# Plant Germplasm Registration Notice*

The Germplasm Registration Committee of ICAR in its XI[th] meeting held on 23[rd] October, 2003 at the National Bureau of Plant Genetic Resources, New Delhi approved the registration of following 55 germplasm lines out of the 171 proposals considered.

## Cytoplasmic Male Sterile Lines of Paddy (*Oryza sativa* L.)

**NT Hoan, MS Ramesha, EA Siddiq, BC Viraktamath, M Ilyas Ahmed, CHM Vijayakumar and NP Sarma**
*Directorate of Rice Research, Rajendra Nagar, Hyderabad-500 030, Andhra Pradesh.*

Development of the cytoplasmic male sterility using new sources is important in rice to avoid outbreak of epidemics, because more than 95 percent of the commercial hybrids are based on a unitary source, wild abortive (WA).

**DMS 4A (RPMS 1-4), DMS 4B, *(INGR No. 03048; IC 296572 & IC 296579)***

DMS 4A, a new diversified cytoplasmic male sterile (CMS) line developed through wide hybridization involving *O. rufipogon* ($VN_1$) as female and PMS 2B as male parent, followed by substitution backcrossing of the male sterile plants with the recurrent parent till $BC_8$ generation.

This new CMS line possesses very high proportion (71-81%) of round sterile pollen grains and about 19-29 per cent of typical abortive pollen grains as against high proportion of (80-85%) typical abortive pollen grains in 'WA' source (Ramesha *et al.*, 1999). Also, it does not restore fertility with IR 66 and IR 70, which are otherwise restorers of 'WA' system. Additionally, DMS 4A (RPMS 1-4A) possess better panicle exsertion (>94%), very high stigma exertion (>58%) and high out crossing ability (>46%) as compared to many 'WA' based CMS lines, like IR 58025A and IR 62829A (Ramesha *et al.*, 1999).

DMS 4A is a long duration (>140 days), non-aromatic, long slender grain type with desirable floral traits and ideal plant stature suitable for hybrid seed production. Good restorers for this source have been identified.

**DMS 3A (RPMS 4), DMS 3B *(INGR No. 03049; IC 296580 & IC 296581)***

DMS 3A is a new diversified CMS line developed through wide hybridization involving *O. nivara* (DRW 21018) as female and IR 66 as male parent. The $F_1$ hybrid plants with less than 30 percent pollen fertility were backcrossed with IR 66 until $BC_8$ to obtain complete male sterile plants. The newly developed CMS line was characterized using pollen morphology (staining pattern with one percent I-KI solution), and interaction after a test cross with a set of maintainers and restorers of the 'WA' cytoplasmic male sterile stock.

The DMS 3A possesses 75-85 percent of typical abortive sterile and 15-25 percent of round sterile pollen grains with hundred percent spikelet female fertility (Hoan *et al.*, 1997 and Ramesha *et al.*, 1999). This line has a different spectrum of restoration and maintenance reaction as compared to the 'WA'. This CMS line possesses early maturity, non-aromatic and medium slender grains with ideal plant stature for hybrid seed production. After identification of good restorers, it may be used for developing a new generation commercial hybrids.

**References**

Hoan NT, NP Sarma and EA Siddiq (1997) Identification and characterization of new sources of cytoplasmic male sterility in rice. *Plant Breedin.* **116:** 547-551.

Ramesha MS, BC Viraktamath, M Ilyas Ahmed and CHM Vijay Kumar (1999) New CMS souces with stable male sterility and better out crossing trait in rice (*O. sativa* L.) *Indian J. Genet.* **59:**403-409.

** Communicated by Dr Anurudh K. Singh, Member Secretary, Plant Germplasm Registration Committee, National Bureau of Plant Genetic Resources, ICAR, New Delhi-110 012*

# High Protein Lines of Wheat (*Triticum aestivum* L.), MBL-2 (*INGR No. 03050; IC 405230) and MBL-5 (INGR No. 03051; IC 405231)*

**Ratan Tiwari, RK Gupta, Rajender Singh and Jag Shoran**
*Directorate of Wheat Research, Karnal-132 001, Haryana*

Among the important factors influencing the milling and baking qualities of wheat is the grain protein content (GPC) with direct effect (Bushuk, 1998), and hectoliter weight and 1000-kernel weight (TKW), with an indirect contribution. Increase in grain yield usually results in decreased GPC. However, there are reports of alleles of high grain protein content without any significant reduction in the TKW (Gross *et al.*, 2003). Two high grain protein content lines, MBL-2 and MBL-5 (3-4% higher over the best parent) with amber colour were developed through selection from cross NP4 x HB 208. Recombinant inbred lines with higher protein content than either of the parents were selected from cross, NP4 x HB 208. Of these selections, MBL-2 and MBL-5 gave consistently high protein content, coupled with acceptable 1000-grain weight. These two genotypes also showed increased hectoliter weight (7%) and sedimentation value (4.5%) over parents. Testing under Quality Component Screening Nursery across the wheat growing regions showed significantly higher protein content, higher bulk density (hectoliter weight) and no reduction in the 1000-grain weight in MBL-2 and MBL-5 compared to the check, P-5-3.

Grain protein content of MBL-2 ranged from 11.63 to 16.91 (av. 14.43) percent and of MBL-5 from 11.51 to 16.57 (av. 14.22) percent, compared to 11.59 to 15.63 (av. 13.55) percent for P-5-3. Hectroliter weight or test weight ranged from 73.0 to 83.0 (av. 81.02) for MBL-2, 78.3 to 83.6 (av. 81.21) for MBL-5 compared to 68.6 to 80.8 (av. 78.08) kg per hl for P-5-3. Thousand-grain weight ranged from 30.6 to 46.2 (av. 39.30) g for MBL-2, and 34.0 to 48.8 for MBL-5 (av. 41.05) and P-5-3 (av. 39.06) g. These result reflects increase in protein content without reduction in 1000-grain weight in MBL-2 and MBL-5.

**References**

Bushuk W (1998) Wheat breeding for end-product use. *Euphytica.* **100:** 137-145.

Grossd C, N Robert, E Bervas and G Charmet (2003) Genetic anlaysis of grain-protein content, grain-yield and thousand-kernel weight in bread wheat. *Theor. Apl. Genet.* **106:** 1032-1040.

# Heterotic Pool Lines of Maize (*Zea mays* L.), MS Pool C4 (*INGR No. 03052; IC 296598) and Tux Pool C4 (INGR No. 03053; IC 296599)*

**AS Khehra[1], BS Dhillon[2], VK Saxena[1] and NS Malhi[1]**
[1] *Punjab Agricultural University, Ludhiana-14 004, Punjab*
[2] *NBPGR, Pusa Campus-110012,, New Delhi*

Heterotic pools, MS Pool C4 and Tux Pool C4 were developed with the objective of developing heterotic populations, which are genetically broad based, diverse, highly heterotic and have high performance *per se* and acceptable inbreeding tolerance (Khehra *et al.*, 1986; Dhillon *et al.*, 1997, 1998; Saxena *et al.*, 1998).

Makki Safed (MS) and Tuxpeno (Tux) pools have long duration and high yield potential (developed using Makki Safed 1-Diseases Resistant (MS1 DR) an improved indigenous flint landrace) and Tuxpeno Planta Baja C7 Ludhiana (Tux PBL), an improved dent Mexican race used as testers. MS1 DR and Tux PBL were the parents of a highly heterotic commercial hybrid Sangam (Khehra *et al.*, 1982). Initially, two cycles of reciprocal recurrent selection (RRS) were carried out in these populations to enhance the level of heterosis and *per se* performance. It was followed by two more cycles of RRS with introgression of germplasm from various sources. The material introgressed in the base populations included germplasm from US Corn Belt, and indigenous and some other germplasm. Lancaster and Stiff Stalk germplasm were assigned to Makki Safed Pool and Tuxpeno Pool, respectively. The materials contributing to the development of these pools are as follows.

MS Pool C4; Arun, Ageti 76 x (MO 17 x FR 13A), CM 104, CM 202, CM 202 x H 101, CM 202 x J 632, CM 600 x H 95, J 101, J 607, J 641, J 663, J 664, J 2006, J 660 x M 017, J 663 x FR Va 16, Kailpur Local Kalakh

# High Protein Lines of Wheat (*Triticum aestivum* L.), MBL-2 (*INGR No. 03050; IC 405230) and MBL-5 (INGR No. 03051; IC 405231)*

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**References**

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Local x MS P2, MSIDR, MSIDR x J617, MSIDR x M 017, MSDR yellow x J 617, MSDR C2, Navjot, Partap x (FR 619 x FR M 017), Partap x (M 017 x B 57), Partap x (M 017 x FR 13A), Sarhad x (FR 619 x FR 670), Tarun x MSI, Vijay and Vijay 444 x CM 202.

Tux Pool C4; CM 123, Cuba 11J, Exp. 10-5, H 104, J 1031, MC Nair Hybrid (EC 103838), Suwan 1, Suwan 1 x B 73, Suwan 1 x H 93, Suwan 2, TAD, Tuxpeno PBL, Tuxpeno C 16, Tuxpeno PBL C 1 x TAD, Tuxpeno C 17 x Suwan 1, Tuxpeno PBL x (Suwan 1 x B 73), Tuxpeno PBL x CM 206) x Tuxpeno PBL, (Tuxpeno PBL x CM 206) x Tuxpeno PBL, (Tuxpeno PBL x TAD) x Tuxpeno PBL and Z 216.

MS Pool C4 has thin long ears. The grains are mostly flint with very low frequency of semidents. Tux Pool C4 has thick ears. Its grains are flint with very low frequency of semi-dents. MS Pool C4 and Tux Pool C4 are highly heterotic to each other. They serve as reservoirs for genetic diversity and are subjected to inbreeding for derivation of inbreds. The first single cross hybrid of India, Paras, released in Punjab in 1995, had both the parental inbred lines derived from these pools.

### References

Dhillon BS, NS Malhi and VK Saxena (1997) Development and improvement of heterotic populations in maize. Book of Abstracts of an international symposium on "The Genetics and Exploitation of Heterosis in Crops", CIMMYT, Mexico, 17-22 August 1997, pp 74-75.

Dhillon BS, NS Malhi, VK Saxena and MS Grewal (1998) Development and improvement of heterotic populations in maize. *Crop improv.* **25**: 6-14.

Khehra AS, BS Dhillon, NS Malhi, VK Saxena, VV Malhotra, SK Dey, SS Pal and WR Kapoor (1986) Systematic introgression of the corn belt germplasm of maize. Proceedings of symposium New Frontiers in Breeding Researches (Eds.) B. Napompeth and S. Subhadrabandhu, Bangkok, Thailand, pp 279-285.

Khehra AS, BS Dhillon, VK Saxena, NS Malhi, WR Kapoor and VV Malhotra (1982) Sangam a new hybrid of maize with a very high yield potential. *Prog. Fmg.* **18**:7.

Saxena VK, NS Malhi, NN Singh and SK Vasal (1998). Heterosis in maize: groupings and patterns. Proceedings of the Seventh Asian Regional Maize Workshop, 23-27 Feb. 1998.

Los Baños, Phillipines. (Eds.) SK Vasa, F Gonzalez and F Xingming, pp 124-128.

## Inbred Lines of Maize (*Zea mays L.*) Post Flowering Stalk Rot (PFSR) Resistant Inbred Line, BPTTI 28 *(INGR No. 03054; IC 396382)*

**S Shankar Lingam and R Vidyasagar**

*Agricultural Rsearch Station, Amberpet, Hyderabad-500013, Andhra Pradesh*

Post Flowering Stalk Rot (PFSR) caused by a complex, comprising three fungi namely, *Cephalsporium acremonium, Macrophomina phaseolina, Fusarium moniliforme* and one bacterium *Erwinia carotovora* var. *zeae* causes severe yield losses in India. BPTTI 28 is a new ibred 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 disease sick plot that is 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 Trails. Table 1 presents the morpho-agronomic characteristics of inbred line BPTTI 28.

BPTTI 28 is an orange seeded, yellow flinted type belonging to full season maturity. The PFSR disease rating of 2.2 classifies this inbred line as highly resistant. The ideal sowing time is first week of June to first fortnight of July in *kharif*, and October 15th to November 15th in *rabi*.

### 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, pp 96-100.

**Table 1. Morpho-agronomic characteristics of inbred line BPTTI-28****

| Inbred Genotype | Days to silk | Pl. ht. (cm) | E.H. (cm) | E.L. (cm) | E.G. (cm) | Kernel Rows | Kernel (row) (g) | 100-kernel wt. (kg/ha) | Grain Yield (1-9) | Disease score* |
|---|---|---|---|---|---|---|---|---|---|---|
| BPTTI 28-1-2-1-1-2-bulk | 74R | 153 | 67 | 10 | 8 | 10 | 24 | 15.5 | 3300 | 2.2 |

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

Local x MS P2, MSIDR, MSIDR x J617, MSIDR x M 017, MSDR yellow x J 617, MSDR C2, Navjot, Partap x (FR 619 x FR M 017), Partap x (M 017 x B 57), Partap x (M 017 x FR 13A), Sarhad x (FR 619 x FR 670), Tarun x MSI, Vijay and Vijay 444 x CM 202.

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MS Pool C4 has thin long ears. The grains are mostly flint with very low frequency of semidents. Tux Pool C4 has thick ears. Its grains are flint with very low frequency of semi-dents. MS Pool C4 and Tux Pool C4 are highly heterotic to each other. They serve as reservoirs for genetic diversity and are subjected to inbreeding for derivation of inbreds. The first single cross hybrid of India, Paras, released in Punjab in 1995, had both the parental inbred lines derived from these pools.

### References

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Khehra AS, BS Dhillon, VK Saxena, NS Malhi, WR Kapoor and VV Malhotra (1982) Sangam a new hybrid of maize with a very high yield potential. *Prog. Fmg.* **18**:7.

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BPTTI 28 is an orange seeded, yellow flinted type belonging to full season maturity. The PFSR disease rating of 2.2 classifies this inbred line as highly resistant. The ideal sowing time is first week of June to first fortnight of July in *kharif*, and October 15th to November 15th in *rabi*.

### 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, pp 96-100.

**Table 1. Morpho-agronomic characteristics of inbred line BPTTI-28****

| Inbred Genotype | Days to silk | Pl. ht. (cm) | E.H. (cm) | E.L. (cm) | E.G. (cm) | Kernel Rows | Kernel (row) (g) | 100-kernel wt. (kg/ha) | Grain Yield (1-9) | Disease score* |
|---|---|---|---|---|---|---|---|---|---|---|
| BPTTI 28-1-2-1-1-2-bulk | 74R | 153 | 67 | 10 | 8 | 10 | 24 | 15.5 | 3300 | 2.2 |

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

# An Early Maturing Protogynous Maize Inbred Line, HKI 209 *(INGR No. 03055; IC 405277)*

**Sain Dass, KS Dhanju and P Arora**
*Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station, Uchani, Karnal-132 001, Haryana*

HKI-209 is an early maturing protogynous inbred line developed from an exotic material, CIMMYT population (Pool-10) by ear to row selection method. Desirable ears were selected and their progenies were subjected to inbreeding. After seven generations of inbreeding the line became uniform. One of the important distinguishing characters of this line is protogyny. In general, anthesis in maize is earlier than silking, but in this case it is reverse that is silking occurs earlier by a day. The data presented in Table 1 indicates the stability of protogyny across the season. Other important characters of this line are early maturity, tall erect narrow green leaves, green stem, lax-tassel erect, green anther; green glume, green prolific silk; husk cover-green, tight; ear cylindrical medium long, grain filling upto tip, straight kernel rows; flint grained light orange with white cap, round and medium bold. The line yields upto two ton per ha. It is resistant to Maydis Leaf Blight with a score of 2.0 on 9-point scale as compared to 4.8 of CM 600. Being protogynous, seed setting is least affected in this line as it escapes moisture stress during pollination period.

**Table 1. Days to silking and tasselling of HKI-209**

| *Kharif* | 2001 | 2002 | 2003 | Mean |
|---|---|---|---|---|
| Days to 50% tasselling | 46 | 46 | 48 | 46.7 |
| Days to 50% silking | 45 | 45 | 47 | 45.7 |
| *Rabi* | 2000-01 | 2001-02 | 2002-03 | Mean |
| Days to 50% tasselling | 134 | 134 | 136 | 134.7 |
| Days to 50% silking | 132 | 132 | 134 | 132.7 |

# An Extra Early Maturing and Stay Green Maize Inbred Line, HKI-335 *(INGR No. 03056; IC 405279)*

**Sain Dass, KS Dhanju and P Arora**
*Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station, Uchani, Karnal-132 001, Haryana*

HKI-335 is an extra early inbred line with stay-green character, selected through ear to row selection method, followed by continuous inbreeding in an exotic germplasm, Pool-10 obtained from CIMMYT. The line possesses an extra early maturing character. Three years data revealed that it takes 43-44 days for 50 percent tasselling and 45-46 days for 50 percent silking. The hybrid developed from this line is extra early possessing stay-green trait, which confirms the inheritance of the trait. Other important characteristics of the line are-semi-dropping green leaf, dense tassel, few secondary branches, purple anther, green glume, green and tight silk, cylindrical, short ear filled upto tip, irregular kernel rows; flinted, semi-dent, orange, flat and bold grains (Annual Report, 1999-2001). It is resistant to Maydis Leaf Blight with a score of 1.3 on 9-point scale as compared to 4.8 of CM 600. Early character also expressed during winter.

**Table 1. Days to silking and tasselling of HKI-335**

| *Kharif* | 2001 | 2002 | 2003 | Mean |
|---|---|---|---|---|
| Days of 50% tasselling | 43 | 44 | 43 | 43.3 |
| Days of 50% silking | 45 | 46 | 45 | 45.3 |
| *Rabi* | 2000-01 | 2001-02 | 2002-03 | Mean |
| Days of 50% tasselling | 129 | 130 | 129 | 129.3 |
| Days of 50% silking | 131 | 132 | 132 | 131.3 |

## Reference

Annual Report (1999-2001) Evaluation of selected/new inbred lines of maize against excess soil moisture. Directorate of Maize Research, Cummings Laboratory, Pusa Campus, New Delhi, pp 102-104.

# An Early Maturing Protogynous Maize Inbred Line, HKI 209 *(INGR No. 03055; IC 405277)*

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*Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station, Uchani, Karnal-132 001, Haryana*

HKI-209 is an early maturing protogynous inbred line developed from an exotic material, CIMMYT population (Pool-10) by ear to row selection method. Desirable ears were selected and their progenies were subjected to inbreeding. After seven generations of inbreeding the line became uniform. One of the important distinguishing characters of this line is protogyny. In general, anthesis in maize is earlier than silking, but in this case it is reverse that is silking occurs earlier by a day. The data presented in Table 1 indicates the stability of protogyny across the season. Other important characters of this line are early maturity, tall erect narrow green leaves, green stem, lax-tassel erect, green anther; green glume, green prolific silk; husk cover-green, tight; ear cylindrical medium long, grain filling upto tip, straight kernel rows; flint grained light orange with white cap, round and medium bold. The line yields upto two ton per ha. It is resistant to Maydis Leaf Blight with a score of 2.0 on 9-point scale as compared to 4.8 of CM 600. Being protogynous, seed setting is least affected in this line as it escapes moisture stress during pollination period.

**Table 1. Days to silking and tasselling of HKI-209**

| *Kharif* | 2001 | 2002 | 2003 | Mean |
|---|---|---|---|---|
| Days to 50% tasselling | 46 | 46 | 48 | 46.7 |
| Days to 50% silking | 45 | 45 | 47 | 45.7 |
| *Rabi* | 2000-01 | 2001-02 | 2002-03 | Mean |
| Days to 50% tasselling | 134 | 134 | 136 | 134.7 |
| Days to 50% silking | 132 | 132 | 134 | 132.7 |

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**Table 1. Days to silking and tasselling of HKI-335**

| *Kharif* | 2001 | 2002 | 2003 | Mean |
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| *Rabi* | 2000-01 | 2001-02 | 2002-03 | Mean |
| Days of 50% tasselling | 129 | 130 | 129 | 129.3 |
| Days of 50% silking | 131 | 132 | 132 | 131.3 |

## Reference

Annual Report (1999-2001) Evaluation of selected/new inbred lines of maize against excess soil moisture. Directorate of Maize Research, Cummings Laboratory, Pusa Campus, New Delhi, pp 102-104.

# Cytoplasmic Male Sterile Lines of Barley (*Hordeum vulgare* L.)

**BN Dahiya, Dalvir Singh, VS Malik and Krishan Kumar**
*Chaudhary Charan Singh Haryana Agricultural University, Hisar-125 004, Haryana*

**BHMS 12A & 12B *(INGR No. 03057; IC 405267 & IC 405268)***

BHMS 12A is a six-rowed cytoplasmic genic male sterile line of spring barley developed through repeated backcrossing using *msm*-1 as source of male sterile cytoplasm and EC 382331 as recurrent parent. In early stages the plants have erect growth, good vigour, green foliage, and broad leaves. Ear-heads are parallel in shape, having medium density and long yellowish awns. Average plant height is 115 cm. It flowers after 90 days and matures in 128 days under Hisar conditions. The BHMS-12A has synchrony in flowering with its maintainer line BHMS-12B (IC 405268). Grains are hulled, plump, finely wrinkled and yellowish, having 1000-grain weight of 43.1 g.

**BHMS 25A & 12B *(INGR No. 03058; IC 405271 & IC 405272)***

BHMS 25A a six-rowed cytoplasmic genic male sterile line of spring barley having short awns, developed by repeated backcrossing, using a male sterile cytoplasm source, two-rowed male sterile line *msm-2* and SxW 15-5 as recurrent parent. Plants of BHMS-25A in early stage have erect growth, good vigour, green foliage, and broad leaves. Leaf coleoptile and auricle are pigmented. Ear-heads are parallel in shape, dense, with short yellowish awns. Average plant height is 118 cm. It flowers after 107 days and matures in 144 days when sown in middle of November, under Hisar conditions. The line has synchrony in flowering with its maintainer line BHMS-25B (IC 405272). Grains are with hull, yellowish, finely wrinkled, long and narrow having 1000-grain weight of 38 g.

# Novel Amaranth Germplasm (*Amaranthus tricolor* L.)

**B Varalakshmi**
*Division of Vegetable Crops, Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore-560 089, Karnataka*

**Type Amaranth, AV-31 (IIHR-31) *(INGR No. 03059; IC 395324)***

AV-31 (IIHR-31) is a *'Dantu'* type (thick stem) amaranth germplasm, was developed by pure line selection from the IIHR Acc. No. 16436. It has thick and tender stem suitable for pulling type of amaranth. It is 66 cm high with 9 branches, has light pink stem and petioles with green leaves and pink veins on the under surface, Leaf weight is 80 g per plant, stem weight 140 g per plant; stem girth 7 cm and total plant weight is 220 g. It takes 34 days flower.

**White Rust Resistant Amaranth, AV-50 (IIHR-50) *(INGR No. 03060; IC 395327)***

AV-50 (IIHR-50), is a white rust [*Albugo bliti* (Biv. – Bern) Kuntze] resistant germplasm of amaranth. It is a high yielding (197 g/plant) germplasm line developed by the pure line selection from the IIHR Acc. No. 18385. The plants have a height of 53 cm with 8 branches. Leaf weight is 92 g per plant and stem weight is 105 g per plant. The stem is green with green petioles and green leaves. It takes 47 days to flower.

# Chickpea (*Cicer arietinum* L.) Mutants

**VK Gour and PM Gaur**
*Department of Plant Breeding, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur-482 004, Madhya Pradesh*

**Fasciated Stem mutant, Fasciata *(INGR No. 03061; IC 395465)***

Fasciata or Jawahar Gram Mutant-2 (JGM-2) is a fasciated broadened and flattened stem mutant developed through mutation breeding by treating the seeds of JG-315 with 0.4 percent of ethyl methane sulphonate for six hours. It was identified in $M_2$ generation. It has irregular leaf arrangement and clustering of pods at the stem tip with delayed maturity, larger seed size, having lesser yield than the parental cultivars. Inheritance studies have shown

# Cytoplasmic Male Sterile Lines of Barley (*Hordeum vulgare* L.)

**BN Dahiya, Dalvir Singh, VS Malik and Krishan Kumar**
*Chaudhary Charan Singh Haryana Agricultural University, Hisar-125 004, Haryana*

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**BHMS 25A & 12B *(INGR No. 03058; IC 405271 & IC 405272)***

BHMS 25A a six-rowed cytoplasmic genic male sterile line of spring barley having short awns, developed by repeated backcrossing, using a male sterile cytoplasm source, two-rowed male sterile line *msm-2* and SxW 15-5 as recurrent parent. Plants of BHMS-25A in early stage have erect growth, good vigour, green foliage, and broad leaves. Leaf coleoptile and auricle are pigmented. Ear-heads are parallel in shape, dense, with short yellowish awns. Average plant height is 118 cm. It flowers after 107 days and matures in 144 days when sown in middle of November, under Hisar conditions. The line has synchrony in flowering with its maintainer line BHMS-25B (IC 405272). Grains are with hull, yellowish, finely wrinkled, long and narrow having 1000-grain weight of 38 g.

# Novel Amaranth Germplasm (*Amaranthus tricolor* L.)

**B Varalakshmi**
*Division of Vegetable Crops, Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore-560 089, Karnataka*

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**White Rust Resistant Amaranth, AV-50 (IIHR-50) *(INGR No. 03060; IC 395327)***

AV-50 (IIHR-50), is a white rust [*Albugo bliti* (Biv. – Bern) Kuntze] resistant germplasm of amaranth. It is a high yielding (197 g/plant) germplasm line developed by the pure line selection from the IIHR Acc. No. 18385. The plants have a height of 53 cm with 8 branches. Leaf weight is 92 g per plant and stem weight is 105 g per plant. The stem is green with green petioles and green leaves. It takes 47 days to flower.

# Chickpea (*Cicer arietinum* L.) Mutants

**VK Gour and PM Gaur**
*Department of Plant Breeding, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur-482 004, Madhya Pradesh*

**Fasciated Stem mutant, Fasciata *(INGR No. 03061; IC 395465)***

Fasciata or Jawahar Gram Mutant-2 (JGM-2) is a fasciated broadened and flattened stem mutant developed through mutation breeding by treating the seeds of JG-315 with 0.4 percent of ethyl methane sulphonate for six hours. It was identified in $M_2$ generation. It has irregular leaf arrangement and clustering of pods at the stem tip with delayed maturity, larger seed size, having lesser yield than the parental cultivars. Inheritance studies have shown

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**BN Dahiya, Dalvir Singh, VS Malik and Krishan Kumar**
*Chaudhary Charan Singh Haryana Agricultural University, Hisar-125 004, Haryana*

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**B Varalakshmi**
*Division of Vegetable Crops, Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore-560 089, Karnataka*

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# Chickpea (*Cicer arietinum* L.) Mutants

**VK Gour and PM Gaur**
*Department of Plant Breeding, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur-482 004, Madhya Pradesh*

**Fasciated Stem mutant, Fasciata *(INGR No. 03061; IC 395465)***

Fasciata or Jawahar Gram Mutant-2 (JGM-2) is a fasciated broadened and flattened stem mutant developed through mutation breeding by treating the seeds of JG-315 with 0.4 percent of ethyl methane sulphonate for six hours. It was identified in $M_2$ generation. It has irregular leaf arrangement and clustering of pods at the stem tip with delayed maturity, larger seed size, having lesser yield than the parental cultivars. Inheritance studies have shown

that fasciation is governed by a single recessive gene, which segregates independently of the loci *slv* (simple leaf), *mlv* (multipinnate leaf), *blv* (bronze leaf) and *B* (blue flower). Fasciation is an easily scorable morphological trait and can be a useful genetic marker for gene mapping. Comparative morphological features of Fasciata mutant and parent JG-315 (Gaur *et al.*, 1999) are given in the Table 1.

**Reference**

Gaur PM and VK Gour (1999) An induced fascinated mutant of chickpea (*Cicer arietinum* L.). *Indian J. Genet.* **59:** 325-330.

**Table 1. Morphological features of JGM-2 (Fasciated mutant) and the normal plants of its parental cv. JG-315**

| Character | JGM-2 (Fasciata) | JG-315 |
|---|---|---|
| Days to maturity | 126±2.01 | 118±1.41 |
| Plant height (cm) | 34.2±0.62 | 42.6±0.51 |
| Number of primary branches | 3.6±0.05 | 4.5±0.05 |
| Number of secondary branched | 9.6±0.18 | 13.1±0.19 |
| Number of pods/plant | 31.0±1.70 | 53.0±2.10 |
| Number of seeds/pod | 1.22±0.01 | 1.20±0.01 |
| Shelling turnover (%) | 0.81±0.02 | 0.85±0.01 |
| Harvest index | 36.1±1.06 | 48.6±1.17 |
| 100-seed weight (g) | 15.1±0.18 | 14.3±0.14 |
| Grain yield/plant (g) | 5.7±0.34 | 9.2±0.37 |

### Broad Few Leaflet mutant, BFL *(INGR No. 0362; IC 395466)*

Broad Few Leaflet or Jawahar Gram Mutant-4 (JGM-4) is a chickpea leaf mutant with 5-9 large leaflets per leaf and 3-5 overlapping leaflets at the terminal end, in comparison to 11-17 leaflets per leaf in parent JG 315. It was developed under mutation breeding programme by treating the seeds of cultivar JG-315 with 0.3 percent ethyl methane sulphonate for eight hours. It was identified in $M_2$ generation. The inheritance studies indicated that a single resessive single gene designated as *bfl* governs the mutant trait (Gaur *et al.*, 2003) The mutant reported would be very useful in linkage mapping studies, as it would be easy to score.

**Reference**

Gaur PM and VK Gour (2003) Broad-few leaflets and outwardly curved wings: two new mutants of chickpea. Short communication. *Pl. Breed.* 192-194.

### Outwardly Curved Wings mutant (OCW), JGM-5 *(INGR No. 03063; IC 395467)*

Outwardly Curved Wings or Jawahar Gram Mutant-5 (JGM-5) is a flower mutant with wings curved outwards, exposing the keel and petal. Normally, the wings in typical chickpea flowers are incurved and enclose the keel. It was developed under mutation breeding programme, by treating the seeds of cultivar, JGM-315 with ethyl methane suphonate. Genetic studies indicate that this trait is governed by single recessive gene, designated as *ocw* (Gaur *et al.*, 2003).

**Reference**

Gaur PM and VK Gour (2003) Broad-few-leaflets and Outwardly Curved Wings: Two new mutants of chickpea. Short communication. *Pl. Breed.* **122:** 192-194.

### Cymose Infloresence Multiflower, Multipodded mutant *(INGR No. 03064; IC 395468)*

Cymose Inflorscence Multiflower, Multipodded is a mutant with one to nine flowers per flowering node arranged in a cymose inflorescence at many axes of the raceme. It was developed under interspecific breeding programme and was isolated from an interspecific cross involving ICC 5783 (*C. arietinum)* x ICCW 9 (*C. reticulatum).* Both parents are single flowered. Inheritence studies indicate that a single recessive gene *cym* is responsible for producing cymose infloresence with multiflowers and multiple pods. The genetic study conducted has revealed that the *cym* gene is not allelic to *sfl*, suggesting that two loci control the number of flowers per peduncle in chickpea (Gaur *et al.*, 2002). The established line exhibited one to nine flowers and pod set variation from 0 to 5 in each cyme in comparison commonly found one or two and rarely three flowers. It may be the result of a spontaneous mutation either in one of the two parents or $F_1$ hybrid. The plants have bronze foliage and produced reticulated or partly reticulated seeds.

**Reference**

Gaur PM and VK Gour (2002) A gene producing one to nine flowers per flowering node in chickpea. *Euphytica.* **128:** 231-235.

# Cytoplasmic Male Sterile and Fertility Restorer Lines of Pigeonpea

**SBS Tikka, RM Chauhan, PT Patel and LD Parmar**
*Main Pulse Research Station, Gujarat Agricultural University, Sardar Krushi Nagar-385506, Gujarat*

**GT 33A & B *(INGR No. 03065; IC 296582 & IC 296590)***

GT 33A is a stable cytoplasmic-genic male sterile line with red seed and indeterminate growth habit incorporating the cytoplasm of *Cajanus scarabaeoides* developed through interspecific hybridization between *Cajanus scarabaeoides* and *Cajanus cajan* (Pusa 33) followed by backcrossing with Pusa 33, up to eight generation. It showed 100 per cent pollen sterility with acetocaramine (2%) test. The plant is non-determinate spreading type and early in maturity (130-145 days) with green stem and yellow flowers. The plant height is 127 to 160 cm with an average of 5-9 branches and 100-130 pods per plant with spreading pod bearing habit. Average pod length is 3-5 cm with 4-5 seeds per pod, and 100 seed weight is 9.1g with 309 per plant. It is moderately resistant to wilt, Sterility Mosaic Disease (SMD) and *Phytophthora* blight disease. GT 33B is identified as mainainer of GT 33A.

**GT 100A & B *(INGR No. 03066; IC 296590 and IC 296592)***

GT 100A is a stable cytoplasmic-genic male sterile line with white bold seeds and determinate habit, incorporating the cytoplasm of *Cajanus scarabaeoides* developed from a cross between *Cajanus scarabaeoides* and *Cajanus cajan* (GT-100) followed by backcrossing with GT-100 upto eighth generation. It showed 100-percent pollen sterility. It is a determinate type with green stem, yellow flower and pods in bunch. The plant height is 101 to 115 cm with an average of 5-6 branches and 120-170 pods per plant. It is early maturing (132-142 days) with an average pod length of 3-5 cm, 4-6 seeds per pod and 10.2 to 100-seed weight giving an average yield of 39 g per plant. It is moderately resistant to wilt, Sterility Mosaic Disease (SMD) and *Phytophthora* blight disease. GT 100B is identified as mainainer of GT 100A.

**GTR-10 *(INGR No. 03101; IC 296588)***

GTR-10 is a fertility restorer line of stable cytoplasmic-genic male sterile line GT-288A, with orange seed, indeterminate habit and early maturity. It was developed through recurrent selection within line, with simultaneous confirmation of restorability from line ICP-9260. It showed 100 per cent fertility restoration of GT 288A. It has scattered pod bearing habit and early maturity (145-160 days). The plant height is 140-160 cm with green stem with an average number of 11-15 branches, yellow flower and 187-205 pods per plant. Average pod length is 4.5 cm with 4-4.5 orange seeds per pod, and 10 g 100-seed weight.

**GTR-11 *(INGR No. 03102; IC 296589)***

GTR-11 is a fertility restorer line of stable cytoplasmic-genic male sterile line GT-288A with bold and white seeds, determinate habit and early maturity. It was developed through recurrent selection within line with simultaneous confirmation of restorability from line GT100. It showed 95.8 percent fertility restoration of GT 288A. It has pods in bunches and early in maturity (135-145 days). The plant height is 100 to 140 cm with green stem with an average number of 5-15 branches, yellow flower and 150-250 pods per plant. Average pod length is 4-5 cm with 3-4.5 white bold seeds per pod, and 10.5 g 100-seed weight. It is moderately resistant to sterility mosaic disease (SMD) and *Phytophthora* blight disease,

pod borer and pod fly.

## Large Seeded, High Oil Content Groundunt (*Arachis hypogea* L.), PBS 29031 *(INGR No. 03096; IC 296913)*

**P Manivel A. Bandyopadhyay, RK Mathur and MY Samdur**
*National Research Centre for Groundnut, Junagadh-362 001, Gujarat*

PBS 29031 is a large seeded Virginia bunch type groundnut (*A. hypogaea* L. subsp. *hypogaea* var. *hypogaea*) with high oil content (52%) high yield, and low oleic/linoleic (O/L) ratio. It was developed following pedigree selection method from a cross between M13 x NCAc 17278. NCAc 17278 is a virginia bunch type. PBS 29031 has a decumbent-3 type (IBPGR and ICRISAT, 1992) growth habit (semi-erect) with alternate floweing and medium to small elliptic dark green leaves. It has 4 to 6 primary branches and 8 to 21 secondary branches. The average height of main axis is 27 cm with 62 cm wide canopy. It matures in 115 to 120 days in the rainy season and has a shelling turn over of 70 percent. It has bold attractive pods with slight reticulation, constriction and beak, predominately two-seeded. The seeds are tan coloured, with an average of 52 per cent oil, 20 percent protein, 9 per cent sucrose, 0.29 per cent free amino acids, and 0.35 per cent reducing sugars. It has an average of 46 percent pod and 60 percent seed yield superiority over the check B 95 (Table 1). It was also superior to Somnath and ICGV 89211 for both pod and seed yield (2700-3000 kg per ha at NRCG in 1998) and produced a 100-seed weight of 67 g as compared to 66 g, 71 g and 78 g of the checks B 95, Somnath and ICGV 89211 respectively.

It has moderate field resistance to gram pod borer (*Helicoverpa armigera*), tobacco caterpillar (*Spodoptera litura*), early leaf spot (*Cercospora arachidicola*) and late leaf spot (*Phaeoisariopsis personata*) (NRCG 1998).

**Table 1. Performance of PBS 29031 compared to checks (rainy season 1996-1999)**

| Year | Culture | Mean Yield Kg/ha* | Increase over the released large seeded cultivars (%) | | |
|---|---|---|---|---|---|
| | | | Somnath | B 95 | ICGV 89211 |
| 1996 | PBS 29031 | P 2058 | 64.6 | 34.2 | 71.4 |
| | | S 1379 | 67.2 | 40.3 | 67.0 |
| 1997 | PBS 29031 | K 1196 | 16.8 | 60.1 | 0.7 |
| | | K 853 | 21.2 | 90.2 | 8.7 |
| 1998 | PBS 29031 | K 2715 | 23.1 | 51.1 | 65.8 |
| | | K 1900 | 22.8 | 63.2 | 75.5 |
| 1999 | PBS 29031 | P 1379 | 67.2 | 40.3 | 82.2 |
| | | K 924 | 69.5 | 46.9 | 69.5 |
| Average | | P 1835 | 42.9 | 46.4 | 55.0 |
| | | **K 1246** | **45.2** | **60.1** | **55.2** |

*P = Pod yield; K = Kernel yield

**References**

IBPGR and ICRISAT (1992) *Descriptors for groundnut*, IBPGR, Rome Italy and ICRISAT. Patancheru, Hyderabad India, 22p.

NRCG (1998) Annual Report 1998-1999, National Research Centre for Groundnut, Ivnagar Road P.O. Box-5, Junagadh, Gujarat, India, 43 p.

## Curved Leaf Mutant of Groundnut (*Arachis hypogaea* L.), PBS 30138 *(INGR No. 03097; IC 296915)*

**P Manivel, RK Mathur, A Bandyopadhyay and MY Samdur**
*National Research Centre for Groundnut, Junagadh-362 001, Gujarat*

PBS 30138 (Girnar 1 CLM) is a Curved Leaf Mutant of groundnut identified in $M_2$ generation progenies of a Spanish bunch type (*Arachis hypogaea* ssp. *hypogaea* var. *vulgaris*) cultivar Girnar 1, whose seeds were treated with 0.10 percent ethyl methane sulphonate (Mathur *et al.*, 2000, NRCG 1995). The mutant bred true in subsequent generations ($M_3$ and $M_4$) and was designated as Girnar 1 CLM. Based on morphological characters (Table 1) it was classified into Virginia bunch type (*Arachis hypogaea* subsp. *hypogaea var. hypogaea).*

**Table 1. Distinctive features of Girnar 1 CLM than its parent Girnar 1**

| Character | Girnar 1 CLM | Girnar 1 |
|---|---|---|
| Leaf | Curved leaf | Normal leaf |
| Botanical group | Virginia bunch | Spanish bunch |
| Growth habit | Semi-erect | Erect |
| Branching pattern | Alternate | Sequential |
| Height of main stem | 30 cm | 20.30 cm |
| Number of primary branches | 7 | 4 |
| Number of secondary branches | 14 | 1.3 |
| Leaf length/width ratio | 2.44 | 2.05 |
| Pod reticulation | Deep | Moderate |
| Pod constriction | Absent | Slight |
| Pod beak | Absent | Slight |
| Pod length | Shorter (28.2 mm) | Longer (39.6 mm) |
| Pod width | Wider (12.4 mm) | Narrow (6.6 mm) |
| Seed shape | Button shape | Long/oblong |
| 100-seed weight | 34 g | 29 g |
| Shelling percent | 69% | 64% |
| Maturity duration | Longer (120 days) | Medium (100 days) |

Girnar 1 CLM has decumbent-3 (IBPGR and ICRISAT 1992) growth habit (semi-erect) with alternate flowering and medium to big obovate light green leaves. It has 6-8 primary branches and 12-16 secondary branches. The average height of main axis is 30 cm with 55-60 cm wide canopy. It matures in 115-120 days (rainy season) and has a shelling turn over of 69 per cent. The pods are of medium size with deep reticulation, no beak and no constriction, predominatly three-seeded. Seeds are ten in colour with a 100-seed weight of 34 g, containing 48.9 percent oil and 11.5 percent protein. The mutant yielded an average of 1800 q per ha, which was significantly higher than the Girnar 1 (1610 q/ha). It has 5 percent higher shelling turn over (69%) than its parent (64%). For rust and late leaf spot on 9-point scale (0 being highly resistant and 9 being highly susceptible), it scored less than three for both rust and LLS (NRCG, 1998 & 1999).

### References

IBPGR and ICRISAT (1992) *Descriptors for groundnut*. IBPGR, Rome Italy and ICRISAT, Patancheru, Hyderabad, India, 22p.

Mathur RK, P Manivel, MY Samdur, HK Gor and BM Chikani (2000) Creation of genetic variability through mutation breeding in groundnuts of the DAE-BRNS symposium on "The use of nuclear and molecular techniques in crop improvement", 6-8 December 2000. BARC, Mumbai, pp 203-213.

NRCG (1998) Annual Report (1998-1999), National Research Centre for Groundnut, Ivnagar Road, P.O. Box-5, Junagadh, Gujarat, India, pp. 34 and 44.

NRCG (1999) Annual Report (1999-2000), National Research Centre for Groundnut, Ivnagar Road, P.O. Box-5, Junagadh, Gujarat, India, 17p.

## A Pentafoliate Leaf Mutant of Groundnut (*Arachis hypogaea* L.) TCGS 635 *(INGR No. 03098; IC 296917)*

**RP Vasanthi, N Rajagopal, J Ramachandra Reddy, K John, L Prasanthi and O Venkateshwarlu**
*Regional Agricultrual Research Station, Tirupati-517 502, Andhra Pradesh*

Peripinnate leaves with two pairs of leaflets are unusual in groundnut. TCGS-635 is a pentafoliate leaf mutant of groundnut identified in $F_3$ generation of the cross, Tirupati-1 x ICGV 86398. It bred true in succeeding generations. The female parent, Tirupati-1 belongs to *Arachis hypogaea* subsp. *Fastigiata* var. *vulgaris*, while ICGV 86398 belongs to *Archis hypogaea* subsp. *Hypogaea* var. *hypogaea* both with normal four leaflets. TCGC-635 is an erect bunch type with thin stem and sparsely hairy five narrow and small leaflets. The fifth leaflet is apical and is slightly smaller than the other four leaflets. The pentafoliate leaves occur in a frequency of 33 to 40 percent starting from 5-6$^{th}$ node. It comes to flowering in 27 days and to full bloom in 33 days after sowing. It matures in 95 days in *kharif* and in 100 days in *rabi*. It gave an average pod yield of 1135 kg per ha in *kharif* and 2568 kg per ha in *rabi*. Pods are mostly two-seeded with slight beak, constriction and reticulation. Its 100-pod weight is 55 g, while 100-seed weight is 33 g with light rose testa. It has field tolerance to *Spodoptera* species (JL-24, a susceptible variety had 63 per cent damaged leaflets, while TCGS 635 had only 43 percent) and bud necrosis disease (JL-24, a susceptible variety had 24 percent affected plants while TCGS 635 had 5.6 per cent affected plants).

**Table 1. Distinctive features of Girnar 1 CLM than its parent Girnar 1**

| Character | Girnar 1 CLM | Girnar 1 |
|---|---|---|
| Leaf | Curved leaf | Normal leaf |
| Botanical group | Virginia bunch | Spanish bunch |
| Growth habit | Semi-erect | Erect |
| Branching pattern | Alternate | Sequential |
| Height of main stem | 30 cm | 20.30 cm |
| Number of primary branches | 7 | 4 |
| Number of secondary branches | 14 | 1.3 |
| Leaf length/width ratio | 2.44 | 2.05 |
| Pod reticulation | Deep | Moderate |
| Pod constriction | Absent | Slight |
| Pod beak | Absent | Slight |
| Pod length | Shorter (28.2 mm) | Longer (39.6 mm) |
| Pod width | Wider (12.4 mm) | Narrow (6.6 mm) |
| Seed shape | Button shape | Long/oblong |
| 100-seed weight | 34 g | 29 g |
| Shelling percent | 69% | 64% |
| Maturity duration | Longer (120 days) | Medium (100 days) |

Girnar 1 CLM has decumbent-3 (IBPGR and ICRISAT 1992) growth habit (semi-erect) with alternate flowering and medium to big obovate light green leaves. It has 6-8 primary branches and 12-16 secondary branches. The average height of main axis is 30 cm with 55-60 cm wide canopy. It matures in 115-120 days (rainy season) and has a shelling turn over of 69 per cent. The pods are of medium size with deep reticulation, no beak and no constriction, predominatly three-seeded. Seeds are ten in colour with a 100-seed weight of 34 g, containing 48.9 percent oil and 11.5 percent protein. The mutant yielded an average of 1800 q per ha, which was significantly higher than the Girnar 1 (1610 q/ha). It has 5 percent higher shelling turn over (69%) than its parent (64%). For rust and late leaf spot on 9-point scale (0 being highly resistant and 9 being highly susceptible), it scored less than three for both rust and LLS (NRCG, 1998 & 1999).

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## A Pentafoliate Leaf Mutant of Groundnut (*Arachis hypogaea* L.) TCGS 635 *(INGR No. 03098; IC 296917)*

**RP Vasanthi, N Rajagopal, J Ramachandra Reddy, K John, L Prasanthi and O Venkateshwarlu**
*Regional Agricultrual Research Station, Tirupati-517 502, Andhra Pradesh*

Peripinnate leaves with two pairs of leaflets are unusual in groundnut. TCGS-635 is a pentafoliate leaf mutant of groundnut identified in $F_3$ generation of the cross, Tirupati-1 x ICGV 86398. It bred true in succeeding generations. The female parent, Tirupati-1 belongs to *Arachis hypogaea* subsp. *Fastigiata* var. *vulgaris*, while ICGV 86398 belongs to *Archis hypogaea* subsp. *Hypogaea* var. *hypogaea* both with normal four leaflets. TCGC-635 is an erect bunch type with thin stem and sparsely hairy five narrow and small leaflets. The fifth leaflet is apical and is slightly smaller than the other four leaflets. The pentafoliate leaves occur in a frequency of 33 to 40 percent starting from 5-6$^{th}$ node. It comes to flowering in 27 days and to full bloom in 33 days after sowing. It matures in 95 days in *kharif* and in 100 days in *rabi*. It gave an average pod yield of 1135 kg per ha in *kharif* and 2568 kg per ha in *rabi*. Pods are mostly two-seeded with slight beak, constriction and reticulation. Its 100-pod weight is 55 g, while 100-seed weight is 33 g with light rose testa. It has field tolerance to *Spodoptera* species (JL-24, a susceptible variety had 63 per cent damaged leaflets, while TCGS 635 had only 43 percent) and bud necrosis disease (JL-24, a susceptible variety had 24 percent affected plants while TCGS 635 had 5.6 per cent affected plants).

# Amphidiploid *Brassica tournefortii* x *Raphanus caudatus (INGR No. 03067; IC 296597)*

**Chakresh Kumar**
*Agriculture Research Station, Navgaon, Alwar-301025, Rajasthan*

Amphidiploid of an inter-generic cross between *Brassica tournefortii* and *Raphanus caudatus* was produced. *Raphanus caudatus* L. (RR=2n=18), a rattail radish is similar to common radish (*Raphanus sativus*) except for characteristic fleshy root and grown mainly for fruits long slender unilocular unripe pods for vegetable purpose. Whereas wild turnip, *Brasica tournefortii* gaunan (TT-2n=20) is a semicultivated species, cultivated for oil in arid regions and has been reported to be a good source of resistance for tolerance against *aphids* (*Lipaphis erysimi*), *Alternaria, Albugo candida, Leptosphaeria maculans* and drought (Ljungberg *et al.*, 1993). The inter-generic hybrids were male sterile. They were treated with one percent colchicine solution at apical meristem for production of an amphidiploid with non-dehiscent siliquae (Kumar, 1994 and 1995). This amphidiploid has pedicillate leaves and hairs on abaxial side. It is bushy in nature with upto 17 primary branches. Petals are white in colour and slightly smaller than those of *R. caudatus*. Its siliquare are 3.7 cm long, bicarpillary and non-dehiscent with caudate tip. Seeds are round in shape and blackish brown in colour with 1000-seed weight of 7.2 g Number of seeds per siliqua are upto eight. It is immune to white rust and moderately resistant to powdery mildew. It might be helpful in development of hybrids in olieferous Brassicas or used as bridge for introgression of desirable traits into cultivated species of tribe Brassicaceae.

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# Salinity Resistant Mustard [*Brassica juncea* (L). Czern & Coss], RH 8814 *(INGR No. 03068; IC 401570)*

**D Singh, ML Chhabra, NK Thakral, DC Nijhawan, SK Thakral, Parkash Kumar, JS Yadava, CD Kaushik and Naveen Chandra**
*Department of Plant Breeding, CCS Haryana Agricultural University, Hissar-125004, Haryana*

Screening of *Brassica juncea* genotypes at Hisar, Karnal, Faizabad and Kanpur under All India Co-ordinated Research Programmed on Rapessed-mustard resulted in identification of RH 8814 with tolerance to salinity. Laboratory screening was done in trays using a calculated amount of salt viz., NaCl, $CaCl_2$, $MgSO_4$, $MgCl_2$ and $Na_2SO_4$ dissolved in water to provide $Cl:SO_4$ ratio of 4:1, Ca:Mg ratio 1.3:1 and Sodium Absorption Ratio between 10-12 in soil. Rate of emergence and final emergence was worked out as suggested by Maguire (1962). Percent reduction in emergence, root and shoot length, dry weight per 5 seedlings over control were used for assessment of salinity tolerance (AICRIPR & M, 2000, 2001). Testing of genotypes was also done at reproductive stage. For field screening, genotypes were sown in field having salinity between 10 to 12 dS/m depending upon location. RH-8814 (RH 765 x R-74-3) proved to be significantly tolerant to salinity both at seedling and reproductive stage (AICRIP R & M, 2000). It is medium in height with upright arranged broad leaves, creamish mid-rib, pale yellow flowers and semi-appressed arrangement of siliquae with medium bold seeds. It is also frost tolerant (AICRIP R & M, 2001).

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# Salinity Resistant Mustard [*Brassica juncea* (L). Czern & Coss], RH 8814 *(INGR No. 03068; IC 401570)*

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# Fusarium Wilt Resistant Castor (*Ricinus communis* L.), RG 297 *(INGR No. 03069; IC 296578)*

**K Anjani**
*Directorate of Oilseeds Research, Rajendranagar, Hyderabad-500 030, Andhra Pradesh*

RG 297 is a castor germplasm resistant to *Fusarium* (*Fusarium oxysporum* f. sp. *ricini*) wilt selected from segregating population of germplasm collection RC 1194 obtained from Tindivanam, Tamil Nadu. The segregating population was initially screened at DOR, Hyderabad and uniform looking resistant plants were selected and sib-mated. Seeds from these plants were bulked. Later on, in the progeny generations selection was made for morphological traits to obtain reasonable uniformity. It was further screened in wilt sick plots at DOR, Hyderabad and Gujarat Agricultural University, S.K. Nagar under All India Co-ordinated Research Project for two years (Ann. Progress Report, Castor 200-01 and 2001-02). It was found resistant to *Fusarium* wilt in wilt sick plots where the incidence of wilt in susceptible checks ranged from 77-98 percent. Its resistance to wilt was further confirmed under very high disease pressure in pots by root-dip technique. It reaches 50 percent flowering in 40 days and maturity in 120 days from the day of sowing and yielded at par with the best check 48-1 (200 g seeds/ plant).

### References

Annual Progress Report, Castor (2000-01). Directorate of Oilseeds Research, Rajendrangar, Hyderabad, pp 127 and 142.

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# Andro-Monoecious *Fusarium* Wilt Resistant Inbred Castor (*Ricinus communis* L.) JI-220, *(INGR No. 03070; IC 395312)*

**PR Golakia, RH Kavani, CJ Dangaria, AB Patel and DB Patel**
*Oilseeds Research Station, Gujarat Agricultural University, Junagadh-362 001, Gujarat*

JI-220 is an andro-monoecious line of castor with resistance to *Fusarium* wilt developed through hybridization followed by pedigree selection. The pedigree of this inbred is the double cross of VP-1 x 48-1 and VP-1 x TMV-5 in which 48-1 and TMV-5 were wilt resistant. The plants of JI-220 have medium tall stature, green stem, spiny capsules, 16 to 18 elongated internodes and compact spike with triple bloom. It yields 1682 kg seed per ha with oil content of 48.7 per cent and 100-seed weight of 26.3 g (average of 16 AICRP trials). It showed least incidence of wilt compared to check (Table 1). The development and diversification of wilt reistance andromonoecious inbred lines to different genetic background would be of help in hybrid breeding programme with resistance to wilt

**Table 1. Percent wilt incidence in JI-220 compared to checks (1997-1999)**

| Entry | 1997 | | | 1998 | | | 1999 | Mean % |
|---|---|---|---|---|---|---|---|---|
| | SKN[1] | DOR[2] | PAL[3] | SKN | DOR | PAL | SKN | Incidence |
| JI-220 | 13.3 | 20.00 | 11.7 | 0.0 | 4.16 | 6.4 | 0.0 | 7.9 0 (7) |
| 48-1 | 0.0 | 15.00 | 43.3 | 0.0 | 20.0 | 8.3 | 0.0 | 12.37 (7) |
| GCH-5 | 100.0 | 80.95 | 60.5 | 93.8 | – | 55.7 | 100.0 | 81.83 (6) |
| GCH-4 | 100.0 | 93.75 | 41.1 | 100.0 | 77.8 | 43.8 | 100.0 | 79.49 (7) |
| Aruna | – | 90.00 | 65.4 | 73.4 | 38.9 | 56.0 | 80.0 | 67.28 (6) |
| GC-2 | – | 100.00 | 55.3 | 100.0 | 92.3 | 63.2 | – | 82.16 (5) |

1. SKN = Sardar Krushinagar, Gujarat, 2. Directorate of Oilseeds Research, Hyderabad and 3. Palem (AP)

# Fusarium Wilt Resistant Castor (*Ricinus communis* L.), RG 297 *(INGR No. 03069; IC 296578)*

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# Andro-Monoecious *Fusarium* Wilt Resistant Inbred Castor (*Ricinus communis* L.) JI-220, *(INGR No. 03070; IC 395312)*

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| GC-2 | – | 100.00 | 55.3 | 100.0 | 92.3 | 63.2 | – | 82.16 (5) |

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disease.

## Pistillate Line of Castor (*Ricinus communis* L.), M 619 *(INGR No. 03095; IC 296508)*

**M Ramachandram[1], SK Chakrabarty[2] and C Lavanya[1]**
[1] *Directorate of Oilseeds Research, Rajendranagar, Hyderabad-500030 Andhra Pradesh*
[2] *Seed Technology Division, Indian Agricultural Research Institute-110 012, New Delhi*

M 619 is a mutant S-type pistillate line of castor with wilt resistance developed through seed treatment of VP-1 with 55 kR gamma rays and selection for early duration and wilt resistance through pedigree selection method and generation advancement in wilt sick plots of DOR (Lavanya *et al.*, 2000). It is a revertant type pistillate line with green stem, spiny capsules, dwarf plant type with condensed internodes, convergent branching, producing on an average 14.8 nodes, at primary spike and triple bloom. It has semi-compact spike with light chocolate coloured medium bold seeds and 41 percent oil content. It is a stable pistillate line producing 90 percent of the plants as pistillate in the entire spike order (Lavanya *et al.*, 2003). It is a good general combiner for seed yield and 100-seed weight (Chakrabarty, 1997; Lavanaya and Chandramohan, 2003). Also, it is resistant to *Fusarium* wilt, nematodes and root rot diseases.

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## New Genetic Male Sterile Line of Cotton (*Gossypium arboreum* L.), MPKV GMS *(INGR No. 03071; IC 296576)*

**SS Mehetre, VR Patil, GC Shinde and AS Mokate**
*Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar-413722 (Maharastra)*

Recognising the importance of indigenous hybrids, efforts were made to develop genetic male sterile (GMS) and cytoplasmic genetic male sterile (CGMS) lines of *G. arboreum* cotton to enable production of hybrid seed in large quantities at cheaper rate. These efforts have resulted in isolation of new GMS line, MPKV-GMS with good combining ability for naked seed, high ginning percentage and good fibre properties in *G. arboreum* cotton during 2000 (Mehetre and Patil, 2001) from segregating populations of intra *arboreum* cross, Y-1 x Sanjay.

Two recessive genes ($gms^{arbns}_1$ $gms^{arbns}_2$) control GMS in the present line. Earlier identified GMS line in diploid cotton was controlled by a single recessive gene $ams_1$ (Singh *et al.*, 1998). Male sterile and fertile counterparts did not differ distinctly except for characters. It has normal chromosome behaviour and pollen abortion is caused due to vacuolation of pollens after tetrad stage and non-degeneration of anther tapetum. This new male sterile line has naked seeds, give best response for vegetative propagation, facilitating production of large number of GMS plants for hybrid seed production (Mehetre *et al.*, 2003). The technical properties of fibre of hybrids involving this male sterile line conform the modern textile requirements.

### References

Singh DP, BPS Lather and (2) SS Nehara (1998) Diversification of source of male sterility in *arboreum* cotton. *Hybrid Cotton Newsletter* **7(2):** 1.

Mehetre SS and VR Patil (2001) New genetic male sterile line of Asiatic *G. arboreum* L. cotton. *Hybrid Cotton Newletter* **10:** 9.

Mehetre SS, GC Shinde, VR Patil, and AS Mokate (2003) Alternative method for rapid seed multiplication of *Gossypium arboreum* GMS based hybrids. *Sci & Cult.*, **69:** 299-301.

disease.

## Pistillate Line of Castor (*Ricinus communis* L.), M 619 *(INGR No. 03095; IC 296508)*

**M Ramachandram[1], SK Chakrabarty[2] and C Lavanya[1]**
[1] *Directorate of Oilseeds Research, Rajendranagar, Hyderabad-500030 Andhra Pradesh*
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Mehetre SS, GC Shinde, VR Patil, and AS Mokate (2003) Alternative method for rapid seed multiplication of *Gossypium arboreum* GMS based hybrids. *Sci & Cult.*, **69:** 299-301.

# New Surgical Type Cotton (*Gossypium arboreum* L.), RH-arb-02-1 (W) (*INGR No. 03072; IC 296577*)

**SS Mehtre, GC Shinde, VR Patil and AS Mokate**
*Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar-413 722, Maharashtra*

RH-arb-02-1 (W) is a new cotton germplasm with surgical type fibre quality (less sinking and good water holding capacity) developed by selection during the year 2002 (Anonymous, 2003) and tested at the Central Institute for Research on Cotton Technology, Mumbai by using a single stage process method for conversion of short staple cotton or cotton waste into absorbent or surgical cotton (Nachane and Nagarkar, 2001). The absorbency is one of the most important components, which characterizes sample's suitability for surgical properties. A comparison of various traits indicated that for all the morphological characters of RH-arb-02-1 (W) were significantly lower than the control Y1, while, for number of bolls, boll diameter, seed per locule, seed index and ginning percentage, it was superior than Y1. Its boll opening is excellent and locule retention is 100 percent. After boll opening, if harvesting is delayed, there is hardly and fall of locule.

The data (Table 1) indicated that uncleaned samples of Y1 required more time (5.2 and 6.5) seconds) than those of RH-arb-02-1 (W) (1.9 second) for absorbency. Likewise, sinking time of un-cleaned and cleaned samples of Y1 (5.9 and 8.5 second) are more than RH-arb-02-1 (W) (2.9 and 2.0). This indicates that the absorbency and sinking time of RH-arb-02-1 (W) is superior to that of Y1. The water holding capacity of this line is also greater than Y1. The uncleaned and cleaned samples of RH-arb-02-1 (W) recorded 27.8 and 26.7 g per g water holding capacity, respectively. Superiority for these traits indicates RH-arb-02-1 (W) to be a better surgical type.

This genotype yields 66 percent higher (1942 kg/ha) than Y1 (1170 kg/ha) and was early in maturity (168 days) than Y1 (190 days). Dwarf habit (97 cm) and creamy flower with red spot are the other important features.

**Table 1. Properties of surgical cotton RH-arb-02-1 (W)**

| Properties | Y1 Clean | Y1 Unclean | RH-arb-02-1 (W) Clean | RH-arb-02-1 (W) Unclean | Standard* |
|---|---|---|---|---|---|
| Moisture content (%) | 6.8 | 6.7 | 6.6 | 6.7 | <8% |
| Water-soluble matter (%) | 0.29 | 0.37 | 0.14 | 0.15 | <0.5% |
| Absorbency (sec) | 6.5 | 5.2 | 1.9 | 1.9 | 10 sec |
| Brightness (%) | 77 | 77 | 74 | 74 | - |
| Solubility in 75% $H_2SO_4$ (w/w) | Soluble | Soluble | Soluble | Soluble | Soluble |
| Solubility in 4% NaOH (w/w) | Insoluble | Insoluble | Insoluble | Insoluble | Insoluble |
| Sinking time (sec) | 8.5 | 5.9 | 2.0 | 2.9 | 10 sec |
| Water holding capacity (g/g of cotton) | 25.0 | 26.7 | 26.7 | 27.8 | >23 |
| Sulphated ash (%) | 0.29 | 0.27 | 0.14 | 0.19 | <0.5 |
| Acidity | Nil | Nil | Nil | Nil | Nil |
| Alkalinity | Nil | Nil | Nil | Nil | Nil |

*Minimum standard values of different properties for surgical grade cotton as given by Indian Pharmacopoeia.

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# Heat Tolerant Upland Cotton (*Gossypium hirsutum* L.) Pusa 17-52-10 *(INGR No. 03073; IC 408236)*

**RP Singh[1], Jagmail Singh[1], M Singh[1], GS Chahal[2] and CB Lal[1]**
[1]*Division of Genetics, Indian Agricultural Research Institute, New Delhi-110012*
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Pusa 17-52-10 is a new tolerant genotype of cotton. In North India, cotton is grown in *kharif* from April to November. Cultivation of cotton during spring/summer could be one of the possible alternatives to increase production. However, the weather during spring/summer season is characterized by low temperature at the time of sowing, establishment and initial growth and unusually high diurnal temperature coupled with low humidity during flowering and boll development stages from April to June. Therefore, a heat tolerant and compact type genotype was developed from a cross between Pusa 595B and Pusa 734 followed by pedigree selection. Later in segregating generations, one more cycle of selective intermating was applied. The segregating progenies were tested for their performance in summer in addition to normal *kharif*, following the shuttle-breeding method. Under Delhi conditions yield of 662.3 kg per ha against 217.4 kg per ha of RS 875, which is more than three times the yield of RS 875. Under multilocation trial conducted at IARI New Delhi, SVBP Bullandshahar and PAU Ludhiana during spring summer season (2003), it was early with regard to germination, days to flowering and days to boll opening on the basis of mean of all 24 genotypes tested under trial. It outperformed in yield (mean yield 802 kg seed cotton/ha), the check, RS 875 (501 kg seed cotton/ha) at three locations.

It has compact plant type, early maturity (125-130 days), high boll weight and very high seed cotton yield with acceptable fibre quality. The leaf shape and orientation of the genotype helps in reducing the evapo-transpirational losses. During April to June, the day temperature ranged from 38.2°C to 43.4°C and the night temperature around 30.6°C. This genotype has the capacity to flower and set bolls under these conditions. It performed well during spring/summer season indicating tolerance to high and diurnal temperature variation.

**Table 1. Heat tolerance of Pusa 17-52-10 as summer crop at Delhi during 2002 & 2003**

| Character | Pusa 17-52-10 | | | RS 875 | | | Superiority (%) |
|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | Mean | 2002 | 2003 | Mean | over check |
| Days to germination | 12.0 | 7.0 | 9.5 | 9.7 | 7.0 | 8.4 | 13.8 |
| Days to I$^{st}$ flower | 66.3 | 62.3 | 64.3 | 69.3 | 63.3 | 66.3 | 3.0* |
| Days to I$^{st}$ boll opening | 100.0 | 97.0 | 98.5 | 100.0 | 99.3 | 99.7 | 1.2* |
| Ist fruiting node | 4.1 | 4.2 | 4.2 | 4.9 | 4.3 | 4.6 | 9.8* |
| Plant height (cm) | 76.0 | 49.9 | 63.0 | 107.7 | 56.3 | 82.0 | 23.2* |
| Monopodia/plant | 0.3 | 0.2 | 0.25 | 0.4 | 0.2 | 0.3 | 16.7* |
| Sympodia/plant | 24.6 | 16.8 | 20.7 | 24.9 | 20.1 | 22.5 | 8.0 |
| Internode length (cm) | 2.7 | 2.4 | 2.6 | 3.6 | 2.3 | 3.0 | 13.6* |
| Total boll (upto 30$^{th}$ June) | 17.5 | 10.8 | 14.2 | 13.3 | 8.4 | 10.9 | 30.4* |
| Opened-ball (upto 30$^{th}$ June) | 11.3 | 10.4 | 10.9 | 4.9 | 8.0 | 6.5 | 68.2* |
| Boll weight (g) | 2.8 | 2.7 | 2.8 | 1.4 | 2.4 | 1.9 | 44.7* |
| Ginning out turn (%) | 34.5 | 32.7 | 33.6 | 33.5 | 32.3 | 32.9 | 2.1* |
| Seed index | 6.9 | 9.3 | 8.1 | 5.6 | 8.0 | 6.8 | 19.1 |
| Lint Index | 3.6 | 3.6 | 3.6 | 2.8 | 3.8 | 3.3 | 9.1* |
| Yield (kg/ha) | 458.3 | 866.3 | 662.3 | 71.1 | 363.7 | 217.4 | 204.7* |
| **Fibre quality character**** | | | | | | | |
| Fibre length (2.5% S.L.) | 25.5 | 25.5 | 25.5 | 26.0 | 25.6 | 25.8 | 1.2 |
| Fibre uniformity ratio | 50.4 | 50.8 | 50.6 | 50.1 | 49.7 | 49.9 | 1.4* |
| Fibre fineness | 3.5 | 4.5 | 4.0 | 3.6 | 4.4 | 4.0 | 0.0 |
| Fibre strength | 17.3 | 20.3 | 18.8 | 22.5 | 19.5 | 21.0 | -10.5 |
| Fibre elongation (%) | 5.40 | 6.00 | 5.7 | 5.2 | 6.40 | 5.8 | 1.7 |
| Fibre quality index | 236.00 | 244.40 | 240.2 | 308 | 238.0 | 273.0 | -12.0 |

*Desirable
**Fibre quality traits were evaluated by Central Institute for Research on Cotton Technology CIRCOT (Mumbai).

# High Fibre Quality and CLCV Resistant Cotton (*Gossypium hirsutum* L.) Pusa GH 95-33-47-2-2 *(INGR No. 03099; IC 296868)*

**VP Singh[1], RP Singh[1], M Singh[1], CB Lal[1], DN Makwana[2] and VG Malthi[1]**
[1] *Indian Agricultural Research Institute, New Delhi-110012*
[2] *Central Institute for Research on Cotton Technology, Mumbai-400 019, Maharastra*

Pusa GH 95-33-47-2-2 is a cotton germplasm with high fibre strength and elongation rate with resistance to Cotton Leaf Curl Virus (CLCV) developed through pedigree selection method. With the adoption of new efficient spinning technologies, the priorities for ranking of fibre properties for various spinning processes have changed to the order of fibre strength, fibre fineness and fibre length. Therefore, there is a need for improvement of fibre strength at 1/8 gauge (3.2 mm) for blending it with synthetic fibres. The fibre strength of this line is 26.4 g per tex at 3.2 mm gauge. The ginning out turn of this line is 30-31 percent with fibre length of 29-30 mm (2.5% SL) will fall in 'superior long' group. It also has desirable fibre fineness with micronaire value of 4.0. The Count Strength Product (CSP) value at 50s count for this line was reported to be 2780 against the standard CSP value of 2125 while the fibre quality index was in the range of 375 to 400 (Singh *et al.*, 2000). Also, it is characterized by seven percent elongation rate. All these fibre quality parameters of Pusa GH 95-33-47-2-2 make it highly suitable to modern textile industry.

### References

Singh RP, VP Singh, M Singh, CB Lal and DN Makwana (2000) Improvement of fibre strength (Bundle tenacity) and other fibre quality traits in Punjab American Cotton (*G. hirsutum* L.) *J. Indian Soc. Cotton Improv.* **25**: 141-147.

# Photo-Thermo Insensitive Cotton (*Gossypium barbadense* L.), Pusa GB 11-135 *(INGR No. 03100; IC 296963)*

**RP Singh, VP Singh, M Singh, BB Singh and CB Lal**
*Division of Genetics, Indian Agricultural Research Institute-110 012, New Delhi*

Dastur (1949) reported than varieties of *G. barbadense* are sensitive to day length and night temperatures and susceptible to diseases and pests (specifically, the sucking pests) restricting their distribution. Pusa GB 11-135 is a photo-thermo insensitivity in Egyptian cotton adapted to north India. It was isolated from intervarietal crosses involving geographically and genetically divergent *G. barbadense* parents belonging to Egyptian, Russian and Sea Island cotton. Rigorous selections using pedigree method were made in the segregating generations for their performance under north Indian conditions. This line was found comparatively more tolerant to high diurnal temperature and dry hot weather conditions of spring season of north India (Singh *et al.*, 1999).

It is medium tall type (110 to 120 cm) and takes 60 days to flower, 105-110 days to I$^{st}$ boll opening with average boll number 20-25 per plant. In maturity it is at per with *G. hirsutum* cotton varieties cultivated during *kharif* in north zone. The ginning out turn of this line is 30 percent with fibre length of 29.4 mm (2.5% S.L.), the fineness as measured by micronaire value is 3.6 and fibre strength (bundle tenacity) at 3.2 mm gauge is 24.3 g per tex. Inter-specific cotton hybrids involving Pusa GB 11-135 as male parent, gave the best fibre quality $F_1$'s in the extra long staple category, with the mean fibre length (MFL value) of 34-35 mm at 2.5 percent SL, the fineness as measured in micronaire between 3.5-4.2, bundle tenacity of 24-25 g per tex at 3.2 mm gauge. The fibre of these $F_1$'s could be spun at 80s count. Hence, it can be used as male parent to develop extra-long-staple inter-specific cotton hybrids (*G. hirsutum* L. x *G. barbadense* L.) suitable for general cultivation (Singh *et al.*, 2000).

### References

Dastur RH (1949) Growth studies on sea island (*G. barbadense* L) cottons under Punjab and Sind conditions to determine causes of their low yields. *Indian Cot. Rev.* **3**: 121-134.

Singh M, RP Singh, VP Singh and CB Lal (1999). Screening Egyptian cotton (*G. hirsutum* L) to high diurnal temperaturers and low relative humidity conditions in North India. *J. Indian Soc. Cotton Improv.* **24**: 115-119.

Singh RP, VP Singh, M Singh and CB Lal (2000). Nuclear cytoplasmic interactions for flowering and maturity in reciprocal interspecific tetraploid cotton hybrids involving new world cotton species (*Gossypium* sp.) *Ann. Agric. Res.* **21**: 584-586.

# High Fibre Quality and CLCV Resistant Cotton (*Gossypium hirsutum* L.) Pusa GH 95-33-47-2-2 *(INGR No. 03099; IC 296868)*

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# Bacterial Wilt Resistant Brinjal (*Solanum melongena* L.) IIHR 3 (96-2-1) *(INGR No. 03074; IC 395333)*

**AT Sadashiva, TH Singh, KM Reddy, MK Reddy, MV Balaram, BC Narasimha Prasad, KM Prasanna, LR Naveen and SG Joshi**

*Division of Vegetable Crops, Indian Institute of Horticultural Research, Bangalore-560 089, Karnataka*

Brinjal suffers from several diseases, of which the Bacterial Wilt (BW) caused by *Ralstonia solanacearum* is most serious. It has been reported to cause yield losses up to 90.6 percent (Baruah *et al.*, 2000; Ika *et al.*, 2001). IIHR-3 (96-2-1) is a BW resistant line of brinjal developed through pedigree selection from a cross between Arka Keshav (purple long) and IIHR-124 (green oval) ($F_9$). The performance of the resistance line for yield and yield contributing characters is given in Table 1. Evaluation of the lines was done in BW sick plot followed by artificial inoculations with bacterial ooze 107 cfu/ml (0.7 ID @ 600 mm) during *rabi* 2002-03. IIHR-3 has tall and spreading plant type with green foliage cover. Fruits are green long (21 cm), with 26 fruits per plant. It has the yield potential of 1.96 kg per plant with an average fruit weight of 43 g.

**Table 1. Performances of BW resitant lines for yield and yield components (*Rabi* 2002-03)**

| Lines | Plant Height (cm) | No. of fruits/ plant | Avg. fruit weight (g) | Fruit length (cm) | Fruit diameter (cm) | Yield/ plant (kg) | Percent BW incidence |
|---|---|---|---|---|---|---|---|
| IIHR-3 | 134.8 | 26.4 | 42.6 | 21.2 | 2.78 | 1.96 | 0 |
| IIHR-7 | 123.2 | 30.8 | 47.8 | 17 | 2.90 | 1.56 | 0 |
| SM6-6 (RC) | 77.8 | 32.4 | 28.2 | 10.8 | 2.96 | 0.07 | 0 |
| Arka Keshav (RC) | 84.8 | 23.4 | 40.0 | 14.4 | 3.04 | 0.67 | 0 |
| Arka Shirish (SC) | 138 | 14.6 | 37.8 | 22.8 | 2.96 | 0.22 | 100 |
| Arka Kusumarkar (SC) | 102.2 | 22 | 32.0 | 13.4 | 3.32 | 0.78 | 100 |
| SEm± | 6.7 | 1.89 | 3.33 | 0.67 | 0.20 | 0.13 | – |
| C.D. @ 5% | 19.7 | 5.58 | 9.82 | 2 | 0.60 | 0.38 | – |
| C.D. @ 1% | 26.9 | 7.6 | 13.39 | 2.7 | 0.80 | 0.52 | – |

## References

Baruah SJN, Binoy Mudiar, Rachid HA and Mudiar B (2000) Yield potentiality of some brinjal cultivars in severe bacterial wilt infected condition. *Vegetable Science.* **27:** 76-77.

Ika Mariska, Hobir, Karden Mulya, Ali Husnil, Suci Rahayu, Ragapadmi Purnamaningsih, Mia Kosmiatin and Darasinh silhackakr (2001) Improvement of bacterial wilt resistance of eggplant through protoplast fusion. *Journal of Litbang Pertanian.* **20:** 25-31.

# Tomato Leaf Curl Virus and Bacterial Wilt Resistant Tomato (*Lycopersicon esculentum* Mill)

**AT Sadashiva, KM Reddy, MK Reddy, TH Singh, MV Balaram, BC Narasimha Prasad, KM Prasanna, LR Naveen and SC Joshi**

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Tomato Leaf Curl Virus (ToLCV) and bacterial wilt (BW) are serious production constraints. Saikia and Muniyappa (1989) reported 100 per cent infection with yield loss exceeding 90 per cent by ToLCV caused by a Gemini virus and BW caused by *Ralstonia solanacearum* is reported to cause up to 90.6 per cent loss in tomato (Ramkishun, 1987), needing development of variety/ hybrid with resistance to ToLCV and BW.

### TLBR-1 (INGR No. 03075; IC 395328)

TLBR-1 is a tomato germplasm with resistance to ToLCV and BW, developed from a cross between a ToLCV resistant line H-24 (Hisar Anmol) and BW resistant line 15SBSB. Hybrids were raised and the seeds of both the back crosses and $F_2$ were produced. Parents, $F_1$, $F_2$ and backcrosses were field evaluated for ToLCV resistance. In the backcross population ($BC_1F_1$) involving 15 SBSB as recurrent

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parent, of the 25 ToLCV disease-free plants, three individual plants viz., H-24 x 15 SBSB $BC_1F_1$-36, H-36, H-24 x 15 SBSB $BC_1F_1$-56 and H-24 x 15 SBSB $BC_1F_1$-64 were advanced. Progeny of the selected back cross ($BC_1F_2$-36) were further screened for ToLCV resistance using virulent white files in the screenhouse. Fifty-nine ToLCV resistant plants from this population were further advanced in BW sick plot followed by artificial inoculations with bacterial ooze. Five individual plants with resistance to ToLCV and BW were identified, bulked and named as TLBR-1.

Plants of TLBR-1 are semi-determinate with good foliar cover. Fruits are medium sized (75 g), obvate round, and medium firm (4.23 kg/cm$^2$) with light green shoulder. It yields 2.03 kg per plant in 140 days (Table 1). Morphoagronomic details of TLBR-1 are summarized in Table 1.

**Table 1. Morpho-agronomic details of TLBR-1**

| Lines | Season | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | April to September 2001 | | | | | October 2001 to March 2002 | | | | |
| | Yield (kg/pl) | Average fruit weight (g) | Fruit firmness (kg/cm$^2$) | ToLCV (%) | BW (%) | Yield (kg/pt) | Average fruit weight (g) | Fruit firmness (kg/cm$^2$) | ToL CV (%) | BW (%) |
| **TLBR-1** | **2.38** | **73.0** | **3.40** | **0.00** | **0.00** | **2.16** | **80.00** | **5.06** | **0** | **0** |
| TLBR-2 | 1.96 | 50.0 | 4.34 | 0.00 | 0.00 | 1.28 | 46.00 | 4.56 | 0 | 0 |
| TLBR-3 | 2.50 | 98.0 | 4.14 | 0.00 | 0.00 | 1.28 | 92.00 | 4.40 | 0 | 0 |
| TLBR-4 | 2.24 | 79.0 | 3.74 | 0.00 | 0.00 | 0.86 | 66.00 | 4.84 | 0 | 0 |
| TLBR-5 | 2.51 | 110.0 | 3.77 | 13.14 | 0.00 | 1.04 | 88.00 | 4.76 | 0 | 0 |
| TLBR-6 | 2.59 | 86.0 | 3.04 | 0.00 | 0.00 | 0.90 | 83.00 | 4.24 | 0 | 0 |
| Arka Saurabh | 0.86 | 51.0 | 3.54 | 91.67 | 98.3 | 0.17 | 63.00 | 3.06 | 100 | 100 |
| SEm± | 0.08 | 6.95 | 0.01 | - | - | 0.18 | 6.10 | 0.25 | - | - |
| C.D. @ 5% | 0.21 | 19.32 | 0.03 | - | - | 0.50 | 16.93 | 0.69 | - | - |
| C.D. @ 1% | 0.27 | 24.82 | 0.04 | - | - | 0.63 | 21.17 | 0.89 | - | - |

**IIHR-2195** ***(INGR No. 03076; IC 395457)***

IIHR-2195 is a tomato germplasm resistant to ToLCV and BW in different genetic background, developed through screening of advance breeding lines received from Asian Vegetable Research and Development Centre. During April to September 2001 eight-advance breeding lines were screened, all were resistant to ToLCV compared to check, Arka Saurabh (92% incidence). All the eight entries except IIHR-2196 (3.7%) were also found completely free from BW incidence compared to Arka Saurabh (98% incidence). IIHR 2195 (CLN2114DC1DF1-20-2-16-8-2-17-0) yielded of 2.24 kg per plant. The resistance was confirmed in subsequent season with a yield of 2.03 kg per plant and an average fruit weight of 19 g (Table 1). It has a determinate growth habit with round fruits of small to medium size (20-30 g); medium firm (2.55 kg/cm$^2$) and light green shoulder produced in 120 days (Table 1). It is suitable for summer cultivation.

**Table 1. Agronomic details of the tomato line TLBR-1**

| Lines | Season | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | April to September 2001 | | | October 2001 to March 2002 | | | | |
| Genotype | Yield (kg/pt) | ToLCV (%) | BW (%) | Yield (kg/pt) | Average fruit weight (g) | Fruit Firmness (kg/cm$^2$) | ToLCV (%) | BW (%) |
| **IIHR-2195** | **2.24** | **0.00** | **0.00** | **2.03** | **19.10** | **2.55** | **0.00** | **0.00** |
| IIHR-2196 | 2.50 | 0.00 | 0.00 | 2.73 | 29.46 | 3.75 | 0.00 | 0.00 |
| IIHR-2197 | 2.20 | 0.00 | 0.00 | 1.73 | 29.52 | 2.40 | 0.00 | 0.00 |
| IIHR-2198 | 2.88 | 0.00 | 0.00 | 2.40 | 38.77 | 3.43 | 0.00 | 0.00 |
| IIHR-2199 | 2.99 | 0.00 | 0.00 | 1.96 | 2.00 | 38.10 | 3.13 | 0.00 |
| IIHR-2100 | 3.19 | 0.00 | 0.00 | 0.50 | 56.51 | 2.90 | 100.00 | 100.00 |
| Arka Saurabh | 0.00 | 100.00 | 100.00 | 0.50 | 56.51 | 2.90 | 100.00 | 100.00 |
| SEm± | 0.21 | - | - | 0.03 | 2.13 | 0.03 | - | - |
| C.D. @ 5% | 0.63 | - | - | 0.09 | 6.39 | 0.08 | - | - |
| C.D. @ 1% | 0.86 | - | - | 0.13 | 8.80 | 0.13 | - | - |

# Cytoplasmic Genetic Male Sterile Line MS 2 A & B OF Chilli (*Capsicum annum* L.) *(INGR No. 03077; IC 296318 & IC 296319)*

**K Madhavi Reddy and AA Deshpande**
*Division of Vegetable Crops, Indian Institute of Horticulture Research, Bangalore-560 089, Karnataka*

MS 2A is a new cytoplasmic genetic male sterile (CGMS) germplasm line of chilli. This malesterile plant was naturally observed in the experimental plot at IIHR, Bangalore. Profuse growth was observed in male sterile plant compared to fertile ones. The male-sterile plants had shrivelled anthers and were devoid of pollen grains. Crosses were made with its sister line and normal pod setting was observed. The $F_1$ plants were male fertile indicating recessive gene actions for male sterility. The fertile $F_1$'s of the cross were backcrossed as pollen parent to corresponding fertile parent and through progeny testing two types of populations were identified from the cross.

Identified heterozygous progenies were selfed and the obtained progenies were crossed with male sterile parent. After evaluating the progency, corresponding maintainer (B line with normal cytoplasm and male sterile nuclear genes) was identified, which gave 100 percent male sterile progeny. The morphological characters of MS2 (A-line) and its mainainter (B line) are given in the Table 1. The plants of MS2A are more vigorous than maintainer, but for characters, such as fruit length, fruit width and 20 fruit weight, male-sterile lines had less mean values compared to their corresponding maintainer line.

**Table 1. Details of MS A and B lines of Chilli**

| Line | Cross/Parent | Days to 50% flowering | Fruit Length (cm) | Fruit width (cm) | Fruit width (cm) | Plant height (cm) | Plant spread (cm) |
|---|---|---|---|---|---|---|---|
| MS-2 | A line | 36 | 3.33 | 1.03 | 23.85 | 80.84 | 65.50 |
| | B line | 36 | 4.13 | 1.06 | 33.00 | 58.33 | 51.65 |

**Reference**

Hundal JS (2000) Double chilli yield by growing hybrid varieties. Spice India. October 2000: 17-20.

# Leafless Pea (*Pisum sativum* L.), PMR-21 *(INGR No. 03078; IC 395309)*

**Yash Vir Singh and Hari Har Ram**
*Department of Vegetable Science, GB Pant University of Agriculture & Technology, Pantnagar-263 145, Uttaranchal*

PMR-21 is a leafless pea genotype with only tendrils compared to normal pinnately compound leaf. It has resistance to powdery mildew (*Erysiphe polygoni)* and was developed through hybridization between Arkel and HEP-4 followed by pedigree selection method. The plant of PMR-21 is medium tall with light green foliage. Flowers are white. Pods are long and slightly curved at the tip. It belongs to the early mid season group of maturity. The seeds are yellow round with small dimple at dry stage. It has been tested for powdery mildew resistance in breeding nurseries and mid season pea varieties under All India Co-ordinated Vegetable Improvement Project (Table 1).

**Table 1. Performance of PMR-21 in AICVIP trials (green pod yield q/ha and reaction to powdery mildew)**

| Entry/ Check* | Location | | | | | |
|---|---|---|---|---|---|---|
| | Solan | IIVR, Varanasi | Almora | IARI, N.Delhi | Pantnagar | Bangalore |
| **PMR-21** | **75 (R)** | **119 (R)** | **125(R)** | **139(R)** | **159(R)** | **38(R)** |
| FC-1* | 70 (HR) | - | 50 (R) | - | 82(R) | - |
| IP-3* | 100 (S) | - | 106 (S) | - | 116 (HS) | 23 (S) |
| C.D. 5% | - | 33 | 19 | - | 16 | 22 |
| C.V. % | - | - | 11 | - | 14 | 19 |

(Source: AIC VIP Annual Report 2001)
R=Resistant, HR=Highly resistant, S=Susceptible, HS Highly susceptible

# Cytoplasmic Genetic Male Sterile Line MS 2 A & B OF Chilli (*Capsicum annum* L.) *(INGR No. 03077; IC 296318 & IC 296319)*

**K Madhavi Reddy and AA Deshpande**
*Division of Vegetable Crops, Indian Institute of Horticulture Research, Bangalore-560 089, Karnataka*

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Identified heterozygous progenies were selfed and the obtained progenies were crossed with male sterile parent. After evaluating the progency, corresponding maintainer (B line with normal cytoplasm and male sterile nuclear genes) was identified, which gave 100 percent male sterile progeny. The morphological characters of MS2 (A-line) and its mainainter (B line) are given in the Table 1. The plants of MS2A are more vigorous than maintainer, but for characters, such as fruit length, fruit width and 20 fruit weight, male-sterile lines had less mean values compared to their corresponding maintainer line.

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| Line | Cross/Parent | Days to 50% flowering | Fruit Length (cm) | Fruit width (cm) | Fruit width (cm) | Plant height (cm) | Plant spread (cm) |
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| | B line | 36 | 4.13 | 1.06 | 33.00 | 58.33 | 51.65 |

**Reference**

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PMR-21 is a leafless pea genotype with only tendrils compared to normal pinnately compound leaf. It has resistance to powdery mildew (*Erysiphe polygoni)* and was developed through hybridization between Arkel and HEP-4 followed by pedigree selection method. The plant of PMR-21 is medium tall with light green foliage. Flowers are white. Pods are long and slightly curved at the tip. It belongs to the early mid season group of maturity. The seeds are yellow round with small dimple at dry stage. It has been tested for powdery mildew resistance in breeding nurseries and mid season pea varieties under All India Co-ordinated Vegetable Improvement Project (Table 1).

**Table 1. Performance of PMR-21 in AICVIP trials (green pod yield q/ha and reaction to powdery mildew)**

| Entry/ Check* | Location | | | | | |
|---|---|---|---|---|---|---|
| | Solan | IIVR, Varanasi | Almora | IARI, N.Delhi | Pantnagar | Bangalore |
| **PMR-21** | **75 (R)** | **119 (R)** | **125(R)** | **139(R)** | **159(R)** | **38(R)** |
| FC-1* | 70 (HR) | - | 50 (R) | - | 82(R) | - |
| IP-3* | 100 (S) | - | 106 (S) | - | 116 (HS) | 23 (S) |
| C.D. 5% | - | 33 | 19 | - | 16 | 22 |
| C.V. % | - | - | 11 | - | 14 | 19 |

(Source: AIC VIP Annual Report 2001)
R=Resistant, HR=Highly resistant, S=Susceptible, HS Highly susceptible

It is a dual-purpose genotype that can be used both as vegetable and grain. Also, it is resistant to powdery mildew (*Erysiphe polygoni).* In north Indian conditions, it should be sown in first fortnight of November with a seed rate of 100 kg per ha.

## Powdery Mildew Resistant Yellow Wrinkle Seeded Pea (*Pisum sativum* L.) DPP 62 *(INGR No. 03079; IC 397028)*

**Pritam Kalia**
*Division of Vegetable Science, Indain Agricultural Research Institute, New Delhi-110 012*

DPP 62 is powdery mildew (*Erysiphe polygoni)* resistant germplasm of pea with yellow wrinkled seeds and medium plant height developed at the Department of Vegetable Science, Himachal Pradesh Krishi Vishvavidyalaya (HPKV), Palampur through hybridization between germplasm 'Bonneville' and powdery mildew resistant stock P388. Individual plant selection for powdery mildew resistance and high yield from $F_2$ population, under artificial epiphytotic conditions was carried out. The selected plants were then advanced following pedigree breeding method. Selection of powdery mildew free plants was done until uniformity. The final selections were again screened under artificial epiphytotic conditions created by infector rows and dusting with fresh inoculum. It takes about 95 days for 50 percent flowering and 120 days for first picking. The availability of pods lasts for about 20 days. The plants attain medium height of 40-50 cm. It bears 12 pods per plant and each pod measures 7.5 cm in length, 5 cm in width with a shelling of 48 percent. The seeds contain 14.5 percent of total soluble sugar, 12 mg per 100 g ascorbic acid and 10.5 percent protein (Pathak, 1999). It gave an average green pod yield of 180.7 q per under dry temperate trans-Himalayan region (Sharma and Sharma, 2000). It is a mid season type. Its pod development stage coincides with the powdery mildew disease incidence in the field. It was also evaluated for pre and post-inflection changes in peroxidase, polyphenoloxidase and phenylalanine ammonia lyase (PAL) activity, which showed that post inflection activity of these phenol oxidinzing enzymes, 2-3 times higher than pre-infection activity (Table1), revealing their role in resistance to powdery mildew disease (Kalia, 1998).

**Table 1. Change in pre- and post-powdery mildew inflection peroxidase, polyphenoloxidase and PAL activity in DPP 62**

| Phenol oxidizing enzymes | Pre-infection | Post-infection |
|---|---|---|
| Peroxidase activity (ΔO.D./min/mg) | 113 | 360 |
| Polyphenol oxidase activity (ΔO.D./min/mg) | 0.12 | 0.25 |
| Phenylalanine ammonia lyase (PAL) activity ($\mu$g-transcinnamic acid formed $hr^{-1}$ $mg^{-1}$) | 133 | 238 |

### References

Kalia P (1998) Enzymic association of powdery mildew resistance in garden pea. *Veg. Sci.* **25:** 166-168.

Pathak S (1999) Variability and Inter-relationships among horticultural traits in powdery mildew resistant genotypes of garden pea (*Pisum sativum* L.) M.Sc. Thesis, PHKV-Palampur (HP).

Sharma TR and JR Sharma (2000) Stability for green pod yield in garden pea (*Pisum sativum* L.) *Indian J. Agric. Sci.* **70:** 40-41.

## Novel Cashew (*Anacardium* spp.) Germplasm

Bigger cashew kernels with ivory white colour fetch premium price in the international trade, hence there is a need to develop varieties with bigger size nuts and other desirable traits (Bhaskar Rao *et al.,* 1996).

## NRC-59 (VTH 196/18) *(INGR No. 03080; IC 296552)*

**KN Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC-59, bold nut and big apple type cashew (*Anacardium occidentale* L.) was obtained from the primary collection of the seedling progency of tree No. 196/18 collected from 8/8 Avivelu, Venkatapuram and maintained at the

It is a dual-purpose genotype that can be used both as vegetable and grain. Also, it is resistant to powdery mildew (*Erysiphe polygoni).* In north Indian conditions, it should be sown in first fortnight of November with a seed rate of 100 kg per ha.

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**Pritam Kalia**
*Division of Vegetable Science, Indain Agricultural Research Institute, New Delhi-110 012*

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**KN Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

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Cashew Research Station (CRS), Baptala, Andhra Pradesh.

The trees of NRC-59 are tall (4.1m in height) with a spread of 4.9 $m^2$ in the 10$^{th}$ year of planting. Trees are extensively branched with small to medium leaves (66.8 $cm^2$). It is a mid-season flowering type with long flowering duration (100 days) and medium flowering intensity (66.8%). The nuts are medium to bold (8.3 g), apple big (130 g) with an average yield of 9.25 kg per tree in the initial six annual harvests and shelling percentage of 30.8 (Swamy *et al.*, 1988).

**References**

Bhaskara Rao EVV, KRM Swamy and MG Bhat (1998) Stauts of cashew breeding and future priorities. *J. Plantation Crops.* **26:** 103-113.

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentate* L.) Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54p.

## NRC-111 (MARDOL-4) *(INGR No. 03081; IC 296555)*

**KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202 Karnataka*

NRC-111 (Mardol-4) is a bold nuts cashew (*Anacardium occidentale* L.) accession collected from Mardol, Goa. Trees of this accession are tall with an average height of 5.2 m in 10$^{th}$ year of planting with canopy of 6.0 $m^2$, extensive branching and fairly small to medium size leaves (56.5 $cm^2$). It is a mid-season type with high flowering intensity (83.3%) and fairly good sex ratio (0.10). Both the nut (12.6 g) and apple (106.6 g) are big in size and the trees had an average of 8.11 kg nuts yield per plant in initital six annual harvests. The nuts had good processing quality with a low shelling percentage of 24.1 (Swamy *et al.*, 1998).

**References**

Bhaskara Rao EVV, KRM Swamy and MG Bhat (1998) Status of cashew breeding and future priorities, *J. Plantation Crops.* **26:** 103-113.

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## NRC-116 (CNSL Free) *(INGR No. 03082; IC 296557)*

**MM Khan, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC-116 is a cashew nut shell liquid (CNSL) free cashew (*Anacardium occidentale* L.) accession, assembled from primary collections of Agricultural Research Station, Ullal, Karnataka. CSNL present in the cashew shells is an important by-product available in cashew processing. However, the CNSL causes skin burning and drudgery to the working force. Thus, development of hybrids with CNSL-free is desirable features. NRC-116 is a medium statured tree with a height of 3.7 m and spread of 5.4 $m^2$ in the 10$^{th}$ year of planting and totally CNSL-free. Trees have extensive branching with medium sized leaves (76.3 $cm^2$). It is early season flowering with long flowering duration (112 days) and high flowering intensity (81.2%). It gave an average yield of 2.66 kg nuts per plant in initial six annual harvests with low shelling percentage of 25.7 (Swamy *et al.*, 1998).

**References**

Bhaskara Rao EVV, KRM Swamy and MG Bhat (1998) Status of cashew breeding and future priorities. *J. Plantation Crops.* **26**: 103-113.

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for cashew (ICAR), Puttur, Karnataka, 54 p.

Cashew Research Station (CRS), Baptala, Andhra Pradesh.

The trees of NRC-59 are tall (4.1m in height) with a spread of 4.9 $m^2$ in the 10$^{th}$ year of planting. Trees are extensively branched with small to medium leaves (66.8 $cm^2$). It is a mid-season flowering type with long flowering duration (100 days) and medium flowering intensity (66.8%). The nuts are medium to bold (8.3 g), apple big (130 g) with an average yield of 9.25 kg per tree in the initial six annual harvests and shelling percentage of 30.8 (Swamy *et al.*, 1988).

**References**

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## NRC-111 (MARDOL-4) *(INGR No. 03081; IC 296555)*

**KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202 Karnataka*

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**References**

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**MM Khan, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC-116 is a cashew nut shell liquid (CNSL) free cashew (*Anacardium occidentale* L.) accession, assembled from primary collections of Agricultural Research Station, Ullal, Karnataka. CSNL present in the cashew shells is an important by-product available in cashew processing. However, the CNSL causes skin burning and drudgery to the working force. Thus, development of hybrids with CNSL-free is desirable features. NRC-116 is a medium statured tree with a height of 3.7 m and spread of 5.4 $m^2$ in the 10$^{th}$ year of planting and totally CNSL-free. Trees have extensive branching with medium sized leaves (76.3 $cm^2$). It is early season flowering with long flowering duration (112 days) and high flowering intensity (81.2%). It gave an average yield of 2.66 kg nuts per plant in initial six annual harvests with low shelling percentage of 25.7 (Swamy *et al.*, 1998).

**References**

Bhaskara Rao EVV, KRM Swamy and MG Bhat (1998) Status of cashew breeding and future priorities. *J. Plantation Crops.* **26**: 103-113.

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for cashew (ICAR), Puttur, Karnataka, 54 p.

Cashew Research Station (CRS), Baptala, Andhra Pradesh.

The trees of NRC-59 are tall (4.1m in height) with a spread of 4.9 $m^2$ in the 10$^{th}$ year of planting. Trees are extensively branched with small to medium leaves (66.8 $cm^2$). It is a mid-season flowering type with long flowering duration (100 days) and medium flowering intensity (66.8%). The nuts are medium to bold (8.3 g), apple big (130 g) with an average yield of 9.25 kg per tree in the initial six annual harvests and shelling percentage of 30.8 (Swamy *et al.*, 1988).

**References**

Bhaskara Rao EVV, KRM Swamy and MG Bhat (1998) Stauts of cashew breeding and future priorities. *J. Plantation Crops.* **26:** 103-113.

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentate* L.) Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54p.

## NRC-111 (MARDOL-4) *(INGR No. 03081; IC 296555)*

**KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202 Karnataka*

NRC-111 (Mardol-4) is a bold nuts cashew (*Anacardium occidentale* L.) accession collected from Mardol, Goa. Trees of this accession are tall with an average height of 5.2 m in 10$^{th}$ year of planting with canopy of 6.0 $m^2$, extensive branching and fairly small to medium size leaves (56.5 $cm^2$). It is a mid-season type with high flowering intensity (83.3%) and fairly good sex ratio (0.10). Both the nut (12.6 g) and apple (106.6 g) are big in size and the trees had an average of 8.11 kg nuts yield per plant in initital six annual harvests. The nuts had good processing quality with a low shelling percentage of 24.1 (Swamy *et al.*, 1998).

**References**

Bhaskara Rao EVV, KRM Swamy and MG Bhat (1998) Status of cashew breeding and future priorities, *J. Plantation Crops.* **26:** 103-113.

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-116 (CNSL Free) *(INGR No. 03082; IC 296557)*

**MM Khan, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC-116 is a cashew nut shell liquid (CNSL) free cashew (*Anacardium occidentale* L.) accession, assembled from primary collections of Agricultural Research Station, Ullal, Karnataka. CSNL present in the cashew shells is an important by-product available in cashew processing. However, the CNSL causes skin burning and drudgery to the working force. Thus, development of hybrids with CNSL-free is desirable features. NRC-116 is a medium statured tree with a height of 3.7 m and spread of 5.4 $m^2$ in the 10$^{th}$ year of planting and totally CNSL-free. Trees have extensive branching with medium sized leaves (76.3 $cm^2$). It is early season flowering with long flowering duration (112 days) and high flowering intensity (81.2%). It gave an average yield of 2.66 kg nuts per plant in initial six annual harvests with low shelling percentage of 25.7 (Swamy *et al.*, 1998).

**References**

Bhaskara Rao EVV, KRM Swamy and MG Bhat (1998) Status of cashew breeding and future priorities. *J. Plantation Crops.* **26**: 103-113.

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-120 (Nairobi) *(INGR No. 03083, IC 296559)*

**MM Khan, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC-120 is a bold nut and big apple cashew *(Anacardium occidentale)* accession, assembled from the primary collections of Nairobi maintained at Agricultural Research Station, Ullal, Karnataka. The trees of NRC-120 are slow growers with a mean plant height of 2.6 m and a canopy spread of 4.6 $m^2$ in the $10^{th}$ year of planting. Trees have extensive branching with small leaves (62.6 $cm^2$) and have early flowering (November-December) with long flowering duration (112 days) and high flowering intensity (86.3%). The nuts (8.8 g) and apple (150 g) are big in size. The trees gave an average yield of 5.78 kg nuts per tree in the initial six harvests with a low shelling percentage of 21.6 percent (Swamy *et al.*, 1998).

### References

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors or cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-121(Purple Genotype) *(INGR No. 03084, IC 296561)*

**MM Khan, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 121 is cashew (*Anacardium occidentale* L.) accession with rare purple coloured leaves and stem. The accession was assembled from the primary collection of the Agricultural Research Station, Ullal, Karnataka. It has purple coloured stem and leaves and slow growth (2.7 m height and 2.5 $m^2$ spread in ten years). It has small sized leaves (51.7 $cm^2$) and extensive branching behaviour. It flowers in mid-season (January-February) with high flowering intensity (73%) and are of medium duration of 89 days. Both the nuts and apple are small in size with purple colour. The trees gave an average yield of 2.47 kg nuts per tree in the initial six harvests with shelling percentage of 28.9 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-140 (VTH-155 L) *(INGR No. 03085, IC 296564)*

**MM Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574202, Karnataka*

NRC-140 (VTH-155L) is a medium tall early season, long flowering duration genotype of cashew (*Anacardium occidentale* L.) assembled from Cashew Research Station, Bapatal, Andhra Pradesh. The treess of this accession are semi-tall type with a height of 3.1 $m^2$ and spread of 4.4 $m^2$ in the initial ten years of growth. Trees have extensive branching with medium to big leaves (109.4 $cm^2$). It is early flowering and have medium to long duration (90-120 days) of flowering with an intensity of 90 percent. The trees produce medium nuts (8.3 g) and big apple (142.8 g) and are high yielding with an average of 12.4 kg nuts per plant in initial six annual harvests and medium shelling percentage of 28.9 (Swamy *et al.*, 1998). This dwarf and compact types is suitable for high-density planting and development of hybrids with slow growth and compactness.

### Reference

Swamy KRM, EVV Bhaskara Rao MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.) Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-120 (Nairobi) *(INGR No. 03083, IC 296559)*

**MM Khan, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC-120 is a bold nut and big apple cashew *(Anacardium occidentale)* accession, assembled from the primary collections of Nairobi maintained at Agricultural Research Station, Ullal, Karnataka. The trees of NRC-120 are slow growers with a mean plant height of 2.6 m and a canopy spread of 4.6 $m^2$ in the $10^{th}$ year of planting. Trees have extensive branching with small leaves (62.6 $cm^2$) and have early flowering (November-December) with long flowering duration (112 days) and high flowering intensity (86.3%). The nuts (8.8 g) and apple (150 g) are big in size. The trees gave an average yield of 5.78 kg nuts per tree in the initial six harvests with a low shelling percentage of 21.6 percent (Swamy *et al.*, 1998).

### References

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors or cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-121(Purple Genotype) *(INGR No. 03084, IC 296561)*

**MM Khan, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 121 is cashew (*Anacardium occidentale* L.) accession with rare purple coloured leaves and stem. The accession was assembled from the primary collection of the Agricultural Research Station, Ullal, Karnataka. It has purple coloured stem and leaves and slow growth (2.7 m height and 2.5 $m^2$ spread in ten years). It has small sized leaves (51.7 $cm^2$) and extensive branching behaviour. It flowers in mid-season (January-February) with high flowering intensity (73%) and are of medium duration of 89 days. Both the nuts and apple are small in size with purple colour. The trees gave an average yield of 2.47 kg nuts per tree in the initial six harvests with shelling percentage of 28.9 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-140 (VTH-155 L) *(INGR No. 03085, IC 296564)*

**MM Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574202, Karnataka*

NRC-140 (VTH-155L) is a medium tall early season, long flowering duration genotype of cashew (*Anacardium occidentale* L.) assembled from Cashew Research Station, Bapatal, Andhra Pradesh. The treess of this accession are semi-tall type with a height of 3.1 $m^2$ and spread of 4.4 $m^2$ in the initial ten years of growth. Trees have extensive branching with medium to big leaves (109.4 $cm^2$). It is early flowering and have medium to long duration (90-120 days) of flowering with an intensity of 90 percent. The trees produce medium nuts (8.3 g) and big apple (142.8 g) and are high yielding with an average of 12.4 kg nuts per plant in initial six annual harvests and medium shelling percentage of 28.9 (Swamy *et al.*, 1998). This dwarf and compact types is suitable for high-density planting and development of hybrids with slow growth and compactness.

### Reference

Swamy KRM, EVV Bhaskara Rao MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.) Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-120 (Nairobi) *(INGR No. 03083, IC 296559)*

**MM Khan, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC-120 is a bold nut and big apple cashew *(Anacardium occidentale)* accession, assembled from the primary collections of Nairobi maintained at Agricultural Research Station, Ullal, Karnataka. The trees of NRC-120 are slow growers with a mean plant height of 2.6 m and a canopy spread of 4.6 $m^2$ in the $10^{th}$ year of planting. Trees have extensive branching with small leaves (62.6 $cm^2$) and have early flowering (November-December) with long flowering duration (112 days) and high flowering intensity (86.3%). The nuts (8.8 g) and apple (150 g) are big in size. The trees gave an average yield of 5.78 kg nuts per tree in the initial six harvests with a low shelling percentage of 21.6 percent (Swamy *et al.*, 1998).

### References

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors or cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-121(Purple Genotype) *(INGR No. 03084, IC 296561)*

**MM Khan, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 121 is cashew (*Anacardium occidentale* L.) accession with rare purple coloured leaves and stem. The accession was assembled from the primary collection of the Agricultural Research Station, Ullal, Karnataka. It has purple coloured stem and leaves and slow growth (2.7 m height and 2.5 $m^2$ spread in ten years). It has small sized leaves (51.7 $cm^2$) and extensive branching behaviour. It flowers in mid-season (January-February) with high flowering intensity (73%) and are of medium duration of 89 days. Both the nuts and apple are small in size with purple colour. The trees gave an average yield of 2.47 kg nuts per tree in the initial six harvests with shelling percentage of 28.9 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-140 (VTH-155 L) *(INGR No. 03085, IC 296564)*

**MM Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574202, Karnataka*

NRC-140 (VTH-155L) is a medium tall early season, long flowering duration genotype of cashew (*Anacardium occidentale* L.) assembled from Cashew Research Station, Bapatal, Andhra Pradesh. The treess of this accession are semi-tall type with a height of 3.1 $m^2$ and spread of 4.4 $m^2$ in the initial ten years of growth. Trees have extensive branching with medium to big leaves (109.4 $cm^2$). It is early flowering and have medium to long duration (90-120 days) of flowering with an intensity of 90 percent. The trees produce medium nuts (8.3 g) and big apple (142.8 g) and are high yielding with an average of 12.4 kg nuts per plant in initial six annual harvests and medium shelling percentage of 28.9 (Swamy *et al.*, 1998). This dwarf and compact types is suitable for high-density planting and development of hybrids with slow growth and compactness.

### Reference

Swamy KRM, EVV Bhaskara Rao MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.) Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-142 (VTH 578/1) *(INGR No. 03086; IC 296565)*

**KN Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 142 (VTH 578/1) is a wild relative of cashew belonging to species *Anacardium microcarpum* L. assembled as seed from Brazil. The trees are tall and huge in size, 4.6 m high and 5.4 $m^2$ spread in the tenth year of planting. Trees have extensive branching with big leaves (137.4 $cm^2$). Usually trees flowers late in season (March-April) with high intensity of flowering (81.8%) and low sex ratio (0.05%). It flowers for medium duration, upto 72 days. It is a good yielder, with an average of 8.31 kg nuts per tree (a cumulative yield of initial six harvests) with medium shelling percentage of 28.5 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-152 (VTH 713/4) *(INGR No. 03087; IC 296567)*

**KN Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 152 (VTH 713/4) is a wild relative of cashew belonging to species *Anacardium orthonianum* L. It is slow growing with thick bark and profuse flowering habit. The accession was assembled as seed from Brazil. Trees are slow growing with a medium height of 3.6 m and very low spreading habit (3.3 $m^2$) in the $10^{th}$ year of planting. It has extensive branching with big leaves (100.3 $cm^2$). It is late flowering type with low flowering intensity (14.3%) and continues to flower for about 80 days. Sex ratio is very low (0.06%) with very poor fruit set. Both the nut (2.0 g) and apple (60 g) are small. It yields with an average of 0.80 kg nuts per plant (a cumulative yield of initital six annual harvests) and with a low shelling percentage of 22 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.) Germplasm Accessions-II. National Research Centre for Cashew, (ICAR), Puttur, Karnataka 54 p.

## NRC-201 *(INGR No. 03088; IC 296571)*

**PC Lenka, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 201 is a semi-tall, upright branching and compact canopy cashew (*Anacardium occidentale* L.) accession collected from Cashew Reseach Station (OUAT), Bhubaneshwar, Orissa. Such dwarf and compact types are preferred for cultivation because of easy management. The trees are slow growing with a height of 2.9 m and a spread of 4.2 $m^2$ in the $10^{th}$ year of planting. They have extensive branching with medium leaves (82.9 $cm^2$). It flowers early (November-December) with medium flowering intensity (68.6%) and for duration of upto 84 days. It has medium size nuts (8.3 g) and apple (60.0 g). Plants are low yielding with an average yield of 3.22 kg nut per plant (a cumulative yield of 6 initial harvests), but high shelling percentage of 30.2 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-142 (VTH 578/1) *(INGR No. 03086; IC 296565)*

**KN Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 142 (VTH 578/1) is a wild relative of cashew belonging to species *Anacardium microcarpum* L. assembled as seed from Brazil. The trees are tall and huge in size, 4.6 m high and 5.4 $m^2$ spread in the tenth year of planting. Trees have extensive branching with big leaves (137.4 $cm^2$). Usually trees flowers late in season (March-April) with high intensity of flowering (81.8%) and low sex ratio (0.05%). It flowers for medium duration, upto 72 days. It is a good yielder, with an average of 8.31 kg nuts per tree (a cumulative yield of initial six harvests) with medium shelling percentage of 28.5 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-152 (VTH 713/4) *(INGR No. 03087; IC 296567)*

**KN Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 152 (VTH 713/4) is a wild relative of cashew belonging to species *Anacardium orthonianum* L. It is slow growing with thick bark and profuse flowering habit. The accession was assembled as seed from Brazil. Trees are slow growing with a medium height of 3.6 m and very low spreading habit (3.3 $m^2$) in the $10^{th}$ year of planting. It has extensive branching with big leaves (100.3 $cm^2$). It is late flowering type with low flowering intensity (14.3%) and continues to flower for about 80 days. Sex ratio is very low (0.06%) with very poor fruit set. Both the nut (2.0 g) and apple (60 g) are small. It yields with an average of 0.80 kg nuts per plant (a cumulative yield of initital six annual harvests) and with a low shelling percentage of 22 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.) Germplasm Accessions-II. National Research Centre for Cashew, (ICAR), Puttur, Karnataka 54 p.

## NRC-201 *(INGR No. 03088; IC 296571)*

**PC Lenka, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 201 is a semi-tall, upright branching and compact canopy cashew (*Anacardium occidentale* L.) accession collected from Cashew Reseach Station (OUAT), Bhubaneshwar, Orissa. Such dwarf and compact types are preferred for cultivation because of easy management. The trees are slow growing with a height of 2.9 m and a spread of 4.2 $m^2$ in the $10^{th}$ year of planting. They have extensive branching with medium leaves (82.9 $cm^2$). It flowers early (November-December) with medium flowering intensity (68.6%) and for duration of upto 84 days. It has medium size nuts (8.3 g) and apple (60.0 g). Plants are low yielding with an average yield of 3.22 kg nut per plant (a cumulative yield of 6 initial harvests), but high shelling percentage of 30.2 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-142 (VTH 578/1) *(INGR No. 03086; IC 296565)*

**KN Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 142 (VTH 578/1) is a wild relative of cashew belonging to species *Anacardium microcarpum* L. assembled as seed from Brazil. The trees are tall and huge in size, 4.6 m high and 5.4 $m^2$ spread in the tenth year of planting. Trees have extensive branching with big leaves (137.4 $cm^2$). Usually trees flowers late in season (March-April) with high intensity of flowering (81.8%) and low sex ratio (0.05%). It flowers for medium duration, upto 72 days. It is a good yielder, with an average of 8.31 kg nuts per tree (a cumulative yield of initial six harvests) with medium shelling percentage of 28.5 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

## NRC-152 (VTH 713/4) *(INGR No. 03087; IC 296567)*

**KN Murthy, PM Kumaran, KRM Swamy, MG Bhat and EVV Bhaskara Rao**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 152 (VTH 713/4) is a wild relative of cashew belonging to species *Anacardium orthonianum* L. It is slow growing with thick bark and profuse flowering habit. The accession was assembled as seed from Brazil. Trees are slow growing with a medium height of 3.6 m and very low spreading habit (3.3 $m^2$) in the $10^{th}$ year of planting. It has extensive branching with big leaves (100.3 $cm^2$). It is late flowering type with low flowering intensity (14.3%) and continues to flower for about 80 days. Sex ratio is very low (0.06%) with very poor fruit set. Both the nut (2.0 g) and apple (60 g) are small. It yields with an average of 0.80 kg nuts per plant (a cumulative yield of initital six annual harvests) and with a low shelling percentage of 22 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao and MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.) Germplasm Accessions-II. National Research Centre for Cashew, (ICAR), Puttur, Karnataka 54 p.

## NRC-201 *(INGR No. 03088; IC 296571)*

**PC Lenka, KRM Swamy, EVV Bhaskara Rao and MG Bhat**
*National Research Centre for Cashew, Puttur-574 202, Karnataka*

NRC 201 is a semi-tall, upright branching and compact canopy cashew (*Anacardium occidentale* L.) accession collected from Cashew Reseach Station (OUAT), Bhubaneshwar, Orissa. Such dwarf and compact types are preferred for cultivation because of easy management. The trees are slow growing with a height of 2.9 m and a spread of 4.2 $m^2$ in the $10^{th}$ year of planting. They have extensive branching with medium leaves (82.9 $cm^2$). It flowers early (November-December) with medium flowering intensity (68.6%) and for duration of upto 84 days. It has medium size nuts (8.3 g) and apple (60.0 g). Plants are low yielding with an average yield of 3.22 kg nut per plant (a cumulative yield of 6 initial harvests), but high shelling percentage of 30.2 (Swamy *et al.*, 1998).

### Reference

Swamy KRM, EVV Bhaskara Rao MG Bhat (1998) Catalogue of minimum descriptors of cashew (*Anacardium occidentale* L.). Germplasm Accessions-II. National Research Centre for Cashew (ICAR), Puttur, Karnataka, 54 p.

# High Yielding and High Curcumin Content Turmeric (*Curcuma longa* L.), Coll No. 657 *(INGR No. 03089; IC 296550)*

**B Sasikumar, Johnson K Geroge and KV Saji**
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Turmeric (*Curcuma longa* L.), indigenous to India is an important spice and medicinal plant. Coll No. 657 with good yield (14.9 kg/3m$^2$) and high curcumin content (7.5%) was identified at the IISR from 899 accessions. This accession is a clonal selection from popular turmeric cultivar 'Alleppey'. The plant height is 52 cm with a stem girth 12 cm. The main shoot bears nine leaves with an average of three tillers and, seven leaves per tiller. Leaves are 56 cm long and 15.3 cm wide. The yield per three square meter beds is 14.9 kg of fresh weight with 18 percent dry recovery and 7.5 percent curcumin content. Table 1 gives the yield and quality features of Coll No. 657. For cultivation, a seed rate of 2500 kg rhizome/ha with spacing of 25.0 x 30.0 cm in beds or 45-60 x 25 cm in ridges and furrows is recommended.

**Table 1. Yield and quality features of Coll No. 657**

| Accessions/ Check | Yield/3m$^2$ (Calicut) | | | | Dry recovery | Curcumin content (%) | Curcumin (kg/ha) |
|---|---|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | 2002-03 | Mean | | | |
| **Acc. 657** | **17.3** | **26.5** | **20.18** | **21.32** | **19.45** | **7.5** | **455.3** |
| Prabha* | 15.0 | 25.4 | 16.21 | 18.84 | 20.0 | 6.5 | 419.1 |
| Prathiba* | 15.0 | 24.1 | 16.67 | 18.59 | 18.7 | 6.5 | 349.1 |

*Checks

# Betelvine *(Pipe betle)* Germplasm, SPb-10 *(INGR No. 03090; IC 296595)*

**R Arulmozhiyanan, R Chitra, K Prabakar and S Md Jalaluddin**
*Sugaracane Research Station, Sirugamani, Tamil Nadu Agricultural University, Trichy-639 115, Tamil Nadu*

SPb-10 (SGM-1) is a high yielding bushy female betel vine with light green, ovate and pungent leaves. This is a pureline selection from Palghat, Kerala. The leaf size, petiole length, venation number and internodal length of SPb-10 are 78.1 cm$^2$, 6.2 cm, 7.00 and 5.6 cm respectively. It produces about 15 branches per vine per year. The selection SPb-10 has given maximum average leaf yield of 105.56 lakhs per hectare as compared to 88.86 lakhs in Karpuri, 80 lakhs in Vellai Kodi and 70.42 lakhs, used as checks in pachaikodi. In the multi-location trails, the leaf yoeld in SPb-10 was about 113.51 lakhs per hactare. It has least elongation of vine (14.5 cm/month) as compared to the traditional varieties (15.2 to 18.5 cm/month). It produced 25 to 32 branches per vine as compared to 7 to 13 that of local checks at Sugarcane Research Station. Also in multi-location trials it produced 27-37 branches as compared to 9-17 in other enteries. Hundred-leaf weight is 240 g. It is moderately resistant to root knot nematode (gall index of 2.0), scales ant mites, (index of 1.5) and to *Phytopthora* wilt under field conditions.

# High Yielding, Disease Tolerant Black Pepper *(Piper nigrum* L) Coll. 1041 *(INGR No. 03091; IC 316598)*

**B Sasikumar; KV Saji, Johnson K George, PN Ravindran and VA Parthasarthy**
*Indian Institute of Species Research, Calicut-673 012, Kerala*

Coll. 1041 black pepper is a high yielding and *Phytophthora* foot rot tolerant accession developed through clonal selection from the popular black pepper cultivar 'Thevanmndi' of Idukki district, Kerala. The vine of Coll. 1041 has dimorphic branching with light purple shoot tip colour, non-pubiscent stem, ovate-elliptic leaves, glabrous-coriacaous texture, pendent spike orientation with filiform shape green in colour, non-fragrant and 8.2 cm long. It produces around 47 round fruits per spike with 100-fruit weight of 15.5 g. Yield and quality attributes

# High Yielding and High Curcumin Content Turmeric (*Curcuma longa* L.), Coll No. 657 *(INGR No. 03089; IC 296550)*

**B Sasikumar, Johnson K Geroge and KV Saji**
*Indian Institute of Species Research, Calicut-673 012, Kerala*

Turmeric (*Curcuma longa* L.), indigenous to India is an important spice and medicinal plant. Coll No. 657 with good yield (14.9 kg/3m$^2$) and high curcumin content (7.5%) was identified at the IISR from 899 accessions. This accession is a clonal selection from popular turmeric cultivar 'Alleppey'. The plant height is 52 cm with a stem girth 12 cm. The main shoot bears nine leaves with an average of three tillers and, seven leaves per tiller. Leaves are 56 cm long and 15.3 cm wide. The yield per three square meter beds is 14.9 kg of fresh weight with 18 percent dry recovery and 7.5 percent curcumin content. Table 1 gives the yield and quality features of Coll No. 657. For cultivation, a seed rate of 2500 kg rhizome/ha with spacing of 25.0 x 30.0 cm in beds or 45-60 x 25 cm in ridges and furrows is recommended.

**Table 1. Yield and quality features of Coll No. 657**

| Accessions/ Check | Yield/3m$^2$ (Calicut) | | | | Dry recovery | Curcumin content (%) | Curcumin (kg/ha) |
|---|---|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | 2002-03 | Mean | | | |
| **Acc. 657** | **17.3** | **26.5** | **20.18** | **21.32** | **19.45** | **7.5** | **455.3** |
| Prabha* | 15.0 | 25.4 | 16.21 | 18.84 | 20.0 | 6.5 | 419.1 |
| Prathiba* | 15.0 | 24.1 | 16.67 | 18.59 | 18.7 | 6.5 | 349.1 |

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Rooted cutting are used as the planting material with a spacing of 3 x 3 $m^2$ on live standards such as *Erythrina spp. or Garuga pinnata* or *Grevilia robusta.*

**Table 1. Yield of Coll. 1041 as compared to checks at Valparai (Tamil Nadu)**

| Line/ Control* | Average yield (fresh/vine (kg) 95-96 | 96-97 | 97-98 | 98-99 | 99-00 | 00-01 | 01-02 | Mean yield/vine (kg) |
|---|---|---|---|---|---|---|---|---|
| **Coll. 1041** | **2.29** | **4.10** | **4.20** | **4.71** | **4.77** | **8.45** | **7.70** | **5.17** |
| Panniyur-1* | 3.60 | 1.90 | 1.84 | 2.76 | 1.15 | 6.60 | 4.94 | 3.23 |
| KS-14* | 0.40 | 0.34 | 0.32 | 0.32 | 0.63 | 1.28 | 0.80 | 0.58 |
| KS-27* | 0.51 | 0.16 | 0.24 | 0.93 | 1.52 | 2.8 | 0.90 | 1.08 |

**Table 2. Quality attributes of Coll. 1041 and controls at Valparai and Peruvannamuzhi**

| Line/ | Valparai | | | | | Peruvannamuzhi | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Control* | Dry recov. (%) | Bulk density (g) | Piperine (%) | Oleo-resin (%) | Essen tialoil (%) | Dry reco. (%) | Bulk density (%) | Piper-ine (%) | Oleo-resin (%) | Essen tial oil (%) |
| **Coll. 1041** | **35.0** | **582** | **1.4** | **8.5** | **3.2** | **30.5** | **569** | **1.9** | **7.8** | **3.0** |
| Panniyu-1* | 30.0 | 512 | 3.0 | 9.4 | 2.0 | - | - | - | - | - |
| KS-27* | - | - | - | - | - | 34.0 | 565.2 | 3.0 | 10.6 | 3.6 |

## Highly Pungent Chilli (*Capsicum grossum* L.) DRLT-1107 (Naga Jalokia) (INGR No. 03092; IC 399066)

**Subash Chandra Das**
*Defence Research Laboratory, Tezpur-784101, Assam*

DRLT-1107 (Naga Jalokia) is a highly pungent chilli germplasm it is an endemic herbaceous annual with plant height of 50-90 cm. 1.5-3.0 cm stem diameter; leaves are yellow and flat, alternate, petiolate, elliptical, wavy, dark green, 5-16 cm long, and 3-6 cm wide. Flowers are complete, actinomorphic, pedicellate, pentamerous, greenish white 0.5-1.0 cm. Fruits are pendulous, wrinkled, yellowish green at young stage and deep red at maturity and 3-7 cm long. The genotype contains maximum capsaicin and dihydrocapsaicin contributing to a pungency of 855,000 SHU (Scoville heat unit) in comparision to Red Savina (577,000 SHU) and famous Thai chillies (100,000 SHU) which is highest till date (Das, 2000). Also, it is disease resistant and tolerance to insect, pest and nematode of chilli.

### Reference

Das Subash Chandra (2000), The hottest chilli variety in India. *Curr Sci* **79**: 287-288.

## Bold Seeded with High Azadirchtin–A Selection of Neem, DOR Neem 2 *(INGR No. 03093; IC 395308)*

**N Mukta**
*Directorate of Oilseeds Research, Rajendra Nagar, Hyderabad-500 030, Andhra Pradesh*

DOR NEEM 2 is a bold seeded selection of neem with high kernel yield and high Azadirachtin-A content, identified from collection of an approximately 20 year old tree growing at Narkhoda village in Rangareddy district, Andhra Pradesh. The region receives an annual rainfall of 700 mm and maximum temperature upto 43°C during the months of April-May. The tree attained a girth at breast height of 177 cm in the year 2000 and was selected, based on the size of the fruit and seed, which were analysed for oil and Azadirachtin-A content

of Coll. 1041 compared to check is presented in Tables 1 and 2 respectively. Also it is tolerant to root rot disease with an index 2 against 4 of Karimunda (2 = rotting of 50% or less root).

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were 39.2 per cent and 0.5 per cent respectively. Though Azadirachtin-A content upto 0.959 per cent has been reported in a study conducted by Venkateswarlu *et al.*, (1996) the maximum 100-seed weight reported in the collection is 22.9 g, which is lesser than DOR Neem 2 (30.0 g).

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Venkateshwarlu B, GR Korwar, K Mukhopadhyaya, and Jayjayanthi Mukhopadhyay (1996) scope and viability of neem plantations for producing quality seeds for biosesticide industry. In: Proceedings & Extended Summaries of International Conference on Neem-Setting Goals for a global vision, 20-22 December. Neem Foundation, Mumbai, pp 72-78.

# A Novel Orchid Hybrid, Dendrobium 'A Abraham' *(INGR No. 03094; IC 401584)*

**PG Latha, N Mohanan and S Seeni**

*Tropical Botanical Garden and Research Institute (TBGRI), Palode Thiruvananthapuram-695 562, Kerala*

*Dendrobium* 'A Abraham' is a novel flowering orchid hybrid developed in 1996 by hybridization between a creamy white flowered *Dendrobium* hybrid called *D.* Ng Eng Cheow as the male parent and deep purple flowered *Dendrobium* hybrid called *D.* Tay Swee Keng as the female parent. *Dendrobium* 'A Abraham' grows erect and is stouter than both parents. The canes are 60-75 cm high, 1-2 cm diameter with 4-7 cm long internodes, greenish with parallel purple anthocyanin-rich stripes, on the sheath. Leaves 2-6 in number are elliptic lanceolate, actue towards the tip of the mature canes. Inflorescence is 30-70 cm long with green peduncles. Flowers are 5-7 cm across, lightly purple, white between the veins of sepals and petals; pedicles greenish-white; sepals 2.5-3 x 1-1.5 cm, oblong, acute, lighter than petals; petals 3.0-3.5 x 1.5-2 cm ovate-rhomboid, slightly emarginated at tip, narrow at base; lip dark purple with darker purple shade at the throat; mid-lobe of the lip not lobed, acute with a thickened tomentose cushion at the base; column purple. It is named after the late Professor. A. Abraham, the Founder-Director of TBGRI. It is fast growing and multiplies by the frequent production of robust 'keikis' from the base of the stock. The flowers of this hybrid exhibit the mixed characters of both the parents. (Seeni and Latha, 1990) but overall morphologically close to that of *D.* Ng Eng Cheow, having petals and lips are larger in size. Most of the first flowered plants are floriferous, as evidenced from 15-20 well spread flowers seen on a spike, produced from the axils of upper leaves and more than 5 spikes, produced from a cane. The young robust rooted offshoots (keikis) developing from the base of the stock can be grown in 10 inch perforated orchid pots, placed on concrete benches.

**References**

Abraham A and P Vatsala (1981) *Introduction to Orchids.* Tropical Botanic Garden and Research Institute, Trivandrum, 108 p.

Seeni S and PG Latha (1990). Green pod culture and post-transplanation growth of a hybrid *Dendrobium.* In: "New Avenues in Crop Breeding". Proceedings of the National Seminar on Plant Genetics and Biotchnology, CMS College, Kottayam, pp 50-53.

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**References**

Abraham A and P Vatsala (1981) *Introduction to Orchids.* Tropical Botanic Garden and Research Institute, Trivandrum, 108 p.

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