility and Resistance to Rust

Cytoplasmic male sterile line Pusa 2022 A carries cytoplasm from *Triticum araraticum* (2n=4x=28, genome AAGG). The characteristic feature of Pusa 2022A is that it has club shaped ear head and exhibits resistance to leaf rust. It has got desirable plant height suitable for hybrid seed production. Its maintainer is HW 2022 a backcross derivative of WH 147 (commercial cultivar in Central India) carrying highly effective rust resistance genes Sr 26 – Sr 24/Lr 24 from *Agropyron elongatum.*

Pusa 2019A/11 & HW 2019 (B line) (INGR No. 05009; IC524014 & IC524283), Wheat (*Triticum aestivum*) Germplasm with Cytoplasmic Male Sterility, Dwarfness and Resistance to Rust

Cytoplasmic male sterile lines Pusa 2019A/11 carry cytoplasm from *Triticum timopheevi* (2n=4x=28, genome AAGG). Its maintainer is a backcross line HW 2019 developed from a commercial cultivar WH 542. The backcross derivative of WH 542 is carrying 1BL.1RS translocation from *Secale cereale* and possesses complex genes Sr31Lr26Yr9Pm8. In addition, it carries highly effective rust resistance genes Sr24/Lr24 from *Agropyron elongatum.*

Pusa 2099A & HW 2099 (B line) (INGR No. 05010; IC524015 & IC524284), Wheat (*Triticum aestivum*) Germplasm with Cytoplasmic Male Sterility, High Grain Number per Spike and Resistance to all Three Rusts

Cytoplasmic male sterile lines Pusa 2099 A carries cytoplasm from *Triticum araraticum* (2n=4x=28, genome AAGG) and therefore it is a diverse line for hybrid seed production. Its maintainer is HW 2099, which carries highly effective resistance genes for all the three rusts. The characteristic features of this line are that it produces high grain number per/spike and possesses other desirable yield components.

Pusa 2338A/20 & UP 2338A/20 (B line) (INGR No. 05011; IC524016 & IC524285), Wheat (*Triticum aestivum*) Germplasm with Cytoplasmic Male Sterility, Non Synchrony and Resistance to Stem Rust

Cytoplasmic male sterile Pusa 2338A/20 carries cytoplasm from *Triticum timopheevi* (2n=4x=29, genome AAGG) and therefore it is a diverse line for hybrid seed production. The maintainer of Pusa 2338A/20 is a commercial cultivar, UP 2338, which carries a segment 1 BL.1RS from *Secale cereale* possessing the genes Sr31Lr26Yr9Pm8. The alien segment from rye is known for yield enhancement.

Pusa 2046A/8 & HW 2046 (B line) (INGR No. 05012; IC524017 & IC524286), Wheat (*Triticum aestivum*) Germplasm with Cytoplasmic Male Sterility, Waxy Bloom and Resistance to Leaf Rust

Cytoplasmic male sterile line Pusa 2046/8 carries cytoplasm from *Triticum timopheevi* (2n=4x=28, genome AAGG). The maintainer of this A line is HW 2046, which is a backcross derivative of HD2329 carrying highly effective rust resistance genes Sr 24/Lr 24 from *Agropyron elongatum.*

PWR 4099 (INGR No. 05013; EC414149), a New Restorer Wheat (*Triticum aestivum*) Germplasm of *timopheevi* and *araraticum* Cytoplasm

PWR 4099 (pedigree = CBHW-R CHN QI RR 925 OCHN S-4BV97 = EC 414149) is an exotic line, which restores complete fertility in the CMS lines carrying cytoplasms from *T. araraticum* and *T. timopheevi.* Genetic studies have revealed that PWR 4099 carries two genes with cumulative effect in fertility restoration. Also this line produce pollen in abundance and the flowering time also coincides with a few CMS lines. The line has also exhibited resistance to stripe rust. The ear is club shaped and the grain number per spike is also high.

PWR 4101 (INGR No. 05014; EC414148), a New Restorer Wheat (*Triticum aestivum*) Germplasm of *timopheevi* and *araraticum* Cytoplasm with Resistance to Yellow Rust

PWR 4101 (pedigree- CBHW-R CHN 89R 4294 OCHN S-2BV97, EC 414148) is an exotic line, which restores complete fertility in the cytoplasmic male sterile (CMS) lines carrying cytoplasms from *T. araraticum* and *T. timopheevi.* The genetic basis of fertility restoration in CMS lines of wheat and rice have been investigated extensively (Yang *et al.*, 1989; Nonaka, *et al.*, 1993; Tomar and Anbalagan, 2004), but it is still to be resolved for locally developed and adapted CMS and restorer lines. Any CMS system would be complete only when restorer genes are available. Genetic studies have revealed that PWR 4101 carried a single dominant gene for fertility restoration. This line produces pollen in abundance and the flowering time also coincides with a few CMS lines. The line has exhibited resistance to stripe rust. It is a diverse line as it differs from PWR 4099 with respect to fertility restorer genes and in various agronomic traits.

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Selection T2600 (INGR No. 05015; EC414148), Wheat (*Triticum aestivum*) Germplasm a New Source of Leaf and Stem Rust

SMS Tomar, Bhanwar Singh, Vinod and Rajendra Singh
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Wheat rusts, particularly, leaf rust (*Puccinia triticina* syn. *Puccinia recondita tritici* Rob. Ex Desm.) occur world wide and are known to cause significant losses in wheat production. Leaf rust is highly variable and is known to have many patho-physiological races or biotypes. About 55 *Lr* genes providing resistance to a range of leaf rust pathotypes have been documented (Marais *et al.*, 2005). Amongst a large number of designated *Lr* genes, many have their origin in *Triticum aestivum* and most of them have become ineffective to virulent Indian pathotypes (Menon and Tomar, 2001). However, the resistance genes introgressed from alien species provided useful resistance to a broad spectrum of leaf rust pathotypes. But in recent past the resistance conferred by the genes, Lr9 (*Aegilops umbellulata*), Lr 19 (*Agropyron elongatum*) and Lr26 from *Secale cereale* has also been overcome by newly evolved biotypes, namely, 77-6, 77-8 and 77-1 respectively of 77 races. This has necessitated to hunt for new sources of resistance continuously, to combat the rust infection.

Triticum miliitnae, a free threshing mutant of *T. timopheevi* (2n=4x=28, genome, AAGG) exhibited complete resistance to Indian leaf rust races. Genetic resistance from *T. militinae* was introgressed to hexaploid wheat though cytogenetical manipulations at the Indian Agricultural Research Institute, New Delhi. Out of many derivatives, the selection T2600 showed resistance to a wide range of physiological races of leaf rust in seedling as well as in adult stage. Genetic studies revealed that resistance in selection T2600 is controlled by a single dominant gene, which is located in 6B chromosome (Nanthakumar and Tomar, 2002). Further, test of allelism indicated that the resistance imparted by selection T2600 is similar to that exhibited by *Aegilops umbellulata* derived gene Lr9, which is also located in chromosome 6B. Literature reveals that homologous group of VI chromosome is frequently involved in translocations; therefore, the resistance in selection T2600 may be diverse and will be useful in wheat breeding.

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S 437-1 (INGR No. 05016; IC471842), Sorghum (*Sorghum bicolor*) Germplasm with Low Hydrocyanic Acid, High Protein and High *in vitro* Dry Matter Digestibility

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Forage Research Section, CCS Haryana Agricultural University, Hisar 125 004 (Haryana)

In forage sorghum for fodder quality and resistance to foliar diseases and insect-pests are the most important criteria for realizing animal performance for milk, meat and draft. The genotype S 437-1 developed at the Forage Research Section, CCS Haryana Agricultural University, Hisar is a superior line with low Hydrocyanic acid (HCN) content (88 ppm), high protein percentage (7.7 %) and high protein yield (9.70 q/ha). It has high *in vitro* Dry Matter Digestibility (IVDMD) per cent and high Digestible Dry Matter (DDM) yield, which are 7.7 % and 9.7 q/ha, respectively. Also, it expressed resistance against three major foliar diseases *viz*., grey leaf spot, *Cercospora sorghi* (1.2 score), zonate leaf spot, *Gloeocercospora sorghi* (1.5 score) and sooty stripe, *Ramulispora sorghi* (1.6 score) and two most important insect-pests of forage sorghum, namely, shoot fly, *Atherigona soccata* (19% dead hearts) and stem borer, *Cochilo porrtellus* (25% dead hearts) at multi-location testing for 2 years *i.e.* 2002 and 2003 (Anonymous, 2002, 2003).

This genotype was developed through pedigree selection method from a cross between S 153/V 60-1 x *Sorghum roxburghii* / P-1-3-7-1-1. *S. roxburghii* has multiple resistances against insects and foliar diseases and V 60-1 possesses better quality traits. It is tall, juicy, tan type with dull green midrib and long anthers. It gives 413 q/ha of green fodder and 132 q/ha of dry matter yield. It is widely adapted and should be sown at the first available opportunity after first monsoon showers, preferably between 25th June and 10th July. Seed should be sown at a depth of 2.5–4.0 cm in rows 30 cm apart. Seed rate of 16-20 kg/acre helps to get maximum fodder yield. In irrigated areas, application of 32 kg N and 12 kg P_2O_5 per acre are recommended to get best returns. Half dose of nitrogen and full dose of P_2O_5 should be applied as basal dose and remaining nitrogen should be top dressed at 30-35 days after sowing. Water stagnation should be avoided. Need based one or two irrigation and weeding may be done at an interval of 15-20 days.

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PBL-123 (INGR No. 05017; IC524012), Berseem (*Trifolium alexandrinum*) Germplasm with Purple Leaflet and Flowers

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Importance of distinct and dominant markers to estimate the extent of natural cross pollination has been emphasised by many workers (Bogdan 1966, Jain 1979 and Sohoo *et al.*, 1988). In Egyptian clover purple flowered strains are rare and utilisation of this trait as a marker would help in understanding of the breeding behaviour of this species (Beri *et al.*, 2001). PBL-123, a purple flowered strain was found as a spontaneous mutant at the Punjab Agricultural University, Ludhiana. Its stem is comparatively hard and has more dry matter content compared to normal plants providing green fodder of improved nutritional quality. Its leaflets are purple green, longer and of narrow size at the time of flowering. It has bold seeds. It can be sown in the end of September, maturing by the end of May, thus supplying green fodder in repeated cuttings.

References

Beri SM, BL Bhardwaj and SR Sharma (2001) Natural Cross pollination in Egyptian clover. *Crop improve.* **28(2):** 191-194.

Bogdan AV (1966) Pollination and breeding behaviour in the *Trifolium ruepellianum* complex in Kenya. *The New Phytologist* **65**: 417-422.

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S 437-1 (INGR No. 05016; IC471842), Sorghum (*Sorghum bicolor*) Germplasm with Low Hydrocyanic Acid, High Protein and High *in vitro* Dry Matter Digestibility

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Forage Research Section, CCS Haryana Agricultural University, Hisar 125 004 (Haryana)

In forage sorghum for fodder quality and resistance to foliar diseases and insect-pests are the most important criteria for realizing animal performance for milk, meat and draft. The genotype S 437-1 developed at the Forage Research Section, CCS Haryana Agricultural University, Hisar is a superior line with low Hydrocyanic acid (HCN) content (88 ppm), high protein percentage (7.7 %) and high protein yield (9.70 q/ha). It has high *in vitro* Dry Matter Digestibility (IVDMD) per cent and high Digestible Dry Matter (DDM) yield, which are 7.7 % and 9.7 q/ha, respectively. Also, it expressed resistance against three major foliar diseases *viz*., grey leaf spot, *Cercospora sorghi* (1.2 score), zonate leaf spot, *Gloeocercospora sorghi* (1.5 score) and sooty stripe, *Ramulispora sorghi* (1.6 score) and two most important insect-pests of forage sorghum, namely, shoot fly, *Atherigona soccata* (19% dead hearts) and stem borer, *Cochilo porrtellus* (25% dead hearts) at multi-location testing for 2 years *i.e.* 2002 and 2003 (Anonymous, 2002, 2003).

This genotype was developed through pedigree selection method from a cross between S 153/V 60-1 x *Sorghum roxburghii* / P-1-3-7-1-1. *S. roxburghii* has multiple resistances against insects and foliar diseases and V 60-1 possesses better quality traits. It is tall, juicy, tan type with dull green midrib and long anthers. It gives 413 q/ha of green fodder and 132 q/ha of dry matter yield. It is widely adapted and should be sown at the first available opportunity after first monsoon showers, preferably between 25th June and 10th July. Seed should be sown at a depth of 2.5–4.0 cm in rows 30 cm apart. Seed rate of 16-20 kg/acre helps to get maximum fodder yield. In irrigated areas, application of 32 kg N and 12 kg P_2O_5 per acre are recommended to get best returns. Half dose of nitrogen and full dose of P_2O_5 should be applied as basal dose and remaining nitrogen should be top dressed at 30-35 days after sowing. Water stagnation should be avoided. Need based one or two irrigation and weeding may be done at an interval of 15-20 days.

References

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Anonymous (2003) Annual Report of All India Co-ordinated Sorghum Improvement Project, NRCS, Hyderabad.

PBL-123 (INGR No. 05017; IC524012), Berseem (*Trifolium alexandrinum*) Germplasm with Purple Leaflet and Flowers

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Punjab Agricultural University, Ludhiana (Punjab)

Importance of distinct and dominant markers to estimate the extent of natural cross pollination has been emphasised by many workers (Bogdan 1966, Jain 1979 and Sohoo *et al.*, 1988). In Egyptian clover purple flowered strains are rare and utilisation of this trait as a marker would help in understanding of the breeding behaviour of this species (Beri *et al.*, 2001). PBL-123, a purple flowered strain was found as a spontaneous mutant at the Punjab Agricultural University, Ludhiana. Its stem is comparatively hard and has more dry matter content compared to normal plants providing green fodder of improved nutritional quality. Its leaflets are purple green, longer and of narrow size at the time of flowering. It has bold seeds. It can be sown in the end of September, maturing by the end of May, thus supplying green fodder in repeated cuttings.

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Sohoo MS, SM Beri and BL Bhardwaj (1988) Inheritance of purple flower colour in Egyptian clover *Trifolium alexandrinum J. Res. Punjab agri. Univ.* **25(1):** 6-8.

NM-58 (INGR No. 05018; IC522204), a Non-lodging Type Sesame (*Sesamum indicum*) Germplasm

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Lodging is a serious problem in crop plants. In sesame (*Sesamum indicum* Linn.), at the Bhabha Atomic Research Centre, Trombay, Mumbai, a stiff stem mutant (NM-58), non-lodging type was identified (Murty and Bhatia, 1987). It was isolated in M_2 generation after exposing the dry seeds of cv. N-8 to 600 Gy gamma rays followed by a treatment with 1% ethyl methane sulphonate for 3 h at 25°C. The mutant bred true in the M_3 and subsequent generations (Murty and Bhatia, 1987, Murty *et al.*, 1995).

The mutant has bushy habit, slower growth rate and is non-lodging compared to its parent. Although number of nodes on main stem is similar to that of parent, number of nodes per unit length is less along with shorter internode length, contributing to shorter plant height. It has bushy appearance due to more number of primary and secondary branches. Capsule size is slightly smaller, while number of capsules and seed yield per plant are similar to the parent. Anatomically, NM-58 has greater proportion of xylem both in ridges and furrows in the terminal and basal portions of stem compared to N-8. Besides, sclerenchymatous phloem fibres are seen in terminal portion of stem in NM-58, while in N-8 they are present only in basal portion. Cortex in NM-58 is comprised of collenchyma, while in N-8 only parenchyma is seen. These anatomical differences appear to contribute for stem stiffness in the mutant. Genetic studies on NM-58 revealed that the mutant trait is governed by duplicate recessive genes, for which gene symbols stf1 and stf2 are proposed (Murty *et al.*, 1995).

References

Murty GSS and CR Bhatia (1987) Lodging due to weak stem, a major problem in sesame improvement. *Sesame and Safflower Newsletter* **3**: 9-13.

Murty GSS, CK Salunkhe and DC Joshua (1995) Inheritance of an induced stiff stem mutant in sesame. *Sesame and Safflower Newsletter* **10**: 62-66.

Bollworm and Jassid Tolerant Diverse Cytoplasmic Strains

SL Ahuja[1], SK Banerjee[1], Jagmail Singh[3], P Singh[2], VV Singh[2], D Monga[2] and OP Tuteja[2]
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BN-ARB-16 (INGR No. 05020; IC471864): *G hirsutum* Cotton, BN (Bikaneri Nerma) with *Gossypium arboreum* Cytoplasm

BN-ARB-16 is a genetic stock having *Gossypium arboreum* cytoplasm in *G. hirsutum* cotton BN (Bikaneri Nerma). It was developed at the Central Institute for cotton Research Regional Station, Sirsa through backcross method (BC_8 generations) using elemental line DES-ARB-16 deriving cytoplasmic background from *G. arboreum* as non-recurrent parent and BN (Bikaneri Nerma), a *G. hirsutum* with *latifolium* cytoplasm as recurrent parent. Exotic *arboreum* cytoplasm influences resistance to pests as reported by various workers (Meyer, 1973; Meredith, 1979 and Singh and Verma, 1982). BN-ARB-16 has higher amount of gossypol and flavanol content in leaves and higher amount of phenols in stem and low reducing sugars and total sugars in leaves (Ahuja *et al.*, 2001). Studies of Lulefer *et al.*, (1969); Deterline (1975); Leigh, (1975) and Agarwal *et al.* (1976) indicate that high amount of gossypol, flavanol and phenol contents in plant parts contribute to lower bollworm infestation, which was considerably low in BN-ARB-16 compared to Bikaneri Nerma. The fibre quality characteristics of BN-ARB-16 are at par with Bikaneri Nerma. Table 1 shows the distinctive morphological features, biochemical components, and yield and its contributing characters.

NM-58 (INGR No. 05018; IC522204), a Non-lodging Type Sesame (*Sesamum indicum*) Germplasm

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Nuclear Agriculture and Biotechnology Division, Bhabha Atomic Research Centre, Trombay, Mumbai 400 085 (Maharashtra)

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The mutant has bushy habit, slower growth rate and is non-lodging compared to its parent. Although number of nodes on main stem is similar to that of parent, number of nodes per unit length is less along with shorter internode length, contributing to shorter plant height. It has bushy appearance due to more number of primary and secondary branches. Capsule size is slightly smaller, while number of capsules and seed yield per plant are similar to the parent. Anatomically, NM-58 has greater proportion of xylem both in ridges and furrows in the terminal and basal portions of stem compared to N-8. Besides, sclerenchymatous phloem fibres are seen in terminal portion of stem in NM-58, while in N-8 they are present only in basal portion. Cortex in NM-58 is comprised of collenchyma, while in N-8 only parenchyma is seen. These anatomical differences appear to contribute for stem stiffness in the mutant. Genetic studies on NM-58 revealed that the mutant trait is governed by duplicate recessive genes, for which gene symbols stf1 and stf2 are proposed (Murty *et al.*, 1995).

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Bollworm and Jassid Tolerant Diverse Cytoplasmic Strains

SL Ahuja[1], SK Banerjee[1], Jagmail Singh[3], P Singh[2], VV Singh[2], D Monga[2] and OP Tuteja[2]
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Table 1. Distinctive morphological, biochemical features and yield of BN-ARB-16 and Bikaneri Nerma

Morphological features	BN-ARB-16			Bikaneri Nerma		
Plant type	Lanky/robust			Lanky		
Plant height (cm)	103.33			143.00		
Number of monopodial branches/plant	3.0			2.67		
Number of sympodial branches/plant	7.33			12.0		
Hairiness	Dense hairy			Hairy		
Colour	Brown			Light pink		
Lobing	Small (3 lobed)			Narrow		
Colour	Dark green			Medium green		
Nectary/leaf	1-3			1-2		
Bolls/plant	36.67			45.0		
Boll weight (g)	2.50			2.58		
Seed cotton yield/plant (g)	85.55			91.00		
Ginning Out Turn (%)	33.0			33.00		
Lint index (g)	3.69			3.49		
Shape	Oval pointed small boll			Oval		
Seeds/locule	6-7			8		
Fuzz colour	White			White		
Seed index (g)	7.50			7.1		
2.5% span length (mm)	25.5			26.7		
Uniformity ratio (%)	49.0			45.0		
Micronaire value 10^{4} g/in	4.4			4.3		
Tenacity (g/tex) (3.2mm)	21.2			22.1		
Biochemical features	L	ST	SQ	L	ST	SQ
Gossypol (mg/g)	5.6	3.8	4.3	4.5	6.4	4.30
Reducing sugar (mg/g)	3.1	2.1	2.0	3.8	2.3	4.30
Flavanol (mg/g)	3.3	3.3	1.5	1.3	3.8	1.8
Total phenol (mg/g)	32.5	60.0	37.5	38.1	40.3	42.3
Total sugar (mg/g)	5.6	5.2	3.1	7.2	5.5	8.8
Bollworm incidence (%)	40.0 (39.1)			70.5 (59.7)		
Jassid grade	1.88			1.33		

Where L=leaves, ST= stem and SQ= square

BN-TOM-277 (INGR No. 05019; IC 471863): *G hirsutum* Cotton, BN (Bikaneri Nerma) with *Gossypium tomentosum* Cytoplasm

BN-TOM-277 is a genetic stock possessing *Gossypium tomentosum* cytoplasm in *G hirsutum* cotton BN (Bikaneri Nerma) developed at the Central Institute for cotton Research Regional Station, Sirsa through backcross method (BC_8 generations) using elemental line DES-TOM-277, deriving cytoplasmic background from *G tomentosum* used as non-recurrent parent and BN (Bikaneri Nerma), a *G hirsutum* with *latifolium* cytoplasm as recurrent parent. Exotic *tomentosum* cytoplasm has effect on resistance to pests (Meyer, 1973; Meredith, 1979 and Singh and Verma, 1982). BN-TOM-277 has higher amount of gossypol and flavanol contents in leaves and higher amount of phenols in stem and low reducing sugars and total sugars in leaves (Ahuja *et al.*, 2001). Lulefer *et al.*, (1969), Leigh (1975) and Agarwal *et al.*, (1976) has indicated that high amount of gossypol, flavanol and phenols contents contribute to lower bollworm infestation. The bollworm incidence and jassid infestation in BN-TOM-277 was considerably less compared to Bikaneri Nerma. BN-TOM-277 has fibre quality characteristics at par with Bikaneri Nerma. Table 2 presents comparative account of morphological characteristics, pest incidence, bio-chemical components, and yield and its contributing characters.

Table 2. Comparative account of BN-TOM-277 and Bikaneri Nerma characteristics

Morphological features	BN-TOM-277			Bikaneri Nerma		
Plant height (cm)	135			143.00		
Number of monopodial branches/plant	1.67			2.67		
Number of sympodial branches/plant	10.0			12.0		
Internodes length (cm)	6-10			5-10		
Colour	Dark green			Medium green		
Bolls/plant	42.67			45.0		
Boll weight (g)	2.75			2.58		
Seed cotton yield/plant (g)	84.67			91.00		
Ginning Out Turn (%)	33.00			33.00		
Lint index (g)	3.45			3.49		
Shape	Oval (pointed tip)			Oval		
Gossypol glands	8			8-10		
Seeds/locule	7-8			8		
Seed index (g)	7.0			7.1		
2.5% span length (mm)	25.0			26.7		
Uniformity ratio (%)	47.0			45.0		
Tenacity (g/tex) (3.2mm)	21.0			22.1		
Biochemical features	L	ST	SQ	L	ST	SQ
Gossypol (mg/g)	5.5	6.5	4.2	4.5	6.5	4.3
Flavanol (mg/g)	2.9	3.1	1.3	1.3	3.8	1.8
Total phenol (mg/g)	42.2	46.3	34.6	38.1	40.3	42.3
Total sugar (mg/g)	8.2	4.2	6.9	7.2	5.5	8.8
Bollworm incidence (%)	36.2 (37.2)			70.5 (59.7)		
Jassid grade	1.43			1.33		
Cytoplasmic background	*G. tomentosum*			*G. hirsutum*		

Where L=leaves, ST= stem and SQ= square

References

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

Ahuja SL, OP Tuteja and SK Banerjee (2001) Biochemical basis of resistance to bollworms and Jassid in cytotypes of *Gossypium hirsutum* cotton. *J Cott Res Dev* **15(1):** 87-92.

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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* p. 81-82.

SSH-1 (INGR No. 05021; IC5229943), Sugarcane and Sorghum Hybrid (*Sorghum bicolor* x *Saccharum officinarum*)

N Vijayan Nair

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The sugarcane hybrid (SSH-1/INGR No.05021) is the first ever *Sorghum bicolor* x *Saccharum* hybrid produced at Sugarcane Breeding Institute, Coimbatore with Sorghum as the female parent. The hybrid is unique, as it has sorghum cytoplasm. The pedigree of the clone is ICSA56 (Sorghum) x IJ 76316 (*Saccharum officinarum*). The hybrid is morphologically similar to the sugarcane parent, but with shorter plant type. Sorghum characters present in the hybrid included soft texture of the leaves, tight clasping of the leaf sheaths, presence of aerial roots and triangular ligule. Somatic chromosome number of the hybrid is 2n+66 indicating n+n transmission. Table 1 presents the detailed morphological characters of Sorghum x *Saccharum* hybrid.

Table 1. Morphological characters of *Sorghum bicolor* x *Saccharum* hybrid

Characters	Detail
Chromosome number	2n+66
Cane colour	Yellow
Cane thickness (cm)	1.6
Number of internodes	20
Internode length (cm)	5.0
No. of rows of root primordia	1
Bud groove	Present
Leaf length (cm)	110
Leaf width (cm)	2.4
Leaf texture	Soft
Leaf carriage	Open droopy
Leaf sheath clasping	Tight
Leaf shape	Triangular
Ligular process	Poorly developed
Aerial root	Present

Table 2. Comparative account of BN-TOM-277 and Bikaneri Nerma characteristics

Morphological features	BN-TOM-277			Bikaneri Nerma		
Plant height (cm)	135			143.00		
Number of monopodial branches/plant	1.67			2.67		
Number of sympodial branches/plant	10.0			12.0		
Internodes length (cm)	6-10			5-10		
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Lint index (g)	3.45			3.49		
Shape	Oval (pointed tip)			Oval		
Gossypol glands	8			8-10		
Seeds/locule	7-8			8		
Seed index (g)	7.0			7.1		
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Uniformity ratio (%)	47.0			45.0		
Tenacity (g/tex) (3.2mm)	21.0			22.1		
Biochemical features	L	ST	SQ	L	ST	SQ
Gossypol (mg/g)	5.5	6.5	4.2	4.5	6.5	4.3
Flavanol (mg/g)	2.9	3.1	1.3	1.3	3.8	1.8
Total phenol (mg/g)	42.2	46.3	34.6	38.1	40.3	42.3
Total sugar (mg/g)	8.2	4.2	6.9	7.2	5.5	8.8
Bollworm incidence (%)	36.2 (37.2)			70.5 (59.7)		
Jassid grade	1.43			1.33		
Cytoplasmic background	*G. tomentosum*			*G. hirsutum*		

Where L=leaves, ST= stem and SQ= square

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SSH-1 (INGR No. 05021; IC5229943), Sugarcane and Sorghum Hybrid (*Sorghum bicolor* x *Saccharum officinarum*)

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Chromosome number	2n+66
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No. of rows of root primordia	1
Bud groove	Present
Leaf length (cm)	110
Leaf width (cm)	2.4
Leaf texture	Soft
Leaf carriage	Open droopy
Leaf sheath clasping	Tight
Leaf shape	Triangular
Ligular process	Poorly developed
Aerial root	Present

E/79-42 (INGR No. 05022; IC522200), a Combined Resistant for Cyst Nematodes and Late Blight Disease of Potato (*Solanum tuberosum*) Germplasm

KS Krishna Prasad, TA Joseph, SK Pandey, IA Khan, DB Singh
Central Potato Research Institute, Regional Station, Muthorai (Tamil Nadu)

The potato cyst nematode (*Globodera pallida* and *G. rostochiensis*) and the late blight (*Phytophthora infestans*) are the major productivity constraints in potato cultivation in Nilgiri hills of Tamil Nadu. Breeding for genetic resistance is the most effective and environment friendly way to manage such diseases. Screening of potato germplasm and advanced breeding lines at the Central Potato Research Institute, Regional Station Muthorai, Tamil Nadu, a hot spot for potato cyst nematode and late blight resulted in identification of the breeding line E/79-42 as a source of resistance to both the diseases. Considering that it has resistance to both it can be effectively used in breeding for resistance to control these diseases and thereby overcoming the yield constraint. It has white flowers with high pollen fertility. The tubers are of medium size, oval, white with shallow eyes. It matures in 125-135 days.

JW 96 (INGR No. 05023; IC524019), Potato (*Solanum tuberosum*) Germplasm with Early Maturity

Raj Kumar[1], GS Kang[1], Jai Gopal[2] and SK Pandey[2]
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2 Crop Improvement Division, Central Potato Research Institute, Shimla 171 001 (Himachal Pradesh)

JW 96 is a selection from the progeny of the cross Kufri Jyoti x CP 1362. The cross was made at during 1984. The clone was selected from the progeny of this cross at the Central Potato Research Station, Jalandhar, Punjab. The breeding methodology is clonal selection from the cross between selected parents (Kumar, 2004).

Tubers of JW 96 are oval shape, white skin, large sized with shallow eyes and creamy flesh colour. JW 96 flowers profusely at Kufri. The flower is red purple. Plant is medium tall. Leaflets are ovate with entire margin. Under early (75 days) harvest, this germplasm accession yielded at par with best control Kufri Ashoka in Indian plains and plateau region in multi-location trials under All India Coordinated Potato Improvement Project from 1997-1998 to 2001-2002. It is moderately resistant to late blight

Reference

Raj Kumar (2004) Estimation of genetic variances and combining ability in potato (*Solanum tuberosum*). *Ind J Agric Sci* 74: 544-547.

IHR 3315 (INGR No. 05024; IC526794), Chilli (*Capsicum annum*) Germplasm with Fertility Restorer Genes and Resistance to PvY and CMV

K Madhavi Reddy
Indian Institute of Horticultural Research, Bangalore (Karnataka)

IIHR 3315 is a pure-line selection from ICPN 11#7 identified at the Indian Institute of Horticultural Research, Bangalore, Bangalore. It is a fertility restorer line with good general combining ability and thereby very much suitable for exploitation of heterosis. Plants are medium tall, fruits are long 13.25 cm. Number of fruits per plant are 30 and number of seeds per fruit are 70-80. It is also resistance to PVY and CMA.

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KS Krishna Prasad, TA Joseph, SK Pandey, IA Khan, DB Singh
Central Potato Research Institute, Regional Station, Muthorai (Tamil Nadu)

The potato cyst nematode (*Globodera pallida* and *G. rostochiensis*) and the late blight (*Phytophthora infestans*) are the major productivity constraints in potato cultivation in Nilgiri hills of Tamil Nadu. Breeding for genetic resistance is the most effective and environment friendly way to manage such diseases. Screening of potato germplasm and advanced breeding lines at the Central Potato Research Institute, Regional Station Muthorai, Tamil Nadu, a hot spot for potato cyst nematode and late blight resulted in identification of the breeding line E/79-42 as a source of resistance to both the diseases. Considering that it has resistance to both it can be effectively used in breeding for resistance to control these diseases and thereby overcoming the yield constraint. It has white flowers with high pollen fertility. The tubers are of medium size, oval, white with shallow eyes. It matures in 125-135 days.

JW 96 (INGR No. 05023; IC524019), Potato (*Solanum tuberosum*) Germplasm with Early Maturity

Raj Kumar[1], GS Kang[1], Jai Gopal[2] and SK Pandey[2]
1 Crop Improvement Section, Central Potato Research Station, Post Bag No. 1, Model Town P.O., Jalandhar 144 003 (Punjab)
2 Crop Improvement Division, Central Potato Research Institute, Shimla 171 001 (Himachal Pradesh)

JW 96 is a selection from the progeny of the cross Kufri Jyoti x CP 1362. The cross was made at during 1984. The clone was selected from the progeny of this cross at the Central Potato Research Station, Jalandhar, Punjab. The breeding methodology is clonal selection from the cross between selected parents (Kumar, 2004).

Tubers of JW 96 are oval shape, white skin, large sized with shallow eyes and creamy flesh colour. JW 96 flowers profusely at Kufri. The flower is red purple. Plant is medium tall. Leaflets are ovate with entire margin. Under early (75 days) harvest, this germplasm accession yielded at par with best control Kufri Ashoka in Indian plains and plateau region in multi-location trials under All India Coordinated Potato Improvement Project from 1997-1998 to 2001-2002. It is moderately resistant to late blight

Reference

Raj Kumar (2004) Estimation of genetic variances and combining ability in potato (*Solanum tuberosum*). *Ind J Agric Sci* 74: 544-547.

IHR 3315 (INGR No. 05024; IC526794), Chilli (*Capsicum annum*) Germplasm with Fertility Restorer Genes and Resistance to PvY and CMV

K Madhavi Reddy
Indian Institute of Horticultural Research, Bangalore (Karnataka)

IIHR 3315 is a pure-line selection from ICPN 11#7 identified at the Indian Institute of Horticultural Research, Bangalore, Bangalore. It is a fertility restorer line with good general combining ability and thereby very much suitable for exploitation of heterosis. Plants are medium tall, fruits are long 13.25 cm. Number of fruits per plant are 30 and number of seeds per fruit are 70-80. It is also resistance to PVY and CMA.

E/79-42 (INGR No. 05022; IC522200), a Combined Resistant for Cyst Nematodes and Late Blight Disease of Potato (*Solanum tuberosum*) Germplasm

KS Krishna Prasad, TA Joseph, SK Pandey, IA Khan, DB Singh
Central Potato Research Institute, Regional Station, Muthorai (Tamil Nadu)

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BWBH-3 (INGR No. 05025; IC526796), Brinjal (*Solanum melongena*) Germplasm with Combined Resistance to Bacterial Wilt

AT Sadashiva and TH Singh
Indian Institute of Horticultural Research, Bangalore (Karnataka)

BWBH–3 is an advanced breeding line with resistance to bacterial wilt. It was developed by crossing IIHR–3 with IIHR–322 at the Indian Institute of Horticultural Research, Bangalore. The plants are spreading type, fruits are long green in colour, weighing from 50-55 gm. It has been found to have high yield potential (60.29 tonnes per hectare).

Acc. No. 315 (INGR No. 05026; IC526796), Okra (*Abelmoschus esculentus*) Germplasm with Dwarf, Bushy Plant Type

Bijendra Singh, G Kalloo and Mathura Rai
Indian Institute of Vegetable Research, Varanasi (Uttar Pradesh)

Okra (*Abelmoschus esculentus* L.) is a medium to tall plant with multi-pickings valued for its tender and delicious fruits. Pickings of green fruit in okra becomes problem during the later stages of the crop when plant becomes tall and dense. Considering this, Okra No. 315 is identified at the Indian Institute of Vegetable Research, Varanasi with short internode's length (0.4 to 0.7 cm), dwarf plant type (12-15 cm) with bushy nature (2-3 effective branches). First flower appears from 3rd or 4th node at about 42 days after sowing. Plant bears 10-15 fruits per plant having 7-9 ridges. It was identified from gene pool of okra germplasm available at Indian Institute of Vegetable Research, Varanasi (Annual report, 2002-2003 and 2003-2004). It breeds true and can be utilized in breeding programme for development of dwarf variety with short inter-node length.

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Indian Institute of Vegetable Research (2003) *Annual Report* (2003-2004), Indian Institute of Vegetable Research, Varanasi, India, 17 p.

SA 90 (INGR No. 05027; IC526796), Pumpkin (*Cucurbita moschata*) Germplasm with High Carotenoid Content

Sudhakar Pandy, Mathura Rai and G Kalloo
Indian Institute of Vegetable Research, Varanasi (Uttar Pradesh)

SA 90 is high carotene content genotype developed through inbreeding at the Indian Institute of Vegetable Research, Varanasi. After collection, first two seasons SA 90 was maintained by sib mating /selfing. SA 90 was grown along with other 70 lines of pumpkin and analyzed for carotenoid content along with record morphological observations. The genotype SA-90 has 14.85mg (100 g edible portion) carotenoid and was considered as a promising line for carotenoid followed by Pumpkin-111(14.19mg), BP-14(13.61mg), IVPK-225(13.29mg) and IVPK-226(13.08mg). SA 90 is vigorous in vine growth. The signal plant bears 1.6 fruits, having the fruit weight 4.0-5.15 kg. The polar and equatorial circumference of fruit is 72cm and 85.5 cm, respectively. The flesh colour of fruit is dark yellow had 3.5 cm thickness. The shape of the fruit is flat round having the 3-4 month storage capacity at ambient room temperature. It is tolerant to pumpkin mosaic virus disease and fruit fly. This line with high carotenoid content may be utilized for further quality improvement of pumpkin through development of hybrids and varieties. These materials may be also utilized for study of gene action, development of mapping population and tagging.

BWBH-3 (INGR No. 05025; IC526796), Brinjal (*Solanum melongena*) Germplasm with Combined Resistance to Bacterial Wilt

AT Sadashiva and TH Singh
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Acc. No. 315 (INGR No. 05026; IC526796), Okra (*Abelmoschus esculentus*) Germplasm with Dwarf, Bushy Plant Type

Bijendra Singh, G Kalloo and Mathura Rai
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SA 90 (INGR No. 05027; IC526796), Pumpkin (*Cucurbita moschata*) Germplasm with High Carotenoid Content

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BWBH-3 (INGR No. 05025; IC526796), Brinjal (*Solanum melongena*) Germplasm with Combined Resistance to Bacterial Wilt

AT Sadashiva and TH Singh
Indian Institute of Horticultural Research, Bangalore (Karnataka)

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Acc. No. 315 (INGR No. 05026; IC526796), Okra (*Abelmoschus esculentus*) Germplasm with Dwarf, Bushy Plant Type

Bijendra Singh, G Kalloo and Mathura Rai
Indian Institute of Vegetable Research, Varanasi (Uttar Pradesh)

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Table 1. Total carotenoids content of 5 most important accession out of 70, based on maximum value

Traits	Range	Population mean	GCV	PCV	CV (%)	C Dat 5%	High value accessions
Beta carotene (mg/100g)	2.34-14.85	9.29	33.19	33.97	7.5	1.07	SA-90, Pumpkin-111, BP-14, IVPK-225, IVPK-226

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Pandey, Sudhakar, J Singh, AK Upadhaya, D Ram and Mathura Rai (2003). Ascorbate and Carotenoid Content in an Indian Collection of Pumpkin (*Cucurbita moschata* Duch. Ex. Poir.). *CGC Report* **26**: 51-53.

CARI Acc. 1 (INGR No. 05028; IC524021), *Morinda citrifolia* an Endemic Fruit of Andaman and Nicobar Islands

DR Singh and RB Rai

Central Agricultural Research Institute, Port Blair (Andaman and Nicobar Islands)

Indian mulberry, *Morinda citrifolia* belongs to the family Rubiaceae, subfamily Rubioideae. It is distributed in India, Indonesia, Hawaiian Islands, Australia, Eastern and Western Polynesia. *Morinda citrifolia* var. *citrifolia*, indigenous and distributed in Andaman & Nicobar Islands is researched at the Central Agricultural Research Institute, Port Blair. This species is found in disturbed forests, in dry to mosaic forests, in open areas near the shoreline, in pastures and in coconut plantations, around villages and wastelands. It is popularly called Noni and locally it is known as Lorang, Burma phal, Suraogi and Pongee phal. It is eaten as fruit and also used in local traditional system of medicine (Singh *et al.*, 2005).

It is a large evergreen shrub or tree attaining a height of 3-5 meters at maturity. Leaves are opposite, glossy, pinnately veined, oval shaped 25-28 cm long and 10-15 cm wide, flowers are perfect and occur in the leaf axils in clusters, corolla is white, 5-lobed, calyx 5 forming a truncated green rim. Stamens 5, ovary 2 inferior, fruits conical, yellowish white, fleshy 9.8 x 5.26 cm in diameter syncarp, soft and fetid when ripe. Seeds are brown, oblong with distinct air chamber.

It can grow on infertile soils as well in brackish tide pools near the coast. It is highly salt tolerant and is reported to gains nutritional benefit from the minerals contained in seawater (Nelson, 2005). The plants are thriving well in tsunami-affected land with the EC 6-15 dsm^{-1} and up to EC 30 dsm^{-1} has been studied in pot cultivation. It can withstand pH ranging from 4-5 to 8.5. The fruit is getting popular in a variety of forms- dried and crushed, juiced and bottled, or freeze-dried. It is being touted as a veritable cure in mitigating diabetes, cardiovascular disease, cancer, headaches, arthritis and a host of degenerative diseases, and also used in veterinary medicine (Dixon *et al.*, 1992). Nelson (2002) reported that in seed propagation of *Morinda citrifolia* without seed treatment, takes 6-12 months or more to germinate, whereas stem cuttings can be rooted within 1-2 months. Treatment with GA (800 ppm) produced cent per cent seed germination and cuttings treated with 4000 ppm IBA produced maximum percentage of rooted cuttings (Singh *et al.*, 2005)

Table 1. Nutrient Composition and analytical studies of *Morinda citrifolia* var. *citrifolia*

Sample	K[1]	Ca [1]	Mg [1]	Mn [1]	Cu[2]	Fe[2]	Juice[1]	TSS[3]	Acidity [1]	Vit C[4]
Leaf	0.1-0.1	0.5-0.6	0.1-0.10	4.5	2.2	Trace	–	–	–	–
M. Fruit	0.1-0.2	0.0004-.0006	0.01-0.05	1.56	11.9	10.7	39.0	8.4	0.1	139.1
R. fruit	0.0005-0.1	0.006-3.5	0.02-0.05	0.5-4.8	27.4	3.3-42	54.3	8.5	0.1	125-1

1 = %; 2 = ppm; 3 = °brix; 4 = mg/100g

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Acc. C 1 (INGR No. 05029; IC370415), Chinese Cassia or Cinnamon *(Cinnamomum cassia)* Germplasm with High Oleoresin Content

B Krishnamoorthy, J Rema and PA Mathew
Indian Institute of Spices Research, Kozhikode (Kerala)

Cinnamomum cassia Blume (Syn. *C. aromaticum* Nees), of family Lauraceae known as cassia cinnamon or Chinese cassia. It is a medium sized and straight trunked evergreen tree reaching a height of about 20 m. Chinese cassia is commercially grown for its aromatic bark which is used as a spice. Besides bark, cassia oleoresin, cassia oil and cassia buds are the important products, which are marketed commercially. Cassia cinnamon has a tremendous potential in the spice industry for flavouring food and beverages and in the manufacture of value added products. It has immense medicinal properties and is used by the pharmaceutical industry. It is also used by the perfume industry to a limited extent. Chinese cassia has originated in China and is cultivated commercially. China is the main producer and exporter of cassia cinnamon.

The Indian Institute of Spices Research (IISR), Calicut has conserved 408 accessions of *Cinnamomum* germplasm in the field repository, of which 25 accessions are of Chinese cassia. They were evaluated, for the bark oleoresin content, which ranged between 6 to 10.5 percent (Krishnamoorthy *et al.*, 1999). Cinnamon accession, IC370415 was identified as an elite accession with very high bark oleoresin content (10.5%). This accession was collected as seedling from Srikundra Estate, Valparai, Coimbatore District during 1990 and is maintained as C-1 (IC370415) at the IISR, Calicut. This accession could be commercially exploited for production of bark specie, which is used in food industry for flavouring food and confectionaries. Plant is 6 m tall, with an average of three main shoot and around 24 secondary shoots. The girth of main shoot one meter above ground is 18.2 cm. Leaves are large, lanceolate, young leaf light green, velvet, old dark green coriaceous, average length 27, breadth 7.8 cm with ratio of 3.46 and size index 2.1; length of petiole 1 cm brown and pungent. Bark, spicy, sweet and pungent, bark oleoresin 10.50 per cent, bark essential oil 3.45 per cent, leaf essential oil 0.5 per cent, cinnamaldehyde content in bark oil is 86.5 per cent and cinnamaldehyde content in leaf oil is 76.5 per cent.

S 288 (INGR No. 05030; IC522201), a Spontaneous Hybrid between *Coffea arabica* and *C. liberica*

Santa Ram, RL Narasimha Swamy, S Vishveshwara and D Ganesh
Division of Botany, Central Coffee Research Institute, Coffee Research Station, Post 577 117, Chikmagalur District, (Karnataka)

S. 288 was developed by pure line selection from S.26 (Thomas, 1960). This is a putative spontaneous interspecific hybrid between tetraploid *C. arabica* (2n=4x=44) and diploid *C. liberica* (2n=2x=22). This hybrid was spotted in 'Doobla Estate' in Chikmagalur District of Karnataka in 1928 and maintained at the Central Coffee Research Institute (Ramachandran and Srinivasan, 1979). This material is known for its wide adaptability. The bushes are tall, vigorous and spreading with a yield potential of 800–1000 kg/ha. It produces

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Acc. C 1 (INGR No. 05029; IC370415), Chinese Cassia or Cinnamon *(Cinnamomum cassia)* Germplasm with High Oleoresin Content

B Krishnamoorthy, J Rema and PA Mathew
Indian Institute of Spices Research, Kozhikode (Kerala)

Cinnamomum cassia Blume (Syn. *C. aromaticum* Nees), of family Lauraceae known as cassia cinnamon or Chinese cassia. It is a medium sized and straight trunked evergreen tree reaching a height of about 20 m. Chinese cassia is commercially grown for its aromatic bark which is used as a spice. Besides bark, cassia oleoresin, cassia oil and cassia buds are the important products, which are marketed commercially. Cassia cinnamon has a tremendous potential in the spice industry for flavouring food and beverages and in the manufacture of value added products. It has immense medicinal properties and is used by the pharmaceutical industry. It is also used by the perfume industry to a limited extent. Chinese cassia has originated in China and is cultivated commercially. China is the main producer and exporter of cassia cinnamon.

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large percentage of defective beans (20–30%) due to false poly-embryony (Anonymous, 1997). This material is reported to have S_H3 resistance gene introgressed from diploid species *C. liberica* (Prakash *et al.*, 2002) imparting resistance against races I and II of rust fungus *Hemileia vastatrix* (Srinivasan *et al.*, 2002). These races are the most prevalent in all coffee growing countries of the world. Thus S.288 is considered to be important source of S_H3 gene. It is reported that the virulence gene V_3 occurs at the lowest frequency in the populations of *H. vastatrix*, implying that the deployment of S_H3 in combination with S_H genes from Hibrido de Timor may prove to be very important in resistance breeding (Ram, 2005). Therefore, it has strategic as well as applied value.

It is a unique Indian coffee germplasm as source of genes for leaf rust resistance and drought in the context of Indian coffee breeding. S.288 donated the S_H3 gene (one of the resistance genes to coffee leaf rust) to the popular coffee selection S.795, the flagship coffee variety of India. S_H3 homozygous individual plants manifesting high resistance to leaf rust are being identified for use in maintenance breeding of S.795, as well as deployment of S_H3 in other breeding exercises like pyramiding resistance gene (Ram, 2001).

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S 2464 (Sln 11) (INGR No. 05031; IC522202), a Natural Self Compatible Tetraploid (*Coffea liberica x C. eugenoides*) Coffee

Santa Ram, RL Narasimha Swamy, S Vishveshwara, AGS Reddy and D Ganesh

Division of Botany, Central Coffee Research Institute, Coffee Research Station, Post 577 117, Chikmagalur District, (Karnataka)

S.2464 (Ligenioides) is a self-compatible allotetraploid of *C. liberica* x *C. eugenoides*. The plants are drought hardy and show high field tolerance to leaf rust disease (*Hemileia vastatrix*). S.2464 was born as a spontaneous tetraploid (2n=4x=44) by natural doubling of chromosomes in a single bud on a hybrid of *C. liberica* and *C. eugenioides* at the Central Coffee Research Institute, Chikmagalur and hence named as 'Ligenioides' (Reddy *et al.*, 1984). This shows characters intermediate between *C. liberica* and *C. eugenioides* and bear close resemblance to *C. arabica* (Narashimhaswamy and Vishveshwara, 1967). This hybrid evolved at central coffee research institute, India in 1955.

Ligenioides is characterized by profuse vegetative growth. The primary branches are 3–4 ft in length; internodes are short, ranging 5–6 cm; leaves are elliptical with sub-acute leaf tip, wavy margin sub-coriaceous. Tip leaves are green. Fruits are born in loose clusters and smaller than spontaneous *arabica* and other *arabica* selections. Plants are drought hardy and show high field tolerance to leaf rust disease and also observed to be least affected by white stem borer (*Xylotrechus quadripes*). The yield of this genotype is ranging from 750–1000 kg/ha under wide range of agro climatic conditions tested. It is drought hardy and is recommended for draught prone zones in the coffee growing tracts in traditional as well as in non-traditional areas in Andhra Pradesh and Orissa (Gopal, 1985 and Ganesh *et al.*, 2002). This is considered as a unique Indian coffee germplasm as it carries the genes of diploid species *C. liberica* and *C. eugenioides*, but resembles *C. arabica* in morphological features as well as beverage characteristics. It has proven

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Recombinant Inbred Lines of Wheat (*Triticum aestivum* L.) Combining Drought Resistance with High Yield

Renu Khanna-Chopra and Rajendra V Patil

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With the objective of combining drought resistance with high yield, a well-known drought resistant wheat cultivar C306 (*Ne1ne2*) was crossed with a high yielding cultivar WL711 (*ne1Ne2*) at the Water Technology Centre, Indian Agricultural Research Institute, New Delhi. The resulting F_1 hybrid (*Ne1Ne2*) was necrotic and survived up to booting stage but died before seed formation. Hence, the F_1 ears enclosed in dead leaf sheath were excised and cultured in ear culture medium (Dalal *et al.*, 1999) to obtain F_2 seeds. In F_2 generation, segregation for necrosis was observed in ratio of 9 necrotic: 7 healthy plants and only surviving healthy F_2 plants were used to raise the subsequent generations (Khanna-Chopra and Patil, 2002). In early generations (F_2 to F_4), the large segregating plant material was evaluated for number of morphological and physiological traits and yield and yield components under fully irrigated and water deficit conditions. In advanced generations i.e. from F_5 to F_8, the selected lines along with their parents were evaluated for response to water variable environments under different irrigation regimes and also using line-source sprinkler system (Hanks *et al.*, 1976) in the fields of Water Technology Centre and in the rain-fed field of Division of Agronomy, IARI, New Delhi. The selected lines were characterized for crop growth rate, cell membrane stability, water relation parameters, canopy temperature depression, water use efficiency and yield and yield components (Patil, 2005). The selected lines were also evaluated for grain characteristics and chapati making quality. The necrosis gene (*Ne1* and *Ne2*) was identified by crossing the selected lines with both the parents and by growing F_1 generation under controlled conditions. The advanced generation lines were developed by pedigree selection. Following were found to be novel and distinct for the features described below.

33. WCF8-BL10 (INGR No. 05032; IC443618)

BL10 is of medium height (110 cm), erect in habit, high yielding (600 g m^{-2}) under normal condition and shows medium yield stability (bi = 1.20) across water variable environments. The phenology is intermediate of parents. It has higher cell membrane stability, lower canopy temperature and improved water use efficiency under drought conditions. It is a carrier for *Ne2* gene of necrosis as it produced necrotic F_1 hybrid when crossed with the parent C306 (*Ne1*).

33. WCF8-W12 (INGR No. 05033; IC443619)

W12 is medium height line (120 cm) with semi-spreading growth habit and shows higher early vigour under normal and water stress conditions. It yields intermediate of parents under normal condition (550 gm^{-2}) and shows higher yield stability (bi = 0.77) across water variable environments. It is slightly early in phenology than both the parents. It is characterized by longer coleoptile,

itself to be a carrier of genes conditioning resistance against biotic adversaries like leaf rust (*Hemileia vastatrix*) and white stem borer (*Xylotrechus quadripes*) and abiotic stress (drought). This amphidiploid freely inter-crosses with a variety of *C. arabica* genotypes to yield fertile hybrids (Reddy *et al.*, 1981 and 1985) and thus constitutes an important source of new genes for breeding of *C. arabica* (Ram *et al.*, 2002 and 2004).

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BL10 is of medium height (110 cm), erect in habit, high yielding (600 g m^{-2}) under normal condition and shows medium yield stability (bi = 1.20) across water variable environments. The phenology is intermediate of parents. It has higher cell membrane stability, lower canopy temperature and improved water use efficiency under drought conditions. It is a carrier for *Ne2* gene of necrosis as it produced necrotic F_1 hybrid when crossed with the parent C306 (*Ne1*).

33. WCF8-W12 (INGR No. 05033; IC443619)

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higher cell membrane stability, lower canopy temperature and improved water use efficiency. It is a carrier for *Ne1* gene as it produced necrotic F_1 hybrid when crossed with WL711 (*Ne2*). It is characterized with grains bolder than both the parents and showed better chapati making characteristics when tested for quality traits.

34. WCF8-HT13 (INGR No. 05034; IC 443622)

HT13 is slightly taller (130 cm) than parent C306 and does not lodge, shows early semi-spreading habit and higher early vigour under normal and water stress condition. It is medium yielding (520 gm^{-2}) under normal condition and shows higher stability (0.67) across water variable environments. It is similar in phenology of parent C306 under both normal and water stress conditions. It is characterized with higher cell membrane stability, lower canopy temperature and higher water use efficiency under water stress conditions. It is carrier for *Ne2* gene as it produced necrotic F_1 hybrid when crossed with C306 (*Ne1*). It is also characterized with bolder grains than both the parents and possesses better chapati making qualities.

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BOOK REVIEW

BP Singh and Umesh Srivastava 2004. Plant Genetic Resources in Indian Perspective: Theory and Practices. Hardback, Price Rs 400/-, ISBN 81-7164-017-6, 715 pages, Directorate of Information and Publications of Agriculture (DIPA), Indian Council of Agricultural Research, New Delhi

Existence of genetic diversity is fundamental for any crop improvement related efforts. The biological diversity among plants is often underutilized and undervalued resource. The local land races are not only numerous, fulfilling a variety of needs and adapted to different conditions, but are also genetically variable adverse biotic and abiotic stresses. These genetic resources would continue playing an important role in the development of new cultivars possessing unique characteristics. Unfortunately, these valuable resources are neither conserved nor documented and utilized properly in many developing countries. It is in this context that conservation of these resources has assumed increasing importance throughout the world. Globally, an awareness has grown to conserve these valuable resources both scientifically and systematically for the benefit of our society and for posterity. It is in right earnest that the ICAR has decided to publish a book, which emphasizes on the latest concepts, methodologies, approaches and practices in the field of plant genetic resources. In view of the growing global debate on aspects such as access, benefit sharing and conservation of genetic resources for food and agriculture, it is rather essential to have all relevant literature compiled documented and published

The contents of the book are dealt with in 13 chapters, which cover a wide range of topics. In the beginning ahead to the regular chapters, an overview was done on plant genetic resources activities in Indian perspective. The first two chapters provide information on general aspects such as Plant genetic resources –Global Scenario, Plant genetic resources–Conservation and Management. Chapters 3, 4, 5 and 6 deal with History of plant genetic resources activities in India and the domestication of crop plants, the centres/ regions of diversity and the richness of crop plant diversity and its distribution in the Indian subcontinent and wild relatives of crop plants. Chapters 7 to 12 elaborate mainly, on the concepts, theories/methodologies, approaches and practices followed namely, the principles of plant germplasm exchange and quarantine regulations and their role as a national service; the techniques, principles and practices of germplasm collecting; ethnobotany in relation to plant genetic resources, methods and techniques of ethnobotanical studies, relevance of indigenous knowledge (IK) with practical approach; the evaluation and utilization of plant genetic resources, core concept, genetic enhancement and genetic manipulations with the emphasis on techniques and procedures, practical considerations, wherever possible practical protocols also followed; documentation of PGR information; different approaches to plant genetic conservation, *ex situ* and *in situ* : *ex situ* through medium-term and long-term storage the gene bank and its management, the recent approaches such as tissue culture and cryo-preservation and role of recent tools i.e., biotechnology in PGR conservation, field gene banks, community gene banks, on-farm conservation, conservation in traditional farming systems etc., *in situ* conservation relating to management of biosphere reserves. The last chapter 13 deals with emerging PGR issues in relation to multi-level and multi-dimensional conflicts of ideas over the ownership/ control, access and sustainable utilization of biodiversity, which rightly led to the development of international legal mechanisms/ global PGR scenario–such as CBD, IUPGR, WTO, TRIPS, increased relevance of MoUs and MTA in PGR management, biosafety protocols, evaluation of transgenic plants, IPR, Farmers' Rights, Breeders' Rights, terminator technology and their applications and registration of plant germplasm.

The book 'Plant Genetic Resources in Indian Perspective : Theory and Practices", the first of its kind, is expected to stimulate interest in the field of plant genetic resources among scientists, researchers, users, curators and all those who are engaged and interested in safeguarding plant biodiversity to promote sustainable agriculture intensification for the benefit of humankind. It will also be useful to teachers and post graduate students of PG School of IARI, traditional and State Agricultural Universities and equally so, by the policy makers and conservationists advocating national and global concern on plant genetic resources conservation and management.

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