# Plant Germplasm Registration Notice

The Germplasm Registration Committee of ICAR in its XII[th] meeting held on 31[st] May, 2004 at the National Bureau of Plant Genetic Resources, New Delhi approved the registration of following 79 germplasm lines out of the 133 proposals considered.

## PD 27 (Khoda, CRRI Acc No. 36470) (INGR No. 04001; IC283020), Paddy (*Oryza sativa* L.) Landrace with Tolerance to Complete Submergence

**BC Patra and RK Sarkar**
*Central Rice Research Institute, Cuttack-753006, Orissa*

Khoda, a photosensitive rice (*Oryza sativa* L.) cultivar was collected from the farmer field in Brahmanigaon, Baranga, Cuttack, Orissa after the super cyclone of 1999. This was found standing in submerged waters and therefore, is a new source of submergence tolerance. Well known germplasm lines, namely FR 13A, FR 43B, identified earlier for submergence tolerance, could not be used in breeding programmes because of poor combining ability and other undesirable agronomic characters.

Khoda is an awn-less genotype and is better than FR 13A in seed quality and elongation ability (Table 1). Morphological characteristics of Khoda are-leaf length 43.4 cm, leaf width 0.9 cm, ligule length 1.9 cm, culm length 112.7 cm, culm number 7.2, panicle length 24.5 cm, 15 days seedling height 20.5 cm, panicle weight 3.54 gm, maturity duration 155 days, grain length 8.0 mm, grain breadth 3.0 mm, grain length width ratio 2.66, 1000 grain weight 26.4 g and grain shape medium.

**Table 1. Effect of submergence on elongation and survival percentage**

| Name of the cultivars | Plant Height (cm) | | | Survival Rate |
|---|---|---|---|---|
| | BS | AS | Elongation | (%) |
| PD 27 (Khoda) | 29 | 68 | 39 | 100 |
| FR 13A (TC) | 30 | 72 | 42 | 100 |
| IR 42 (SC) | 20 | 68 | 48 | 15 |

BS = before submergence; AS = after submergence; TC = tolerant check; SC = susceptible-check

## RP-3135-97-1-11-5 (IET 15833) (INGR No. 04002; IC296643), Semi-dwarf *Basmati* Type Paddy (*Oryza sativa* L.)

**N Shobha Rani and GSV Prasad**
*Directorate of Rice Research, Hyderabad-500030, Andhra Pradesh*

The semi-dwarf RP 3135-97-1-11-5 was developed from a cross between PR 109 and Pak basmati using pedigree-breeding method at the Directorate of Rice Research, Hyderabad (DRR, 1999). Basmati varieties are tall, while this culture is semi-dwarf with all the desirable characters of basmati rice and high yield potential. It has long slender aromatic white translucent grains with high milling as well as head rice recovery, intermediate amylose content, intermediate alkali-spreading value, high kernel elongation on cooking with soft gel consistency, flaky texture and pleasant aroma.

It is 109 cm tall with moderate tillering, well-exerted intermediate panicle, awned spikelets and brown apiculus. It is a medium duration culture of 145 days from seed to seed. It was evaluated with promising results at Kaul, Karnal, R.S. Pura and with an overall mean yield of 3217 kg/ha, superior to Taroari Basmati with an increase of 23 per cent.

It is resistant to leaf blast. This culture is recommended for traditional basmati growing areas in Delhi, Haryana, Uttranchal, Punjab and Himachal Pradesh.

### References

DRR (1999) *The Directorate of Rice Research Annual Progress Report*, **Vol. 1:** Varietal Improvement; pp 1.291-1.308.

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## RP-3135-97-1-11-5 (IET 15833) (INGR No. 04002; IC296643), Semi-dwarf *Basmati* Type Paddy (*Oryza sativa* L.)

**N Shobha Rani and GSV Prasad**
*Directorate of Rice Research, Hyderabad-500030, Andhra Pradesh*

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It is 109 cm tall with moderate tillering, well-exerted intermediate panicle, awned spikelets and brown apiculus. It is a medium duration culture of 145 days from seed to seed. It was evaluated with promising results at Kaul, Karnal, R.S. Pura and with an overall mean yield of 3217 kg/ha, superior to Taroari Basmati with an increase of 23 per cent.

It is resistant to leaf blast. This culture is recommended for traditional basmati growing areas in Delhi, Haryana, Uttranchal, Punjab and Himachal Pradesh.

### References

DRR (1999) *The Directorate of Rice Research Annual Progress Report*, **Vol. 1:** Varietal Improvement; pp 1.291-1.308.

## PADDY GENETIC STOCK WITH RESISTANCE TO RICE GALL MIDGE DISEASE

### Samridhi (INGR No. 04003; IC296614), paddy (*Oryza sativa* L.) Germplasm Line with *Gm1* Gene for Rice Gall Midge Resistance

**BP Chaudhary[1], PS Shrivastava[1], MN Shrivastava[1] and GS Khush[2]**
*1. Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*
*2. International Rice Research Institute, Manila, Philippines*

Samridhi is a germplasm of paddy with the *Gm1* gene for resistance to rice gall midge disease caused by *Orseolina oryzae* Wood Mason, identified at the Indira Gandhi Krishi Vishwavidyalaya, Raipur. Over the last twenty years, the inheritance and allelic relationship of gene(s) for resistance present in more than two hundred donors obtained from different parts of India were studied. This has led to the identification of nine different genes for gall midge resistance. Chaudhary *et al.*, (1986) reported the identification of the first gall midge resistance *Gm1* gene in cultivar "Samridhi" (IR 22 x W1263). This genotype is derived the resistance from W 1263 (Eswarakora x MTU 15), which in turn derived its resistance from Eswarakora. Eswarakora, the source of the *Gm1* gene, is a local germplasm accession belonging to Andhra Pradesh. *Gm1* gene provides resistance against gall midge biotype 1 prevalent in Chhattisgarh and Andhra Pradesh; biotype 3 prevalent at Ranchi, Jharkhand; biotype 5 prevalent in Moncompu, Kerala and biotype 6 prevalent in Manipur. The genotype has a plant height of 89.2 cm, days to 50 percent flowering of 102 days; number of panicles/$m^2$ 325 with grain yield of 3133 kg/ha.

**Reference**

Chaudhary BP, PS Shrivastava, MN Shrivastava and GS Khush (1986) Inheritance of resistance to gall midge in some cultivars of rice. *Rice Genetics* 523-528.

### Surekha (INGR No. 04004; IC296615), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm2* for Rice Gall Midge Resistance

**BP Chaudhary[1], PS Shrivastava[1], MN Shrivastava[1] and GS Khush[2]**
*1. Indira Gandhi Krishi Vishwavidyalaya, Raipur 492006, Chhattisgarh*
*2. International Rice Research Institute, Manila, Philippines*

Surekha, a paddy germplasm line with *Gm2* gene for resistance to rice gall midge caused by *Orseolia oryzae* Wood Mason was identified at the Indira Gandhi Krishi Vishwavidyalaya, Raipur. It was identified by Chaudhary *et al.*, (1986). The *Gm2* gene identified in cultivar "Surekha" (IR 8 x Siam 29) derived its resistance from "Siam 29", a local germplasm accession of Thailand. *Gm2* gene provides resistance against biotype 1 prevalent in Chhattisgarh and Andhra Pradesh; biotype 2 prevalent in Orissa and biotype 5 prevalent in Moncompu, Kerala. The genotype has plant height of 101.2 cm, days to 50 percent flowering of 102 days; number of panicles/$m^2$ 290 and grain yield of 3111 kg/ha.

**Reference**

Chaudhary BP, PS Shrivastava, MN Shrivastava and GS Khush (1986) Inheritance of resistance to gall midge in some cultivars of rice. *Rice Genetics* 523-528.

## PADDY GENETIC STOCK WITH RESISTANCE TO RICE GALL MIDGE DISEASE

### Samridhi (INGR No. 04003; IC296614), paddy (*Oryza sativa* L.) Germplasm Line with *Gm1* Gene for Rice Gall Midge Resistance

**BP Chaudhary[1], PS Shrivastava[1], MN Shrivastava[1] and GS Khush[2]**
*1. Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*
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**Reference**

Chaudhary BP, PS Shrivastava, MN Shrivastava and GS Khush (1986) Inheritance of resistance to gall midge in some cultivars of rice. *Rice Genetics* 523-528.

### Surekha (INGR No. 04004; IC296615), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm2* for Rice Gall Midge Resistance

**BP Chaudhary[1], PS Shrivastava[1], MN Shrivastava[1] and GS Khush[2]**
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Surekha, a paddy germplasm line with *Gm2* gene for resistance to rice gall midge caused by *Orseolia oryzae* Wood Mason was identified at the Indira Gandhi Krishi Vishwavidyalaya, Raipur. It was identified by Chaudhary *et al.*, (1986). The *Gm2* gene identified in cultivar "Surekha" (IR 8 x Siam 29) derived its resistance from "Siam 29", a local germplasm accession of Thailand. *Gm2* gene provides resistance against biotype 1 prevalent in Chhattisgarh and Andhra Pradesh; biotype 2 prevalent in Orissa and biotype 5 prevalent in Moncompu, Kerala. The genotype has plant height of 101.2 cm, days to 50 percent flowering of 102 days; number of panicles/$m^2$ 290 and grain yield of 3111 kg/ha.

**Reference**

Chaudhary BP, PS Shrivastava, MN Shrivastava and GS Khush (1986) Inheritance of resistance to gall midge in some cultivars of rice. *Rice Genetics* 523-528.

## RP2068-18-3-5 (INGR No. 04005; IC296616), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *gm3* for Rice Gall Midge Resistance

**Arvind Kumar, MN Shrivastava and RK Sahu**
*Indira Gandhi Krishi Vishwavidyalaya, Raipur-492006, Chhattisgarh*

RP2068-18-3-5, a paddy germplasm line with the *gm3* gene conferring resistance to rice gall midge caused by *Orseolia oryzae* Wood Mason was identified at the Indira Gandhi Krishi Vishwavidyalaya, Raipur. Kumar *et al.*, (1998) identified this gene. The allelic study revealed the non-allelic nature of the *gm3* gene from *Gm1*, *Gm2* and *Gm4* genes. The breeding line identified to possess the *gm3* recessive gene, derives its resistance from Velluthacheera (Swarnadhan x Velluthacheera), a local germplasm accession from Tamil Nadu. The *gm3* gene provides resistance against the gall midge biotype 1 prevalent in Raipur, Chhatisgarh; biotype 2 prevalent in Cuttack, Orissa and biotype 3 prevalent in Ranchi, Jharkhand. This genotype has plant height of 181.2 cm, days to 50 percent flowering of 124 days; number of panicles/ $m^2$ is 376 with grain yield of 4577 kg/ha.

### Reference

Kumar, Arvind, MN Shrivastava and RK Sahu (1998) Genetic analysis of ARC5984 for gall midge resistance – a reconsideration. *Rice Genet. Newsl.* **15**: 142-143.

## Abhaya (INGR No. 04006; IC296617), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm4*, for Rice Gall Midge Resistance

**MN Shrivastava, Arvind Kumar, SK Shrivastava and RK Sahu**
*Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*

Abhaya, a paddy germplasm line with the gene *Gm4*, conferring resistance to rice gall midge was identified at the Indira Gandhi Krishi Vishwavidyalya, Raipur by Shrivastava *et al.*, (1993). The allelic study revealed the non-allelic nature of the *Gm4* genes from *Gm1*, *Gm2* and *Gm3* genes identified earlier. The resistant variety Abhaya (CR 157-392 x OR57-21) derived its resistance from CR 157-392 (Vijaya x Ptb 10), which in turn derived its resistance from Ptb 10, a local germplasm accession of Pattambi, Kerala, India. *Gm4* provides resistance against the gall midge biotype 1 prevalent in Raipur, Chhattisgarh; biotype 2 prevalent in Cuttack, Orissa and biotype 3 prevalent in Ranchi, Jharkhand and biotype 4 prevalent in Vijayanagram and Srikakulam districts of Andhra Pradesh. The genotype has a plant height of 91.3 cm, days to 50 percent flowering of 98 days; number of panicles/ $m^2$ is 361 with grain yield of 4067 kg/ha.

### Reference

Shrivastava, MN, Arvind, Kumar, SK Shrivastava, and RK Sahu (1993) A new gene for resistance to gall midge in rice variety Abhaya. *Rice Genet. Newsl.* **10**: 79-80.

## ARC 5984 (INGR No. 04007; IC296618), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm5* for Rice Gall Midge Resistance

**Arvind Kumar, MN Shrivastava and RK Sahu**
*Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*

ARC 5984, a paddy germplasm line with the *Gm5* gene conferring resistance against rice gall midge was identified at the Indira Gandhi Krishi Vishwavidyalya, Raipur by Kumar *et al.*, (1998). The *Gm5* gene is non-allelic with respect to the genes, *Gm1*, *Gm2*, *Gm3* and *Gm4*. Assam Rice Collection accessions have been a rich source of resistance against gall midge. *Gm5* gene provides resistance against the gall midge biotype 1 prevalent in Raipur, Chhattisgarh; biotype 2 prevalent in Cuttack Orissa and biotype 5 prevalent in Moncompu

## RP2068-18-3-5 (INGR No. 04005; IC296616), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *gm3* for Rice Gall Midge Resistance

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*Indira Gandhi Krishi Vishwavidyalaya, Raipur-492006, Chhattisgarh*

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## Abhaya (INGR No. 04006; IC296617), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm4*, for Rice Gall Midge Resistance

**MN Shrivastava, Arvind Kumar, SK Shrivastava and RK Sahu**
*Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*

Abhaya, a paddy germplasm line with the gene *Gm4*, conferring resistance to rice gall midge was identified at the Indira Gandhi Krishi Vishwavidyalya, Raipur by Shrivastava *et al.*, (1993). The allelic study revealed the non-allelic nature of the *Gm4* genes from *Gm1*, *Gm2* and *Gm3* genes identified earlier. The resistant variety Abhaya (CR 157-392 x OR57-21) derived its resistance from CR 157-392 (Vijaya x Ptb 10), which in turn derived its resistance from Ptb 10, a local germplasm accession of Pattambi, Kerala, India. *Gm4* provides resistance against the gall midge biotype 1 prevalent in Raipur, Chhattisgarh; biotype 2 prevalent in Cuttack, Orissa and biotype 3 prevalent in Ranchi, Jharkhand and biotype 4 prevalent in Vijayanagram and Srikakulam districts of Andhra Pradesh. The genotype has a plant height of 91.3 cm, days to 50 percent flowering of 98 days; number of panicles/ $m^2$ is 361 with grain yield of 4067 kg/ha.

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## ARC 5984 (INGR No. 04007; IC296618), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm5* for Rice Gall Midge Resistance

**Arvind Kumar, MN Shrivastava and RK Sahu**
*Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*

ARC 5984, a paddy germplasm line with the *Gm5* gene conferring resistance against rice gall midge was identified at the Indira Gandhi Krishi Vishwavidyalya, Raipur by Kumar *et al.*, (1998). The *Gm5* gene is non-allelic with respect to the genes, *Gm1*, *Gm2*, *Gm3* and *Gm4*. Assam Rice Collection accessions have been a rich source of resistance against gall midge. *Gm5* gene provides resistance against the gall midge biotype 1 prevalent in Raipur, Chhattisgarh; biotype 2 prevalent in Cuttack Orissa and biotype 5 prevalent in Moncompu

Kerala. The genotype has a plant height of 166.7 cm, days to 50 percent flowering of 116 days; number of panicles/$m^2$ is 326 with grain yield of 3200 kg/ha.

**Reference**

Kumar Arvind, MN Shrivastava and RK Sahu (1998) Genetic analysis of ARC 5984 for gall midge resistance-a reconsideration. *Rice Genet, Newsl.* **15**: 142-143.

## RP2333-156-8 (INGR No. 04008; IC296619), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm7* for Rice Gall Midge Resistance

**Arvind Kumar, MN Shrivastava and BC Shukla**
*Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*

RP2333-156-8, a paddy germplasm line with the *Gm7* gene conferring resistance against Rice Gall Midge was identified at Indira Gandhi Krishi Vishwavidyalya; Raipur by Kumar *et al.*, (1999). The *Gm7* gene was identified in an Assam Rice Collection, ARC 106590 derivative line RP2333-156-8 (Ratna x ARC 10659). The allelic study revealed the non-allelic nature of *Gm7* gene from the *Gm1, Gm2, gm3, Gm4* and *Gm5* genes. *Gm7* gene provides resistance against gall midge biotype 1 prevalent in Raipur, Chhattisgarh; biotype 2 prevalent in Cuttack, Orissa and biotype 4 prevalent in Srikakulam and Vijayanagram districts of Andhra Pradesh. It is yet to be tested against biotype 5 (Moncompu, Kerala) and biotype 6 (Imphal, Manipur). The genotype has a plant height of 95.8 cm, days to 50 percent flowering of 92 days; number of panicles/$m^2$ is 304 with grain yield of 3067 kg/ha.

**Reference**

Kumar Arvind, MN Shrivastava and BC Shukla (1999) A new gene for resistance to gall midge in rice cultivar RP2333-156-8. *Rice Genet, Newsl.* **16**: 85-87.

## Jhitpiti (INGR No. 04009; IC296620), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm8* for Rice Gall Midge Resistance

**Arvind Kumar, S Bhandarkara, DJ Pophlay and MN Shrivastava**
*Indira Gandhi Krishi Vishwavidyalaya, Raipur 492006, Chhattisgarh*

Jhitpiti, rice with the *Gm8* gene conferring resistance against rice gall midge was identified at the Indira Gandhi Krishi Vishwavidyalaya, Raipur, from the accessions collected by Dr RH Richharia. One of the accessions of Chhattisgarh Rice Germplasm, "Jhitpiti" was found to possess the *Gm8* gene conferring resistance to gall midge resistance (Kumar *et al.*, 2000). Allelic study has proved the non-allelic nature of *Gm8* gene from the earlier identified genes, namely *Gm1, Gm2, Gm3, Gm4, Gm5* and *Gm7*. The *Gm8* gene provides resistance against biotype 1 prevalent in Raipur, and its reaction against other gall midge biotypes is to be tested. The genotype has a plant height of 122.1 cm, days to 50 percent flowering of 87 days; number of panicles/$m^2$ is 314 with grain yield of 2845 kg/ha.

**Reference**

Kumar Arvind, S Bhandarkar, DJ Pophlay and MN Shrivastava (2000) A new gene for gall midge resistance in rice cultivar Jhitpiti. *Rice Genet, Newsl.* **17**: 83-84.

Kerala. The genotype has a plant height of 166.7 cm, days to 50 percent flowering of 116 days; number of panicles/$m^2$ is 326 with grain yield of 3200 kg/ha.

**Reference**

Kumar Arvind, MN Shrivastava and RK Sahu (1998) Genetic analysis of ARC 5984 for gall midge resistance-a reconsideration. *Rice Genet, Newsl.* **15**: 142-143.

## RP2333-156-8 (INGR No. 04008; IC296619), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm7* for Rice Gall Midge Resistance

**Arvind Kumar, MN Shrivastava and BC Shukla**
*Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*

RP2333-156-8, a paddy germplasm line with the *Gm7* gene conferring resistance against Rice Gall Midge was identified at Indira Gandhi Krishi Vishwavidyalya; Raipur by Kumar *et al.*, (1999). The *Gm7* gene was identified in an Assam Rice Collection, ARC 106590 derivative line RP2333-156-8 (Ratna x ARC 10659). The allelic study revealed the non-allelic nature of *Gm7* gene from the *Gm1, Gm2, gm3, Gm4* and *Gm5* genes. *Gm7* gene provides resistance against gall midge biotype 1 prevalent in Raipur, Chhattisgarh; biotype 2 prevalent in Cuttack, Orissa and biotype 4 prevalent in Srikakulam and Vijayanagram districts of Andhra Pradesh. It is yet to be tested against biotype 5 (Moncompu, Kerala) and biotype 6 (Imphal, Manipur). The genotype has a plant height of 95.8 cm, days to 50 percent flowering of 92 days; number of panicles/$m^2$ is 304 with grain yield of 3067 kg/ha.

**Reference**

Kumar Arvind, MN Shrivastava and BC Shukla (1999) A new gene for resistance to gall midge in rice cultivar RP2333-156-8. *Rice Genet, Newsl.* **16**: 85-87.

## Jhitpiti (INGR No. 04009; IC296620), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm8* for Rice Gall Midge Resistance

**Arvind Kumar, S Bhandarkara, DJ Pophlay and MN Shrivastava**
*Indira Gandhi Krishi Vishwavidyalaya, Raipur 492006, Chhattisgarh*

Jhitpiti, rice with the *Gm8* gene conferring resistance against rice gall midge was identified at the Indira Gandhi Krishi Vishwavidyalaya, Raipur, from the accessions collected by Dr RH Richharia. One of the accessions of Chhattisgarh Rice Germplasm, "Jhitpiti" was found to possess the *Gm8* gene conferring resistance to gall midge resistance (Kumar *et al.*, 2000). Allelic study has proved the non-allelic nature of *Gm8* gene from the earlier identified genes, namely *Gm1, Gm2, Gm3, Gm4, Gm5* and *Gm7*. The *Gm8* gene provides resistance against biotype 1 prevalent in Raipur, and its reaction against other gall midge biotypes is to be tested. The genotype has a plant height of 122.1 cm, days to 50 percent flowering of 87 days; number of panicles/$m^2$ is 314 with grain yield of 2845 kg/ha.

**Reference**

Kumar Arvind, S Bhandarkar, DJ Pophlay and MN Shrivastava (2000) A new gene for gall midge resistance in rice cultivar Jhitpiti. *Rice Genet, Newsl.* **17**: 83-84.

Kerala. The genotype has a plant height of 166.7 cm, days to 50 percent flowering of 116 days; number of panicles/$m^2$ is 326 with grain yield of 3200 kg/ha.

**Reference**

Kumar Arvind, MN Shrivastava and RK Sahu (1998) Genetic analysis of ARC 5984 for gall midge resistance-a reconsideration. *Rice Genet, Newsl.* **15**: 142-143.

## RP2333-156-8 (INGR No. 04008; IC296619), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm7* for Rice Gall Midge Resistance

**Arvind Kumar, MN Shrivastava and BC Shukla**
*Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*

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## Jhitpiti (INGR No. 04009; IC296620), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm8* for Rice Gall Midge Resistance

**Arvind Kumar, S Bhandarkara, DJ Pophlay and MN Shrivastava**
*Indira Gandhi Krishi Vishwavidyalaya, Raipur 492006, Chhattisgarh*

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**Reference**

Kumar Arvind, S Bhandarkar, DJ Pophlay and MN Shrivastava (2000) A new gene for gall midge resistance in rice cultivar Jhitpiti. *Rice Genet, Newsl.* **17**: 83-84.

## Line 9 (INGR No. 04010; IC296621), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm9*, for Rice Gall Midge Resistance

**MN Shrivastava, Arvind Kumar, S Bhandarkar, BC Shukla and KC Agrawal**
*Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*

Line 9 is a rice germplasm with the *Gm9* gene conferring resistance to rice gall midge was identified at the Indira Gandhi Krishi Vishwavidyalya, Raipur by Shrivastava *et al.*, (2003). The resistance against gall midge in Line 9 was presumed to might have arisen (i) by a spontaneous mutation or (ii) by one of the parent involved in the progenitor cross (Jaya x Dubraj) having a gene for resistance along with an inhibitory gene. The allelic study revealed non-allelic nature of *Gm9* gene from the earlier identified genes, *Gm1*, *Gm2*, *gm3*, *Gm4*, *Gm5*, *Gm7* and *Gm8*. The *Gm9* gene has been recorded to provide resistance against biotype 1 prevalent in Raipur, and its reaction against other gall midge biotypes prevalent in India needs to be tested. The genotype has a plant height of 122.1 cm, days to 50 percent flowering of 87 days; number of panicles/$m^2$ is 314 with grain yield of 2845 kg/ha.

### Reference

Shrivastava MN, Arvind Kumar, S Bhandarkara, BC Shukla and KC Agrawal and (2003) A new gene for resistance in rice to Asian rice gall midge (*Orseolia oryzae* Wood Mason) Biotype I at Raipur, India. Euphytica **130**:143-145.

## Mutant Cluster Rice (INGR No. 04064; IC396397), Paddy (*Oryza sativa* L.) Germplasm Line with Clustered Spikelets

**G Suresh Babu and SS Singh**
*Department of Genetics and Plant Breeding, Allahabad Agricultural Institute, Deemed University (AAI-DU), Allahabad-211007, Uttar Pradesh*

Mutant Cluster Rice is a novel mutant line of paddy (*Oryza sativa* L.) with clustered spiklelets, identified at AAI (DU). It has multiple caryopsis i.e. having 3-4 spikelets per node, 45-55 clusters per panicle. It was derived from Sonachur, an indigenous local variety through single plant selection. This mutant line has following morphological characteristics- plant height 105-109 cm, number of tillers 10-13, number of productive tillers 8-11, panicle length 17-19 cm, flag leaf length 27 cm, number of clusters/panicle 53.1, number of spikelets/clusters 3.1-3.8, total number of spikelets per panicle 189.5-192.0, kernel length 0.74 cm, kernel width 0.28 cm, test weight 23.0 g. The standard agronomic practices include transplanting of 25 days old seedlings into main field with 2-3 seedlings per hill at 20x15 cm spacing and fertilization with 60:40:40 NPK along with 20 kg $ZnSO_4$ both under transplanted wet land and direct seeded upland conditions. The crop matures in 120-125 days time.

## Line 9 (INGR No. 04010; IC296621), Paddy (*Oryza sativa* L.) Germplasm Line with Gene *Gm9*, for Rice Gall Midge Resistance

**MN Shrivastava, Arvind Kumar, S Bhandarkar, BC Shukla and KC Agrawal**
*Indira Gandhi Krishi Vishwavidyalya, Raipur-492006, Chhattisgarh*

Line 9 is a rice germplasm with the *Gm9* gene conferring resistance to rice gall midge was identified at the Indira Gandhi Krishi Vishwavidyalya, Raipur by Shrivastava *et al.*, (2003). The resistance against gall midge in Line 9 was presumed to might have arisen (i) by a spontaneous mutation or (ii) by one of the parent involved in the progenitor cross (Jaya x Dubraj) having a gene for resistance along with an inhibitory gene. The allelic study revealed non-allelic nature of *Gm9* gene from the earlier identified genes, *Gm1*, *Gm2*, *gm3*, *Gm4*, *Gm5*, *Gm7* and *Gm8*. The *Gm9* gene has been recorded to provide resistance against biotype 1 prevalent in Raipur, and its reaction against other gall midge biotypes prevalent in India needs to be tested. The genotype has a plant height of 122.1 cm, days to 50 percent flowering of 87 days; number of panicles/$m^2$ is 314 with grain yield of 2845 kg/ha.

### Reference

Shrivastava MN, Arvind Kumar, S Bhandarkara, BC Shukla and KC Agrawal and (2003) A new gene for resistance in rice to Asian rice gall midge (*Orseolia oryzae* Wood Mason) Biotype I at Raipur, India. Euphytica **130**:143-145.

## Mutant Cluster Rice (INGR No. 04064; IC396397), Paddy (*Oryza sativa* L.) Germplasm Line with Clustered Spikelets

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## FLW 6 (INGR No. 04011; IC296606), Wheat (*Triticum aestivum* L.) Germplasm Line with Resistance to Brown and Black Rusts (*Lr9 + Lr 24 and Sr2 + Sr 24*)

**Dibendu Datta[1], SK Nayar[1], M Prashar[1], SC Bhardwaj[1] and M Siwaswamy[2]**
*1. Directorate of Wheat Research (DWR), Regional Station, Shimla-171002, Himachal Pradesh*
*2. Indian Agricultural Research Institute, Regional Station Wellington-643231, Tamil Nadu*

FLW 6 is a wheat germplasm line resistant to brown and black rust. It was derived through pedigree selection method from the cross, HP1633 x HP1776 at DWR, Regional Station, Flower dale. It possesses pyramided brown rust resistance genes *Lr9* and *Lr24* in addition to *Sr2* and *Sr24* unknown black rust resistance genes. The plants are 100 cm tall and mature in 120 days. It produces amber coloured grains with a test weight of 37.6 g and yield per meter row is at par with HP1776 the local check, but inferior than the best check PBW343. The disease reaction to various rusts is reflected in Table 1.

**Table 1. Disease reaction of FLW 6 to various rusts**

| Genetic Stock | Field Data | Seedling Resistance Test | | | Genes Postulated |
|---|---|---|---|---|---|
| FLW 6 | Brown rust | 121R63-1 | 121R127 | 21R55 | |
| | Resistant | ; | ; 12 | ; | Lr9, Lr24 |
| | Black rust | 62G29 | 62G29-1 | | |
| | 10MR | 2- | 2+ | | Sr2, Sr24* |

*Additional unknown resistance gene

## FLW 8 (INGR No. 04012; IC296607), Wheat (*Triticum aestivum L.*), Germplasm Line with Resistance to Brown and Black Rust (*Lr19 and Sr25*)

**Dibendu Datta[1], SK Nayar[1], M Prashar[1], SC Bhardwaj[1] and RN Brahma[2]**
*1. Directorate of Wheat Research, Regional Station, Shimla-171002, Himachal Pradesh*
*2. Indian Agricultural Research Institute, Regional Station Wellington-643231, Tamil Nadu*

FLW 8, a wheat genotype, resistant to brown and black rusts derived through pedigree selection from the cross, HI1077 x Tc+*Lr19* at the Directorate of Wheat Research, Regional Station, Flower dale. It possesses unexploited rust resistance genes *Lr19* and *Lr25*. The plants of this genotype are 100 cm tall and mature in 118 days, producing non-amber coloured grains with 36.5 g test weight. Yield per meter row is at par with HI1077, but inferior than the best check PBW343. The disease reaction to various rusts are given in the Table 1 below.

**Table 1. Disease reaction of FLW 8 to various rusts**

| Genetic Stock | Field Data | Seedling Resistance Test | | | Genes Postulated |
|---|---|---|---|---|---|
| FLW 8 | Brown rust | 121R63-1 | 121R127 | 21R55 | |
| | Resistant | 0; | 0; | 0; | Lr19 |
| | Black rust | 62G29 | 62G29-1 | | |
| | 10MR | 2- | 2 | | Sr25 |

## FLW 6 (INGR No. 04011; IC296606), Wheat (*Triticum aestivum* L.) Germplasm Line with Resistance to Brown and Black Rusts (*Lr9 + Lr 24 and Sr2 + Sr 24*)

**Dibendu Datta[1], SK Nayar[1], M Prashar[1], SC Bhardwaj[1] and M Siwaswamy[2]**
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| Genetic Stock | Field Data | Seedling Resistance Test | | | Genes Postulated |
|---|---|---|---|---|---|
| FLW 6 | Brown rust | 121R63-1 | 121R127 | 21R55 | |
| | Resistant | ; | ; 12 | ; | Lr9, Lr24 |
| | Black rust | 62G29 | 62G29-1 | | |
| | 10MR | 2- | 2+ | | Sr2, Sr24* |

*Additional unknown resistance gene

## FLW 8 (INGR No. 04012; IC296607), Wheat (*Triticum aestivum L.*), Germplasm Line with Resistance to Brown and Black Rust (*Lr19 and Sr25*)

**Dibendu Datta[1], SK Nayar[1], M Prashar[1], SC Bhardwaj[1] and RN Brahma[2]**
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**Table 1. Disease reaction of FLW 8 to various rusts**

| Genetic Stock | Field Data | Seedling Resistance Test | | | Genes Postulated |
|---|---|---|---|---|---|
| FLW 8 | Brown rust | 121R63-1 | 121R127 | 21R55 | |
| | Resistant | 0; | 0; | 0; | Lr19 |
| | Black rust | 62G29 | 62G29-1 | | |
| | 10MR | 2- | 2 | | Sr25 |

02 seasons, i.e. of nine years and resistance to Karnal bunt pathogen under artificial screening.

**WL-3526 (INGR No. 04020; IC296785)**

WL-3526 is a wheat (*Triticum aestivum* L) germplasm line resistant to loose smut, Karnal bunt, stripe and leaf rust in a new genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method in cross, HD2009 x WG 377. The plants have intermediate growth habit with plant height of 99 cm and dark green foliage. Heading and maturity on an average take 95 and 128 days respectively. Ear is dense white coloured with tapering shape. Ear length is 10 cm. Grains are amber coloured, hard textured, elongated with average 1000-grain weight of 36 g. Resistance to loose smut pathogen was tested 24 times since 1978, while to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-02 seasons, i.e. for 9 years and resistance to Karnal bunt pathogen under artificial testing.

**WL-5634 (INGR No. 04021; IC296603)**

WL-5634 is a wheat (*Triticum aestivum* L.) germplasm line resistant to loose smut, Karnal bunt, stripe and leaf rust in a different genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method in cross, kav kaz-Cno-Inia x WL 905. The plants have intermediate growth habit with height of 97 cm and dark green foliage. Heading and maturity on an average take 96 and 130 days respectively. Ear is dense, white coloured with tapering shape and white coloured awns. Ear length is 9 cm. Grains are amber coloured, hard textured, elongated with average 1000-grain weight of 30 g. The resistance to loose smut pathogen was tested 23 times since 1980, while resistance to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-02 seasons (9 years) and resistance to Karnal bunt pathogen under artificial testing

## AKW 2862-1 (INGR No. 04022; IC296767), Wheat (*Triticum aestivum* L.) Germplasm Line with Heat Tolerance

**DG Vitkare**
*Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola-444104, Maharashtra*

AKW 2862-1 is a wheat germplasm line with tolerance to heat and early maturity. It was developed through pedigree selection method in germplasm VEE # 6 || DOVE "S"/BUC "S" CM 92225-66Y-OM at Wheat Research Unit, PDKV, Akola. It was screened in 15 Short Duration cum Heat Tolerance Screening Nurseries conducted at 17 locations with an aim to identify genotypes of early maturity and tolerance to high temperature during grain-filling period under late sowing conditions. The genotype AKW 2862-1 showed consistent performance for these important traits during three subsequent seasons (1999-2000, 2000-2001 and 2001-2002). Mean days to heading were 63 days (with range of 46 - 106) with maximum and minimum temperature of 37.26°C and 8.83°C, respectively, and 1000-grain weight of 49 g (with range of 30-56 g).

## Harit-1 (M3) (INGR No. 04023; IC427810), Wheat (*Triticum aestivum* L.) Germplasm Line, a New Source of Leaf Blight Resistance

**DP Singh, Jag Shoran and Pankaj Kumar**
*Directorate of Wheat Research, Karnal-132001, Haryana*

Leaf blight is a major biotic factor causing yield losses up to 50 percent in susceptible wheat varieties under warmer and humid weather of Northeastern plains zone (NEPZ). The disease causing pathogen *Bipolaris sorokiniana* syn. *Helminthosporium sativum* is present in all the six agro-climatic zones of India, neighbouring south Asia, China, North and Latin America and Brazil. Genotype showing no or little halo around necrotic spot is considered highly resistant.

Harit-1 (M3) is a new wheat (*Triticum aestivum*)

# KRL 35 (INGR No. 04013; IC408332), Wheat (*Triticum aestivum* L.) Germplasm Line with AmberColoured Grains and Agronomic Superiority over Parent Kharchia

**KN Singh[1] and Ravish Chatrath[2]**
1. *Central Soil Salinity Research Institute, Karnal-134201, Haryana*
2. *Directorate of Wheat Research, Karnal-134201, Haryana*

KRL 35 is a new wheat germplasm line with amber coloured grains and agronomic superiority over parent Kharchia, developed at the Central Soil Salinity Research Institute, Karnal. KRL 35 is tolerant to salinity and alkalinity/sodicity and was also found to be quite tolerant to water logging conditions in comparison to other wheat varieties. This genotype was tested in most of the northern states of the country coming under Northeastern plain I, and Northwestern plain zone. To improve salt tolerance and yield, a high yielding dwarf variety HD2160 was crossed with salt tolerant amber grained wheat variety KRL1-4, and KRL 35 was developed. It was first evaluated in the All India Coordinated Salinity/Alkalinity Tolerance Screening Nursery and was found promising, and promoted for salinity/alkalinity trial. Directorate of Wheat Research, Karnal regularly organises Salinity/ alkalinity nursery and trials under salinity/alkalinity conditions, at least at 10 different centres across the country in the states of Bihar, Uttar Pradesh, Haryana, Punjab, Gujarat, Maharashtra and Rajasthan. KRL35 was evaluated for three seasons from 2000-2001 to 2002-2003 under these trials and was found quite promising and yielded better than Kharchia 65 and high yielding check KRL 19 with overall average yield of 35.1 q/ha Singh and Chatrath (2003, 2002, 2001). However, it was found susceptible to leaf and strip rusts under artificially inoculated conditions.

KRL 35 is a two-gene dwarf wheat germplasm with an average plant height (recorded in salt affected soils and normal soil) of 98 cm with green leaf of intermediate width and waxy look. On an average it takes 90 days to heading and matures in about 145 to 150 days. It has medium awns and has parallel ears and intermediate ear density with average 1000-grain weight of 39 g.

### Reference

Singh KN and R Chatrath (2003, 2002, 2001) *Reports presented in the All India Coordinated Wheat Research Workers Workshop* organized by Directorate of Wheat Research, Karnal.

# WHEAT GENETIC STOCKS RESISTANT TO BROWN AND BLACK RUSTS

**MK Menon[1], Bhojan[1], KA Nayeem[1], RN Brahma[1], M Sivasamy[1], AJ Prabakaran[1], R Asir[1], A Saikia[1], SMS Tomar[2], SK Nayar[2], M Prashar[2], SC Bhardwaj[2]and RK Gupta[4]**
1. *Indian Agricultural Research Institute, Regional Station Wellington-643231, Tamil Nadu*
2. *Division of Genetics, Indian Agricultural Research Institute, New Delhi-110012*
3. *Directorate of Wheat Research, Regional Station, Shimla-171002, Himachal Pradesh*
4. *Directorate of Wheat Research, Karnal-134201, Haryana*

## HW-2002 (INGR No. 04014; IC408333), Wheat (*Triticum aestivum* L.) Germplasm Line with Resistance to Brown and Black Rust (*Lr24* and *Sr24*)

HW-2002 is a wheat germplasm line carrying *Lr24* and *Sr24* linked genes, conferring resistance to brown rust and moderate resistance to black rusts. It was developed at the Indian Agricultural Research Institute, Regional Station, Wellington, through pedigree selection and backcrossing method involving Kalyansona*6/ TR 380-4*7/Ag#14. It has erect plant growth habit with 62 days to 50 percent heading and 114 days to maturity. It has white coloured elliptical grains with medium hard texture, 26.8 seeds/spike, and 1000-grain weight of 32 g. with 11.94 percent seed protein.

## HW-2031 (INGR No. 04015; IC408334), Wheat (*Triticum aestivum* L.) Germplasm Line with Resistance to Brown Rust (*Lr28*)

HW-2031 is a wheat germplasm line carrying *Lr28* gene, conferring resistance to brown rust. It was

# KRL 35 (INGR No. 04013; IC408332), Wheat (*Triticum aestivum* L.) Germplasm Line with AmberColoured Grains and Agronomic Superiority over Parent Kharchia

**KN Singh[1] and Ravish Chatrath[2]**
1. *Central Soil Salinity Research Institute, Karnal-134201, Haryana*
2. *Directorate of Wheat Research, Karnal-134201, Haryana*

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KRL 35 is a two-gene dwarf wheat germplasm with an average plant height (recorded in salt affected soils and normal soil) of 98 cm with green leaf of intermediate width and waxy look. On an average it takes 90 days to heading and matures in about 145 to 150 days. It has medium awns and has parallel ears and intermediate ear density with average 1000-grain weight of 39 g.

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Singh KN and R Chatrath (2003, 2002, 2001) *Reports presented in the All India Coordinated Wheat Research Workers Workshop* organized by Directorate of Wheat Research, Karnal.

# WHEAT GENETIC STOCKS RESISTANT TO BROWN AND BLACK RUSTS

**MK Menon[1], Bhojan[1], KA Nayeem[1], RN Brahma[1], M Sivasamy[1], AJ Prabakaran[1], R Asir[1], A Saikia[1], SMS Tomar[2], SK Nayar[2], M Prashar[2], SC Bhardwaj[2]and RK Gupta[4]**
1. *Indian Agricultural Research Institute, Regional Station Wellington-643231, Tamil Nadu*
2. *Division of Genetics, Indian Agricultural Research Institute, New Delhi-110012*
3. *Directorate of Wheat Research, Regional Station, Shimla-171002, Himachal Pradesh*
4. *Directorate of Wheat Research, Karnal-134201, Haryana*

## HW-2002 (INGR No. 04014; IC408333), Wheat (*Triticum aestivum* L.) Germplasm Line with Resistance to Brown and Black Rust (*Lr24* and *Sr24*)

HW-2002 is a wheat germplasm line carrying *Lr24* and *Sr24* linked genes, conferring resistance to brown rust and moderate resistance to black rusts. It was developed at the Indian Agricultural Research Institute, Regional Station, Wellington, through pedigree selection and backcrossing method involving Kalyansona*6/ TR 380-4*7/Ag#14. It has erect plant growth habit with 62 days to 50 percent heading and 114 days to maturity. It has white coloured elliptical grains with medium hard texture, 26.8 seeds/spike, and 1000-grain weight of 32 g. with 11.94 percent seed protein.

## HW-2031 (INGR No. 04015; IC408334), Wheat (*Triticum aestivum* L.) Germplasm Line with Resistance to Brown Rust (*Lr28*)

HW-2031 is a wheat germplasm line carrying *Lr28* gene, conferring resistance to brown rust. It was

developed at the Indian Agricultural Research Institute, Regional Station, Wellington, through pedigree selection and backcrossing method involving Sonalika*8/CS2A/2M#4/2. It has erect growth habit with early maturity. It takes 60 days to 50 percent heading and 110 days to matures; produces amber, elliptical semi-hard textured grains, 28.6 seeds/spike, and 1000-grain weight of 28.0 g with 12.9 percent seed protein.

**HW-2049 (INGR No. 04016; IC408338), Wheat (*Triticum aestivum* L.) Germplasm Line, Best Recombinant with Resistance to Brown and Black Rust (*Lr19* and *Sr25*)**

HW-2049 is a wheat germplasm line carrying *Lr19* and *Sr25* linked genes, conferring resistance to brown and black rusts. It was developed at the Indian Agricultural Research Institute, Regional Station, Wellington, Tamil Nadu, through pedigree selection and backcrossing method involving HD 2285/Sunstar*C/C80-1. It has an erect plant growth habit and takes 63 days to 50 percent heading and 113 days to maturity. The grains are amber coloured, oblong with hard texture with 22 seeds/spike, and 1000-grain weight of 29.4 g. with 12.2 percent seed protein.

## WHEAT GENETIC STOCKS RESISTANT TO LOOSE SMUT, KARNAL BUNT, STRIPE AND LEAF RUSTS

**Avtar Singh Grewal, GS Nanda and Karam Chand**
*Punjab Agricultural University, Ludhiana-141005, Punjab*

**ML-1194 (INGR No. 04017; IC296780)**

ML-1194 is a wheat (*Triticum aestivum* L.) germplasm line with resistance to loose smut, Karnal bunt, stripe and leaf rust in new genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method from the cross between Bb-Nad and No66-Pi. The genotype has intermediate growth habit with a plant height of 98 cm and dark green foliage. Heading and maturity on an average takes 97 and 130 days respectively. Ears are dense, white coloured with tapering shape. Grains are amber coloured, hard textured, elongated with average 1000-grain weight of 32.0 g. Resistance to loose smut pathogen was tested 26 times since 1976, while resistance to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-02 seasons, i.e. for nine years and resistance to Karnal bunt pathogen under artificial screening.

**WL-3093 (INGR No. 04018; IC296781)**

WL-3093 is a wheat (*Triticum aestivum* L.) germplasm line with resistance to loose smut, Karnal bunt, stripe and leaf rust in different genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method in cross, USA251-WL223 x WG 377. The plants have semi-spreading growth habit with plant height of 116 cm and dark green foliage. Heading and maturity on an average take 105 and 130 days respectively. Ear is dense white coloured with tapering shape with a length of 9 cm. Grains are amber coloured, hard textured, elongated with average 1000-grain weight of 37.0 g. Resistance to loose smut pathogen was tested 27 times since 1975, while that to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-02, seasons i.e. for 9 years and resistance to Karnal bunt pathogen under artificial screening.

**WL-3203 (INGR No. 04019; IC296784)**

WL-3203 is a wheat (*Triticum aestivum* L) germplasm line with resistance to loose smut, Karnal bunt, stripe and leaf rust in different genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method in cross, (USA255 x K816) x WL202. The plant has an intermediate growth habit with plant height of 97 cm and dark green foliage. Heading and maturity on an average take 101 and 130 days respectively. Ear is dense white coloured with tapering shape with a length of 11 cm. Grains are amber coloured, hard textured, elongated with an average 1000-grain weight of 35.0 g. The resistance to loose smut pathogen was tested 26 times since 1976, while to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-

developed at the Indian Agricultural Research Institute, Regional Station, Wellington, through pedigree selection and backcrossing method involving Sonalika*8/CS2A/2M#4/2. It has erect growth habit with early maturity. It takes 60 days to 50 percent heading and 110 days to matures; produces amber, elliptical semi-hard textured grains, 28.6 seeds/spike, and 1000-grain weight of 28.0 g with 12.9 percent seed protein.

**HW-2049 (INGR No. 04016; IC408338), Wheat (*Triticum aestivum* L.) Germplasm Line, Best Recombinant with Resistance to Brown and Black Rust (*Lr19* and *Sr25*)**

HW-2049 is a wheat germplasm line carrying *Lr19* and *Sr25* linked genes, conferring resistance to brown and black rusts. It was developed at the Indian Agricultural Research Institute, Regional Station, Wellington, Tamil Nadu, through pedigree selection and backcrossing method involving HD 2285/Sunstar*C/C80-1. It has an erect plant growth habit and takes 63 days to 50 percent heading and 113 days to maturity. The grains are amber coloured, oblong with hard texture with 22 seeds/spike, and 1000-grain weight of 29.4 g. with 12.2 percent seed protein.

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**Avtar Singh Grewal, GS Nanda and Karam Chand**
*Punjab Agricultural University, Ludhiana-141005, Punjab*

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**WL-3093 (INGR No. 04018; IC296781)**

WL-3093 is a wheat (*Triticum aestivum* L.) germplasm line with resistance to loose smut, Karnal bunt, stripe and leaf rust in different genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method in cross, USA251-WL223 x WG 377. The plants have semi-spreading growth habit with plant height of 116 cm and dark green foliage. Heading and maturity on an average take 105 and 130 days respectively. Ear is dense white coloured with tapering shape with a length of 9 cm. Grains are amber coloured, hard textured, elongated with average 1000-grain weight of 37.0 g. Resistance to loose smut pathogen was tested 27 times since 1975, while that to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-02, seasons i.e. for 9 years and resistance to Karnal bunt pathogen under artificial screening.

**WL-3203 (INGR No. 04019; IC296784)**

WL-3203 is a wheat (*Triticum aestivum* L) germplasm line with resistance to loose smut, Karnal bunt, stripe and leaf rust in different genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method in cross, (USA255 x K816) x WL202. The plant has an intermediate growth habit with plant height of 97 cm and dark green foliage. Heading and maturity on an average take 101 and 130 days respectively. Ear is dense white coloured with tapering shape with a length of 11 cm. Grains are amber coloured, hard textured, elongated with an average 1000-grain weight of 35.0 g. The resistance to loose smut pathogen was tested 26 times since 1976, while to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-

02 seasons, i.e. of nine years and resistance to Karnal bunt pathogen under artificial screening.

**WL-3526 (INGR No. 04020; IC296785)**

WL-3526 is a wheat (*Triticum aestivum* L) germplasm line resistant to loose smut, Karnal bunt, stripe and leaf rust in a new genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method in cross, HD2009 x WG 377. The plants have intermediate growth habit with plant height of 99 cm and dark green foliage. Heading and maturity on an average take 95 and 128 days respectively. Ear is dense white coloured with tapering shape. Ear length is 10 cm. Grains are amber coloured, hard textured, elongated with average 1000-grain weight of 36 g. Resistance to loose smut pathogen was tested 24 times since 1978, while to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-02 seasons, i.e. for 9 years and resistance to Karnal bunt pathogen under artificial testing.

**WL-5634 (INGR No. 04021; IC296603)**

WL-5634 is a wheat (*Triticum aestivum* L.) germplasm line resistant to loose smut, Karnal bunt, stripe and leaf rust in a different genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method in cross, kav kaz-Cno-Inia x WL 905. The plants have intermediate growth habit with height of 97 cm and dark green foliage. Heading and maturity on an average take 96 and 130 days respectively. Ear is dense, white coloured with tapering shape and white coloured awns. Ear length is 9 cm. Grains are amber coloured, hard textured, elongated with average 1000-grain weight of 30 g. The resistance to loose smut pathogen was tested 23 times since 1980, while resistance to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-02 seasons (9 years) and resistance to Karnal bunt pathogen under artificial testing

## AKW 2862-1 (INGR No. 04022; IC296767), Wheat (*Triticum aestivum* L.) Germplasm Line with Heat Tolerance

**DG Vitkare**
*Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola-444104, Maharashtra*

AKW 2862-1 is a wheat germplasm line with tolerance to heat and early maturity. It was developed through pedigree selection method in germplasm VEE # 6 || DOVE "S"/BUC "S" CM 92225-66Y-OM at Wheat Research Unit, PDKV, Akola. It was screened in 15 Short Duration cum Heat Tolerance Screening Nurseries conducted at 17 locations with an aim to identify genotypes of early maturity and tolerance to high temperature during grain-filling period under late sowing conditions. The genotype AKW 2862-1 showed consistent performance for these important traits during three subsequent seasons (1999-2000, 2000-2001 and 2001-2002). Mean days to heading were 63 days (with range of 46 - 106) with maximum and minimum temperature of 37.26°C and 8.83°C, respectively, and 1000-grain weight of 49 g (with range of 30-56 g).

## Harit-1 (M3) (INGR No. 04023; IC427810), Wheat (*Triticum aestivum* L.) Germplasm Line, a New Source of Leaf Blight Resistance

**DP Singh, Jag Shoran and Pankaj Kumar**
*Directorate of Wheat Research, Karnal-132001, Haryana*

Leaf blight is a major biotic factor causing yield losses up to 50 percent in susceptible wheat varieties under warmer and humid weather of Northeastern plains zone (NEPZ). The disease causing pathogen *Bipolaris sorokiniana* syn. *Helminthosporium sativum* is present in all the six agro-climatic zones of India, neighbouring south Asia, China, North and Latin America and Brazil. Genotype showing no or little halo around necrotic spot is considered highly resistant.

Harit-1 (M3) is a new wheat (*Triticum aestivum*)

02 seasons, i.e. of nine years and resistance to Karnal bunt pathogen under artificial screening.

**WL-3526 (INGR No. 04020; IC296785)**

WL-3526 is a wheat (*Triticum aestivum* L) germplasm line resistant to loose smut, Karnal bunt, stripe and leaf rust in a new genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method in cross, HD2009 x WG 377. The plants have intermediate growth habit with plant height of 99 cm and dark green foliage. Heading and maturity on an average take 95 and 128 days respectively. Ear is dense white coloured with tapering shape. Ear length is 10 cm. Grains are amber coloured, hard textured, elongated with average 1000-grain weight of 36 g. Resistance to loose smut pathogen was tested 24 times since 1978, while to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-02 seasons, i.e. for 9 years and resistance to Karnal bunt pathogen under artificial testing.

**WL-5634 (INGR No. 04021; IC296603)**

WL-5634 is a wheat (*Triticum aestivum* L.) germplasm line resistant to loose smut, Karnal bunt, stripe and leaf rust in a different genetic background. It was developed at the Punjab Agricultural University, Ludhiana through pedigree selection method in cross, kav kaz-Cno-Inia x WL 905. The plants have intermediate growth habit with height of 97 cm and dark green foliage. Heading and maturity on an average take 96 and 130 days respectively. Ear is dense, white coloured with tapering shape and white coloured awns. Ear length is 9 cm. Grains are amber coloured, hard textured, elongated with average 1000-grain weight of 30 g. The resistance to loose smut pathogen was tested 23 times since 1980, while resistance to stripe and leaf rust races prevalent in the region, since 1993-94 to 2001-02 seasons (9 years) and resistance to Karnal bunt pathogen under artificial testing

## AKW 2862-1 (INGR No. 04022; IC296767), Wheat (*Triticum aestivum* L.) Germplasm Line with Heat Tolerance

**DG Vitkare**
*Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola-444104, Maharashtra*

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Harit-1 (M3) is a new wheat (*Triticum aestivum*)

02 seasons, i.e. of nine years and resistance to Karnal bunt pathogen under artificial screening.

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## Harit-1 (M3) (INGR No. 04023; IC427810), Wheat (*Triticum aestivum* L.) Germplasm Line, a New Source of Leaf Blight Resistance

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Harit-1 (M3) is a new wheat (*Triticum aestivum*)

germplasm resistant to leaf blight. It was bred at CIMMYT, Mexico by using multiple crosses in which *T. tauschii* is one of the parents. The pedigree of the genetic stock is Cando/R143//Mexi"S"/3/*T. tauschii* (CI18). Screening against leaf blight was done at the Directorate of Wheat Research, Karnal. The present genetic stock has been found resistant to both pathogen (Table 1) and its toxin, helminthosporol (Singh, 2003; Singh *et al.*, 2002).

**Table 1. Reactions of Harit-1 against leaf blight in comparison with susceptible check**

| Test | Harit-1 (Resistant) | | Sonalika (Susceptible) | |
|---|---|---|---|---|
| | 2002-03 | 2003-04 | 2002-03 | 2003-04 |
| Infection response (seedling and adult stage) | R | R | S | S. |
| Leaf blight score on Flag (F) and F-1 leaf (adult stage) | 01 | 02 | 89 | 99 |

R-Resistant, S-Susceptible

Harit-1 (M3) has spreading growth habit with plant height 127 cm, pink coloured coleoptile, colourless auricle and hairy green foliage (boot stage), flag leaf angle erect, leaf length 38 cm, leaf width 2 cm; leaf sheath, leaf blade, peduncle and ear-non waxy, ear semi-drooper, brown, medium length; 18 spikelets/spike, long brown awn, brown outer glume, densely pubescent, shoulder shape with elevated beak and short curvature; red grain, semi hard, oblong, medium; light brown phenol reaction and takes 98 days to heading. Reaction to brown rust 0, yellow rust total resistant (TR), leaf blight, Karnal bunt 0 (under natural conditions) and powdery mildew 2.

### References

Singh DP (2003) Screening of wheat genotypes for leaf blight resistance at seedling stage based on infection response against *Bipolaris sorokiniana*- a rapid and effective technique. *Indian Wheat Newsletter* 9: 10-11.

Singh DP, H Maraite, E Duveiller, M Diego and E Renard (2003) Comparison of host resistance to *Bipolaris sorokiniana*, the casual agent of leaf botches and its toxin in wheat. In: JB Rasmussen, TL Friesen and S Ali (eds). *Proceedings of 4th International Wheat Tan Spot and Spot Blotch Workshop*, held at Bemidji, MN, USA, (21-24 July 2002). pp 74-78.

## MAIZE INBRED LINES FOR DIFFERENT NOVEL TRAITS

**Sai Kumar Ramanujam, E Satyanarayana, P Mary Rekha, S Ravindra Babu, P Shanthi and D Rajesham**

*Agricultural Research Station, Acharya NG Ranga Agricultural University, Amberpet, Hyderabad- 500013, Andhra Pradesh*

### BML-2 (INGR No. 04024; IC411279)

BML-2 is a maize inbred line with prolific rabbit ears, tolerance to banded leaf sheath blight (BLSB), sorghum downy mildew (SDM), post flowering stock rot (PFSR) and water logging, and general combining ability (GCA). This inbred line was derived through pedigree selection method from improved germplasm stock namely modified $X_1Y$ pools ($X_1Y$ 110-OP-b96k-) at Agricultural Research Station, Amberpet, Hyderabad by introgressing a series of elite materials and through the adaptation of restricted pollination coupled with pedigree selection.

This inbred has tall green sturdy plants with anthocyanin pigmentation on culm. Leaf is dark green, semi erect, broad and normal with green leaf sheath. It bears erect loose tassel with medium side branches, green silk with pink tinge, green tight husk. The white ears bear lemon yellow coloured semi-dented grains. It takes 74 days to 50 percent pollen shedding and 76 days of 50 percent silking. Ear length is 15 cm and girth is 13 cm. with 14 seed rows/ear, 26 seeds/row, seed test weight of 34 g and shelling percentage of 87. It gave a mean yield of 4000 kg/ha.

### BML-3 (INGR No. 04025; IC411280)

BML-3 is a maize (*Zea mays* L.) inbred line with long productive ears, resistant to post flowering stock rot (PFSR), maydis leaf blight (MLB) and banded leaf sheath blight (BLSB), and general combining ability (GCA). This inbred was derived through pedigree selection method from improved germplasm stock, namely, NMH 502-B97K at Agricultural Research Station, Amberpet, Hyderabad by introgressing series of elite materials and through adaptation of restricted pollination coupled with pedigree selection.

The inbred has short sturdy plants, green culm

germplasm resistant to leaf blight. It was bred at CIMMYT, Mexico by using multiple crosses in which *T. tauschii* is one of the parents. The pedigree of the genetic stock is Cando/R143//Mexi"S"/3/*T. tauschii* (CI18). Screening against leaf blight was done at the Directorate of Wheat Research, Karnal. The present genetic stock has been found resistant to both pathogen (Table 1) and its toxin, helminthosporol (Singh, 2003; Singh *et al.*, 2002).

**Table 1. Reactions of Harit-1 against leaf blight in comparison with susceptible check**

| Test | Harit-1 (Resistant) | | Sonalika (Susceptible) | |
|---|---|---|---|---|
| | 2002-03 | 2003-04 | 2002-03 | 2003-04 |
| Infection response (seedling and adult stage) | R | R | S | S. |
| Leaf blight score on Flag (F) and F-1 leaf (adult stage) | 01 | 02 | 89 | 99 |

R-Resistant, S-Susceptible

Harit-1 (M3) has spreading growth habit with plant height 127 cm, pink coloured coleoptile, colourless auricle and hairy green foliage (boot stage), flag leaf angle erect, leaf length 38 cm, leaf width 2 cm; leaf sheath, leaf blade, peduncle and ear-non waxy, ear semi-drooper, brown, medium length; 18 spikelets/spike, long brown awn, brown outer glume, densely pubescent, shoulder shape with elevated beak and short curvature; red grain, semi hard, oblong, medium; light brown phenol reaction and takes 98 days to heading. Reaction to brown rust 0, yellow rust total resistant (TR), leaf blight, Karnal bunt 0 (under natural conditions) and powdery mildew 2.

### References

Singh DP (2003) Screening of wheat genotypes for leaf blight resistance at seedling stage based on infection response against *Bipolaris sorokiniana*- a rapid and effective technique. *Indian Wheat Newsletter* 9: 10-11.

Singh DP, H Maraite, E Duveiller, M Diego and E Renard (2003) Comparison of host resistance to *Bipolaris sorokiniana*, the casual agent of leaf botches and its toxin in wheat. In: JB Rasmussen, TL Friesen and S Ali (eds). *Proceedings of 4th International Wheat Tan Spot and Spot Blotch Workshop*, held at Bemidji, MN, USA, (21-24 July 2002). pp 74-78.

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*Agricultural Research Station, Acharya NG Ranga Agricultural University, Amberpet, Hyderabad- 500013, Andhra Pradesh*

### BML-2 (INGR No. 04024; IC411279)

BML-2 is a maize inbred line with prolific rabbit ears, tolerance to banded leaf sheath blight (BLSB), sorghum downy mildew (SDM), post flowering stock rot (PFSR) and water logging, and general combining ability (GCA). This inbred line was derived through pedigree selection method from improved germplasm stock namely modified $X_1Y$ pools ($X_1Y$ 110-OP-b96k-) at Agricultural Research Station, Amberpet, Hyderabad by introgressing a series of elite materials and through the adaptation of restricted pollination coupled with pedigree selection.

This inbred has tall green sturdy plants with anthocyanin pigmentation on culm. Leaf is dark green, semi erect, broad and normal with green leaf sheath. It bears erect loose tassel with medium side branches, green silk with pink tinge, green tight husk. The white ears bear lemon yellow coloured semi-dented grains. It takes 74 days to 50 percent pollen shedding and 76 days of 50 percent silking. Ear length is 15 cm and girth is 13 cm. with 14 seed rows/ear, 26 seeds/row, seed test weight of 34 g and shelling percentage of 87. It gave a mean yield of 4000 kg/ha.

### BML-3 (INGR No. 04025; IC411280)

BML-3 is a maize (*Zea mays* L.) inbred line with long productive ears, resistant to post flowering stock rot (PFSR), maydis leaf blight (MLB) and banded leaf sheath blight (BLSB), and general combining ability (GCA). This inbred was derived through pedigree selection method from improved germplasm stock, namely, NMH 502-B97K at Agricultural Research Station, Amberpet, Hyderabad by introgressing series of elite materials and through adaptation of restricted pollination coupled with pedigree selection.

The inbred has short sturdy plants, green culm

and green brace root. Leaves are light green, semi erect, medium with green leaf sheath. It bears medium tassel that are loose, erect, medium side branches and green silk, while husk is green and tight. It has very long productive ears. The cobs are cylindrical and white with yellow semi-dented grains. It gave a mean yield of 4000 kg/ha with 80 days to 50 percent pollen shedding and 83 days to 50 percent silking. Ear length is 18 cm and girth is 13 cm with 14 seed rows/ear, 35 seeds/row, seed test weight of 35 g and shelling percentage 87. It is good as female parent.

**BML-5 (INGR No. 04026; IC411281)**

BML-5 is maize (*Zea mays* L.) inbred line with dwarf plants and tolerance to BLSB, MLB and Turcicum Leaf Blight (TLB), and high GCA. This inbred was derived through pedigree selection method in Nizamabad OP 7 at the Nizamabad, Andhra Pradesh, and improved at the Agricultural Research Station, Amberpet, Hyderabad by introgressing a series of elite materials and through the adaptation of restricted pollination coupled with pedigree selection.

The inbred has short internodal length, bending plant type, stem with green culm and green red brace roots. Leaves are green, drooping, broad and with green leaf sheath. It bears medium semi-compact tassel with semi-drooping side and purple silk. Husk is green and tight. It bears white cylindrical straight rowed, tip filled rigid cob with pink flinted grains. It gave a mean yield of 2666 kg/ha with 78 days to 50 percent pollen shedding, 78 days to 50 percent silking, ear length of 12 cm and girth 14 cm with 16 seed rows/ ear, 20 seeds/row, seed test weight of 26.0 g and shelling percentage 83.

**BML-7 (INGR No. 04027; IC411283)**

BML-7 is a maize (*Zea mays* L.) inbred line with orange colour seeds, tolerant to BLSB, MLB and SDM, and high GCA It was derived through pedigree selection method from $F_1$ progeny of $X_2Y$ pool x CML-226 germplasm at the Nizamabad, Andhra Pradesh, and improved at the Agricultural Research Station, Amberpet, Hyderabad through adaptation of restricted pollination coupled with pedigree selection.

The inbred has tall plants with broad green leaves and orange coloured seeds. It is a good general and specific combiner. Leaves are broad normal green and drooping with green leaf sheath. The medium size loose tassels are erect with medium side branches. The glumes and anthers are purple pigmented and the silk is pink. Husk is green and tight. It bears white cylindrical straight rowed, tip filled rigid cob with pink flinted grains. It gave a mean yield of 3333 kg/ha with 74 days to 50 percent pollen shedding and 76 days of 50 percent silking. Ear length is 13 cm and girth is 12.5 cm. with 14 seed rows/ear and 20 seeds/row, seed test weight of 27.5 g. and shelling percentage of 83.

**BML-8 (INGR No. 04028; IC411284)**

BML-8 is a maize (*Zea mays* L.) inbred line with tall plants, conical shape ears and high GCA. This inbred line was derived through pedigree selection from stock rot resistant germplasm, SRRL 79 screened at pathology section of the station and it was modified and improved at the Agricultural Research Station, Amberpet, Hyderabad through adaptation of restricted pollination coupled with pedigree selection.

It has very tall plants, characteristic conical shaped ears with yellow dent grains with presence of aborted cluster of glumes, above the tip of the shank. Leaves are green and drooping with green leaf sheath. The medium size loose tassel are erect and with medium side branches. The glumes and silk are green and anthers are yellow. Husk is green and tight covering the tip. It bears white cylindrical straight rowed, tip filled rigid cob with yellow flint grains. It gave a mean yield of 3733 kg/ha and took 78 days to 50 percent pollen shedding and 82 days of 50 percent silking. Ear length is 16 cm and girth is 13 cm. 14 seed rows/ear and 30 seeds/row. Seed test weight was 27 g. and shelling percentage 85. It is good both as male and female parent.

**BML-11 (INGR No. 04029; IC411285)**

BML-11 is a maize inbred line with prolific ears, very peculiar tassel resembling sorghum panicle i.e. lateral branches arranged in a distinct manner and length. Anthers are very small. It was derived through pedigree selection from Suavan germplasm SUVAN3-B96 and improved for its adaptability and productivity at the Agricultural Research Station, Amberpet, Hyderabad through adaptation of restricted pollination coupled with pedigree selection.

It gave mean yield of 4000 kg/ha and took 73 days to 50 percent pollen shedding and 75 days to

50 percent silking. Ear length is 11 cm and girth is 14 cm with 14 seed rows/ear and 28 seeds/row. The seed test weight was 20.5 g and shelling percentage 83. It bears green culm with purple brace roots, light green semi-erect leaf and light green leaf sheath. The tassel is medium erect, with few side branches having purple tinge and green anther. The white cylindrical rigid cob bears orange yellow flint grains filled up to the tip in straight row.

**BML-14 (INGR No. 04030; IC411286)**

BML-14 is a maize inbred line with medium height plants, green tassel and extended pollen shedding period (7 days) and good combining ability. This maize inbred line was derived through pedigree selection from an improved germplasm stock, namely, modified $XY_2$ pools COIB 96K and improved at the Agricultural Research Station, Amberpet, Hyderabad, by introgressing a series of elite material and adopting restricted pollination coupled with pedigree selection.

It gives a mean yield of 3060 kg/ha and took 65 days to 50 percent pollen shedding and 68 days to 50-percent silking. Ear length is 11.0 cm and girth is 16 cm with 16 seed rows/ear and 25 seeds/row. The seed test weight was 25.0 g and shelling percentage 85. It bears green culm with green brace roots, light green broad drooping normal leaf and green leaf sheath. The tassel is loose and medium in size. The white cylindrical rigid cob with green tight husk bears orange flint grains. The central rachis of the tassel is U shaped at the tip.

**BML-15 (INGR No. 04031; IC411287)**

BML-15 is a maize inbred line used as tester and is endowed with water logging tolerance and resistant to maydis leaf blight, turcicum leaf blight, banded leaf sheath blight and Sorghum downy mildew, and have good general combining ability. This maize inbred line was derived through pedigree selection from $F_1$ progeny of $X_2Y$ pools x CML-226, and improved at the Agricultural Research Station, Amberpet, Hyderabad for adaptability and productivity through adaptation of restricted pollination coupled with pedigree selection method.

BML-15 has tall plants, drooping light green long leaves and bold pointed seeds with light pigment at the base of the seed. The plants are sturdy bearing green culm. Leaves are normal dark green, broad, drooping with green leaf sheath and few purple spots. The big loose drooping tassels bare drooping large side branches. It has green glumes with purple tinge and pink silk. It has tight green husk covering the tip. It bears white cylindrical straight rowed, tip filled rigid cob with pink flint grains. It gave a mean yield of 2133 kg/ha and took 74 days to 50 percent pollen shedding and 78 days to 50 percent silking. Ear length is 15 cm and girth is 12.5 cm. with 12 seed rows/ ear and 25 seeds/row. The seed test weight is 27 g, while the shelling percentage is 87.

**BML-20 (INGR No. 04032; IC411288)**

BML-20 is a maize (*Zea mays* L.) inbred line with extra green stem, tolerant to lodging and good general combining ability. It has medium height dark green sturdy plant having angular bold orange seed with a small dot on the top. It was derived through pedigree selection from SUVAN-1 (D) and improved for its adaptability and productivity at the Agricultural Research Station, Amberpet, Hyderabad through adaptation of restricted pollination coupled with pedigree selection method.

Leaves are normal, dark green and broad, erect with green leaf sheath. The tassels are semi compact erect bearing large side branches. It bears green glumes with green anthers, green silk and tight green husk covering the tip. It cobs are white cylindrical straight rowed, tip filled rigid cob with orange flint grains. It gave a mean yield of 3333 kg/ha with 73 days to 50% pollen shedding and 75 days to 50% silking. Ear length is 13 cm and girth is 14 cm with 14 seed rows/ear and 25 seeds/row. The seed test weight is 29 g and 86 percent shelling.

**BML-22 (INGR No. 04033; IC411289)**

BML-22 is a maize (*Zea mays* L.) inbred line with big tassel, drooping large narrow leaves, without anthocyanin pigmentation on brace roots. This maize inbred line was derived through pedigree selection from improved germplasm stock, namely modified $X_1Y$ pool improved at Agricultural Research Station, Amberpet, Hyderabad by introgressing series of elite materials and through the adaptation of restricted pollination coupled with pedigree selection.

It has medium tall plants with green culm and green brace roots. Leaves are normal, light green and with green leaf sheath. The medium tassel is semi-compact, erect bearing medium side branches. It bears green glumes, yellow anthers, and green silk and tight

green husk covering the tip. Cobs are white cylindrical straight rowed, tip filled rigid cob with orange yellow flinted grains. It gave a mean yield of 3066 kg/ha with 74 days to 50% pollen shedding and 76 days to 50% silking. Ear length is 14 cm and girth is 12 cm 12 seed rows/ear, 30 seeds/row. The seed test weight is 25.2 g and shelling percentage 85.

# MAIZE INBRED LINES FOR DIFFERENT NOVEL TRAITS

**Sain Dass and Kulbir Singh Dhanju**
*Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station, Uchani, Karnal-132001, Haryana*

## HKI-139 (INGR No. 04065; IC405276)

HKI-139 is an early maize (*Zea mays* L.) inbred line, with an orange grain colour, cold tolerance, high general combining ability and resistance to maydis leaf blight (MLB) [(*Drechslera maydis* Nisik.) Subram. and Jain] (Table 1). It was developed at the Chaudhary Charan Singh Haryana Agricultural University (CCSHAU), Regional Research Station, Uchani, Karnal (Annual Report, 1999-2001). The line was developed by utilizing exotic germplasm, Pozarica 80 MBRS from CIMMYT Mexico. Inbreeding was initiated in this population and ear to row selection was practiced. After six generations of selfing the line was evaluated for different characters along with combining ability. It has long cob (9.0-11.5 in different seasons) with attractive grain colour, medium maturity (95-110 cm in *kharif* and 75-85 cm in *rabi*), dark green, semi-drooping leaf; green stem, dense tassel, medium secondary branches, green anther, green glume, green silk, husk cover green and tight, cylindrical ear, purple heart, grain up to tip, straight kernel rows, flint grain orange, round, medium bold in size. It takes 50-54 days and 134-137 days to 50 per cent tasselling and 53-57 days and 136-141 days to silking in *kharif* and *rabi*, respectively. This line could survive during the month of January at around 4°C, suggesting; it possessed fair tolerance to cold (Table 1). The productivity of this line in winter is high as compared to *kharif* season.

**Table 1. Disease reaction of hki-139 under artificial inoculation conditions and cold tolerance under natural field conditions**

| Year | MLB | | Common Rust | | Cold Tolerance (1-5) |
|---|---|---|---|---|---|
| | HKI 139 | CM-600* | HKI 139 | CM-202* | 139 |
| 2001 | 2.5 | 4.5 | 2.0 | 4.5 | 1.5 |
| 2002 | 2.0 | 5.0 | 2.5 | 5.0 | 1.5 |
| 2003 | 2.0 | 5.0 | 2.5 | 4.5 | 1.5 |
| Mean | 2.2 | 4.8 | 2.3 | 4.6 | 1.5 |

* Susceptible check

## 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, pp102-104.

## HKI-323-8 (INGR No. 04066; IC405278)

HKI-323-8 is a medium maturing MLB (*Drechslera maydis* Nisik.) Subram. and Jain] resistant inbred line with orange grain colour and high GCA, developed from subtropical Pool-28 population from CIMMYT. It was developed at the CCS HAU, Regional Research Station, Uchani, Karnal (Annual Report, 1999-2001). This line was derived through continuous selfing till the line became uniform for morpho-physiological traits.

It has medium maturity, medium height (100-115 cm), medium broad and dark green drooping leaf, green stem, lax, semi-drooping, medium, without secondary branches tassel, pink anther, purple glume, purple silk and attractive, green with purple patches, tight husk cover, cylindrical long (10.5-13.0 cm) ear, white heart, grain up to tip and straight kernel rows. It has shining flint grain with white thin gully, orange colour, round with medium bold size. It takes 52-54 and 134 days to 50 percent tasselling and 54-56 and 136 days to silking in *kharif* and *rabi*, respectively. The yield potential of the line varies from 20.0-24.4 q/ha in different seasons. This line was evaluated for MLB under artificial disease condition to confirm the level of resistance to disease (Table 1). High yielding hybrids with dark orange grain colour were produced, when HKI-1105, 288, 295, 488, 1040-7 were crossed with 323-8.

**Table 1. Disease reaction of HKI 323-8 against Maydis Leaf Blight under artificial inoculation conditions.**

| *Kharif* | HKI-323-8 | CM-600* |
|---|---|---|
| 2001 | 2.0 | 4.5 |
| 2002 | 2.5 | 5.0 |
| 2003 | 2.0 | 5.0 |
| Mean | 2.2 | 4.6 |

*Susceptible check

**Table 1. Cold tolerance and disease reaction of HKI 586**

| Year | Cold Tolerance | Common Rust | |
|---|---|---|---|
| | HKI 586 | HKI 586 | CM-202* |
| *2001* | 1.5 | 1.0 | 4.5 |
| *2002* | 1.0 | 1.5 | 5.0 |
| *2003* | 1.5 | 1.5 | 5.0 |
| *Mean* | 1.3 | 1.3 | 4.8 |

* Susceptible Check

### Reference

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

## HKI-1344 (INGR No. 04075; IC408330)

HKI-1344 is a maize inbred line with white, flint, bold grain, maydis leaf blight [(*Drechslera maydis* Nisik.) Subram. and Jain] and rust resistance (Table 1), productive and good general combiner. It was derived from subtropical heterotic Group-B, CIMMYT, Mexican population through continuous inbreeding, following ear to row selection procedure at the CCSHAU, Regional Research Station, Uchani, Karnal (Annual Report,1999-2001). It belongs to medium to full season maturity group and takes 57-58 days to flower in *kharif* and 90-95 days to maturity. It takes 60 days in *kharif* and 137-139 days in *rabi* to 50 percent silking. Leaves are broad, erect and dark green, white glume, green silk, green and tight husk cover, cylindrical, medium long (10.5-12.0 in different seasons) ear, white heart, bold, flat, flint/semi-flint grain with a yield of 24-28.0 q/ha.

**Table 1. Disease reaction of HKI-1344 against maydis leaf blight and common rust under artificial inoculation conditions**

| Year | MLB | | Rust | |
|---|---|---|---|---|
| | 1344 | CM-600* | 1352-58-9 | CM-202* |
| 2001 | 1.0 | 4.5 | 1.0 | 4.5 |
| 2002 | 1.0 | 5.0 | 1.0 | 5.0 |
| 2003 | 1.0 | 5.0 | 1.5 | 4.5 |
| Mean | 1.0 | 4.8 | 1.2 | 4.6 |

### Reference

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

## JCR/TRS-489 (INGR No. 04034; IC258233), an Easy De-hulling Type Buckwheat (*Fagopyrum tataricum* Gaertn.)

**JC Rana[1], TR Sharma[2], VD Verma[1], SK Yadav[1] and K Pradheep[1]**

*1. National Bureau of Plant Genetic Resources, Regional Station Shimla-171004, Himachal Pradesh*

*2. Centre of Hill Bioresources and Biotechnology, Himachal Pradesh Agricultural University, Palampur-176 062, Himachal Pradesh*

JCR/TRS-489 is an easy de-hulling type buckwheat, (*Fagopyrum tataricum* Gaertn.), identified from a local germplasm at NBPGR, Regional Station Shimla. Buckwheat in general is bitter and difficult to de-hull, thus produces black flour, which is not liked for bread making. Easily de-hulled type germplasm are very rare. Germplasm accession IC258233 collected from Kullu district of Himachal Pradesh has non-adhering hull and can be de-hulled just by rubbing with hands. Easily de-hulled varieties give white flour, which has great potential in the noodle/by product industry of buckwheat. Generally, sweet buckwheat is used in the noodle industry because of its easy de-hulling characteristic, although bitter buckwheat has more nutritional and medicinal value, but due to difficulty in de-hulling it has limited use in the industry. This type of buckwheat is popularly known as 'rice buckwheat' due to its white kernels. The material can be directly brought into cultivation or after selection of high yielding materials. This accession has also been found high yielding and included in the All India Coordinated Research Network on Under-utilised Crops in the year 2004. The data showed that it has average seed weight, plant height and fall in medium flowering and maturity group. The grain yield is above average. The details of other morphological characters are given in Table 1.

**Table 1. Characteristic feature of the germplasm accessions JCR/TRS-489**

| Characters | Mean Value | Characters | Mean Value |
|---|---|---|---|
| Plant height (cm) | 53.65 | No. of seed/cyme | 10.00 |
| Leaf length (cm) | 7.45 | 1000 seed wt. (g) | 15.40 |
| Leaf width (cm) | 9.00 | Seed yield/plant (g) | 28.96 |
| No. of leaves | 12.50 | Leaf colour | Green |
| No. of internodes | 11.50 | Leaf margin colour | Pink |
| Petiole length (cm) | 5.80 | Leaf blade shape | Hastate |
| No. of primary branches | 4.50 | Early plant vigour | Very good |
| No. of cymes/plant | 14.50 | Plant growth habit | Erect |
| Length of cyme (cm) | 2.55 | Seed shattering | Moderate |
| Days to 50% flowering | 39.00 | Seed shape | Ovate |
| Days to 80% maturity | 107.00 | Seed colour | Black |

**Table 1. Cold tolerance and disease reaction of HKI 586**

| Year | Cold Tolerance | Common Rust | |
|---|---|---|---|
| | HKI 586 | HKI 586 | CM-202* |
| *2001* | 1.5 | 1.0 | 4.5 |
| *2002* | 1.0 | 1.5 | 5.0 |
| *2003* | 1.5 | 1.5 | 5.0 |
| *Mean* | 1.3 | 1.3 | 4.8 |

* Susceptible Check

### Reference

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

## HKI-1344 (INGR No. 04075; IC408330)

HKI-1344 is a maize inbred line with white, flint, bold grain, maydis leaf blight [(*Drechslera maydis* Nisik.) Subram. and Jain] and rust resistance (Table 1), productive and good general combiner. It was derived from subtropical heterotic Group-B, CIMMYT, Mexican population through continuous inbreeding, following ear to row selection procedure at the CCSHAU, Regional Research Station, Uchani, Karnal (Annual Report,1999-2001). It belongs to medium to full season maturity group and takes 57-58 days to flower in *kharif* and 90-95 days to maturity. It takes 60 days in *kharif* and 137-139 days in *rabi* to 50 percent silking. Leaves are broad, erect and dark green, white glume, green silk, green and tight husk cover, cylindrical, medium long (10.5-12.0 in different seasons) ear, white heart, bold, flat, flint/semi-flint grain with a yield of 24-28.0 q/ha.

**Table 1. Disease reaction of HKI-1344 against maydis leaf blight and common rust under artificial inoculation conditions**

| Year | MLB | | Rust | |
|---|---|---|---|---|
| | 1344 | CM-600* | 1352-58-9 | CM-202* |
| 2001 | 1.0 | 4.5 | 1.0 | 4.5 |
| 2002 | 1.0 | 5.0 | 1.0 | 5.0 |
| 2003 | 1.0 | 5.0 | 1.5 | 4.5 |
| Mean | 1.0 | 4.8 | 1.2 | 4.6 |

### Reference

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

## JCR/TRS-489 (INGR No. 04034; IC258233), an Easy De-hulling Type Buckwheat (*Fagopyrum tataricum* Gaertn.)

**JC Rana[1], TR Sharma[2], VD Verma[1], SK Yadav[1] and K Pradheep[1]**

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JCR/TRS-489 is an easy de-hulling type buckwheat, (*Fagopyrum tataricum* Gaertn.), identified from a local germplasm at NBPGR, Regional Station Shimla. Buckwheat in general is bitter and difficult to de-hull, thus produces black flour, which is not liked for bread making. Easily de-hulled type germplasm are very rare. Germplasm accession IC258233 collected from Kullu district of Himachal Pradesh has non-adhering hull and can be de-hulled just by rubbing with hands. Easily de-hulled varieties give white flour, which has great potential in the noodle/by product industry of buckwheat. Generally, sweet buckwheat is used in the noodle industry because of its easy de-hulling characteristic, although bitter buckwheat has more nutritional and medicinal value, but due to difficulty in de-hulling it has limited use in the industry. This type of buckwheat is popularly known as 'rice buckwheat' due to its white kernels. The material can be directly brought into cultivation or after selection of high yielding materials. This accession has also been found high yielding and included in the All India Coordinated Research Network on Under-utilised Crops in the year 2004. The data showed that it has average seed weight, plant height and fall in medium flowering and maturity group. The grain yield is above average. The details of other morphological characters are given in Table 1.

**Table 1. Characteristic feature of the germplasm accessions JCR/TRS-489**

| Characters | Mean Value | Characters | Mean Value |
|---|---|---|---|
| Plant height (cm) | 53.65 | No. of seed/cyme | 10.00 |
| Leaf length (cm) | 7.45 | 1000 seed wt. (g) | 15.40 |
| Leaf width (cm) | 9.00 | Seed yield/plant (g) | 28.96 |
| No. of leaves | 12.50 | Leaf colour | Green |
| No. of internodes | 11.50 | Leaf margin colour | Pink |
| Petiole length (cm) | 5.80 | Leaf blade shape | Hastate |
| No. of primary branches | 4.50 | Early plant vigour | Very good |
| No. of cymes/plant | 14.50 | Plant growth habit | Erect |
| Length of cyme (cm) | 2.55 | Seed shattering | Moderate |
| Days to 50% flowering | 39.00 | Seed shape | Ovate |
| Days to 80% maturity | 107.00 | Seed colour | Black |

## CMS 67A & B, (INGR No. 04036; IC296622 & IC296623), Pigeonpea (*Cajanus cajan* L.) Germplasm Line with Cytoplasmic Male Sterility Conferred by a New Cytoplasm (*Cajanus sericeus*)

**PP Zaveri[1] and BB Singh[2]**
1. *Gujarat State Fertilizer and Chemical Ltd., Vadodara, Gujarat*
2. *Indian Institute of Pulses Research, Kanpur-208024, Uttar Pradesh*

CMS 67A is a cytoplasmic male sterile (CMS) line carrying cytoplasm of wild *Cajanus sericeus* (Benth. Ex Bak.) van der Maesen. The material was developed by wide hybridisation followed by mutagenesis and backcross [*Cajanus sericeus* x ICPL85010 x Mutant of QMS 1 ($M_7$)] (Singh *et al.*, 2004). This line was evaluated. purified and is being maintained at the Indian Institute of Pulses Research, Kanpur. CMS 67A is an early maturing, determinate type, but is susceptible to wilt (60% mortality), moderately resistant to sterility mosaic and *Phytophthora* stem blight diseases. The plants are 100 percent male sterile with white translucent anthers, which are devoid of pollen grains.

The plants are 102-106 cm tall with an average of 6.6 branches per plant, flowering in about 80-85 days, bearing yellow coloured flowers. The average number of pods per plant is 182.33. The pods are 4-6 cm long and their colour is green with black strips. Average number of seeds per pod is 3.66. The test weight of seed is 8.02. Seeds are dark red in colour. The seed yield was optimum at proportion of 6 female: 1 male row and 60 cm row spacing.

### Reference

Singh BB, IP Singh, Sudha Asthana, G Singh and ND Majumdar (2004) Diversification and evaluation of CMS lines in pigeonpea. *Indian J. Pulses Research* (In Press).

## CMS ICPL 84023 A & B (INGR No. 04035; IC296624 & IC296625), Pigeonpea (*Cajanus cajan* L.) Germplasm Line with Cytoplasmic Male Sterility in Early and Multiple Disease Resistance Background

**BB Singh, IP Singh, Sudha Asthana, G Singh and ND Majumdar**
*Indian Institute of Pulses Research, Kanpur-208 002, Uttar Pradesh*

ICPL 84023 A is a converted cytoplasmic genetic male sterile line obtained at $BC_7$ stage by crossing CMS 67A with ICPL 84023 maintained in the gene bank of IIPR Kanpur (Singh *et al.*, 2004). It was produced through recurrent selection, individual plants in CMS as well as in recurrent parents were tagged. Crosses were made on plant-to-plant basis. The individual plants of ICPL 84023 used in crossing programme were selfed to get pure seed for next season. The hybrid seed were grown along with selfed seed of recurrent parent (ICPL 84023). The individual $F_1$ plants were tested for pollen sterility. The sterile plants were crossed with the recurrent parent till $BC_5F_1$ generation. For the seed production of CMS 84023 A, proportion of 6 female : 1 male row is found to be better with 60 cm spacing between rows.

ICPL 84023 A has creamy white anthers devoid of pollen grains and was found to be 100% male sterile during *kharif* 2002-2003 and 2003-2004. It is high yielding, resistant to wilt and sterility mosaic virus, and tolerant to *Phytophthora* stem blight. The plants are 188-190 cm tall having 6-8 branches per plant and flower in about 88 days. Flowers are yellow in colour. There are about 155-168 pods per plant, which are light green in colour. The average pod length is about 4.4 cm. Each pod has 3.3 (average) seeds, which are reddish in colour. The test weight of seeds is 8.12 g.

### Reference

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## CMS 67A & B, (INGR No. 04036; IC296622 & IC296623), Pigeonpea (*Cajanus cajan* L.) Germplasm Line with Cytoplasmic Male Sterility Conferred by a New Cytoplasm (*Cajanus sericeus*)

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The plants are 102-106 cm tall with an average of 6.6 branches per plant, flowering in about 80-85 days, bearing yellow coloured flowers. The average number of pods per plant is 182.33. The pods are 4-6 cm long and their colour is green with black strips. Average number of seeds per pod is 3.66. The test weight of seed is 8.02. Seeds are dark red in colour. The seed yield was optimum at proportion of 6 female: 1 male row and 60 cm row spacing.

### Reference

Singh BB, IP Singh, Sudha Asthana, G Singh and ND Majumdar (2004) Diversification and evaluation of CMS lines in pigeonpea. *Indian J. Pulses Research* (In Press).

## CMS ICPL 84023 A & B (INGR No. 04035; IC296624 & IC296625), Pigeonpea (*Cajanus cajan* L.) Germplasm Line with Cytoplasmic Male Sterility in Early and Multiple Disease Resistance Background

**BB Singh, IP Singh, Sudha Asthana, G Singh and ND Majumdar**
*Indian Institute of Pulses Research, Kanpur-208 002, Uttar Pradesh*

ICPL 84023 A is a converted cytoplasmic genetic male sterile line obtained at $BC_7$ stage by crossing CMS 67A with ICPL 84023 maintained in the gene bank of IIPR Kanpur (Singh *et al.*, 2004). It was produced through recurrent selection, individual plants in CMS as well as in recurrent parents were tagged. Crosses were made on plant-to-plant basis. The individual plants of ICPL 84023 used in crossing programme were selfed to get pure seed for next season. The hybrid seed were grown along with selfed seed of recurrent parent (ICPL 84023). The individual $F_1$ plants were tested for pollen sterility. The sterile plants were crossed with the recurrent parent till $BC_5F_1$ generation. For the seed production of CMS 84023 A, proportion of 6 female : 1 male row is found to be better with 60 cm spacing between rows.

ICPL 84023 A has creamy white anthers devoid of pollen grains and was found to be 100% male sterile during *kharif* 2002-2003 and 2003-2004. It is high yielding, resistant to wilt and sterility mosaic virus, and tolerant to *Phytophthora* stem blight. The plants are 188-190 cm tall having 6-8 branches per plant and flower in about 88 days. Flowers are yellow in colour. There are about 155-168 pods per plant, which are light green in colour. The average pod length is about 4.4 cm. Each pod has 3.3 (average) seeds, which are reddish in colour. The test weight of seeds is 8.12 g.

### Reference

Singh BB, IP Singh, Sudha Asthana, G Singh and ND Majumdar (2004) Diversification and evaluation of CMS lines in pigeonpea. *Indian J. Pulses Research* (In Press).

## GDM–1, Guar Determinate Mutant (INGR No. 04037; IC296671), Cluster Bean (*Cyamopsis tetragonoloba* (L). Taub.)

**A Henry**
*Central Arid Zone Research Institute, Jodhpur-342003, Rajasthan*

GDM–1 is a cluster bean (*Cyamopsis tetragonoloba* (L). Taub.) mutant with determinate plant type. It was developed at the Department of Plant Sciences and Biotechnology, Central Arid Zone Research Institute, Jodhpur through mutation breeding by treating the seeds of variety FS-277 with Ethyl Methane sulphonate (0.25%) (Henry, 2001). This mutant has determinate growth habit in comparison to indeterminate habit of its parent. It has relatively less plant height (average 70.6 cm) over the parent with slight reduced maturity (average 70.6 days), with more number of pods per plant and higher grain yield potential.

### Reference

Henry A (2001) Performance of determinate plant type mutant vis-à-vis indeterminate varieties of clusterbean. In: *Plant physiology for sustainable forestry agri-horticulture and industry, stress and environmental plant physiology* KK Bora, Karan Singh and Arvind Kumar (eds.), Pointer Publishers, Jaipur, Chapter 15.

## CAZC-B (INGR No. 04038; IC296672), Cowpea (*Vigna unguiculata* (L.) Walp.) Germplasm Line with Black Seed Coat Colour

**A Henry**
*Central Arid Zone Research Institute, Jodhpur-342 003, Rajasthan*

CAZC-B 38 is a cowpea mutant with black seed coat colour. It was developed at the Department of Plant Sciences and Biotechnology, Central Arid Zone Research Institute, Jodhpur through mutation breeding by treating variety Charodi-1 with gamma irradiation (Henry, 2001). It is suitable for cowpea growing areas particularly arid regions. This mutant has marginally excelled the parent variety with increased plant height (IVT mean of 70.0 cm; Jodhpur it was 58.2 cm), pods/plant (28.3), days to maturity (IVT mean of 73.2 days; in Jodhpur mean is 70.0 cm) and 100-seed weight (IVT mean of 8.2 g; in Jodhpur it was 8.0 g). The performance is superior to most of the check varieties including Pusa Phalguni in All India Coordinated Research Project on arid legumes. The disease incidence in arid regions it was low.

### Reference

Henry A (2001) Performance of induced black seed cost mutant in cowpea. A short communication. *Indian J. Genet.* **61:** 381-382.

## TG-18AM (INGR No. 04039; IC296610), Groundnut (*Arachis hypogaea* L.) Germplasm Line with Leaf Disease Like Mimic Lesion

**Chandra Mouli, DM Kale, AM Badigannavar and GSS Murty**
*Nuclear Agriculture & Biotechnology Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, Maharashtra*

In groundnut (*Arachis hypogaea* L.) a leaf mutant with mimic disease lesion, designated as TG-18AM, was isolated in M3 generation of TG 18A produced by irradiating seeds with 300 Gy g rays at the Bhabha Atomic Research Centre, Mumbai (Chandramouli and Kale, 1982). It is characterized by the basal four to five leaves remaining green and subsequent newly opened leaves showing light green colour with yellow specks, which start from the leaflet tip and progress towards the base of leaflet. Coalescence of specks result in yellow blotches, which gradually spread to make the whole leaflet yellow. Simultaneously, brown

## GDM–1, Guar Determinate Mutant (INGR No. 04037; IC296671), Cluster Bean (*Cyamopsis tetragonoloba* (L). Taub.)

**A Henry**
*Central Arid Zone Research Institute, Jodhpur-342003, Rajasthan*

GDM–1 is a cluster bean (*Cyamopsis tetragonoloba* (L). Taub.) mutant with determinate plant type. It was developed at the Department of Plant Sciences and Biotechnology, Central Arid Zone Research Institute, Jodhpur through mutation breeding by treating the seeds of variety FS-277 with Ethyl Methane sulphonate (0.25%) (Henry, 2001). This mutant has determinate growth habit in comparison to indeterminate habit of its parent. It has relatively less plant height (average 70.6 cm) over the parent with slight reduced maturity (average 70.6 days), with more number of pods per plant and higher grain yield potential.

### Reference

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## CAZC-B (INGR No. 04038; IC296672), Cowpea (*Vigna unguiculata* (L.) Walp.) Germplasm Line with Black Seed Coat Colour

**A Henry**
*Central Arid Zone Research Institute, Jodhpur-342 003, Rajasthan*

CAZC-B 38 is a cowpea mutant with black seed coat colour. It was developed at the Department of Plant Sciences and Biotechnology, Central Arid Zone Research Institute, Jodhpur through mutation breeding by treating variety Charodi-1 with gamma irradiation (Henry, 2001). It is suitable for cowpea growing areas particularly arid regions. This mutant has marginally excelled the parent variety with increased plant height (IVT mean of 70.0 cm; Jodhpur it was 58.2 cm), pods/plant (28.3), days to maturity (IVT mean of 73.2 days; in Jodhpur mean is 70.0 cm) and 100-seed weight (IVT mean of 8.2 g; in Jodhpur it was 8.0 g). The performance is superior to most of the check varieties including Pusa Phalguni in All India Coordinated Research Project on arid legumes. The disease incidence in arid regions it was low.

### Reference

Henry A (2001) Performance of induced black seed cost mutant in cowpea. A short communication. *Indian J. Genet.* **61:** 381-382.

## TG-18AM (INGR No. 04039; IC296610), Groundnut (*Arachis hypogaea* L.) Germplasm Line with Leaf Disease Like Mimic Lesion

**Chandra Mouli, DM Kale, AM Badigannavar and GSS Murty**
*Nuclear Agriculture & Biotechnology Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, Maharashtra*

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specks start appearing and cover the entire leaflet, resembling rust disease symptom. With the advancement of age, the lower leaves gradually turn green. Unopened leaves on the main axis have a few yellow specks. The $10^{th}$ – $12^{th}$ leaf below the shoot apex has green colour with or without brown specks. Leaves on branches exhibit a similar pattern. Chlorophyll a, chlorophyll b, and total chlorophyll in the upper leaves of mutants were much lower than parent. Two suppressive genes govern the mutant traits, which are also found allelic to disease lesion mimic leaf of somaclonal variant derived from cv. TAG-24 (Badigannavar *et. al.*, 2002). Mutant is inferior to its parent TG-18A with respect to pod yield. It has papery thin shell resulting in very high kernel out turn of 84% (Chandramouli, *et. al.*, 1989).

**References**

Badiganavar AM, DM Kale, S Eapan and GSS Murty (2002) Inheritance of disease lesion mimic leaf trait in groundnut. *J. Hered.* **93**: 50-52.

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

Chandramouli, DM Kale and SH Patil (1989) Mutation research on groundnut in India. In: SA Farook and IA Khan (eds.) *Recent Advances in Genetics and Cytogenetics*, Hyderabad, India, pp 141-153.

## TGE-1 (INGR No. 04040; IC296612), Groundnut (*Arachis hypogaea* L.) Germplasm Line with Foliaceous Stipule

**Chandra Mouli and DM Kale**

*Nuclear Agriculture & Biotechnology Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, Maharashtra*

In groundnut (*Arachis hypogaea* L.), early maturity facilitates the crop to fit into diverse cropping systems. Trombay Groundnut Early (TGE-1) with an early maturity and foliaceous stipules was obtained in $F_3$ generation from a cross between TG-9 and tall mutant during *kharif* 1974 at the Bhabha Atomic Research Centre, Mumbai (Chandramouli and Kale, 1982). In TGE-1, the basal two leaves on main stem and branches were modified from the usual sickle shaped stipules to oval shaped leafy stipules. Presence of modified stipules gave the false appearance of a pinnate leaf with three-paired leaflets. In a comparative study involving TGE-1, TG-3 and Chico, TGE-1 was found taller than Chico and shorter than TG-3. It had more number of primary and secondary branches, dark green leaves, pods with shallow constriction, smooth reticulation and more three seeded pods. TGE-1 matured in 95 days, which was 10 days earlier than TG-3. Besides, it had comparatively high kernel out turn (80%) and oil content (51%).

TGE-1 was identified for earliness (less than 90 days) among Spanish bunch types in All India Coordinated Research Project on Oilseeds (Anonymous, 1988). By using TGE-1, new varieties, such as, TAG-24 (Patil *et al.*, 1995) and JCC-88 were bred (Bandyopadhyay and Manivel, 2001).

**References**

Anonymous, (1988) All India Coordinated Research Programme on Oilseeds, *Annual Progress Report-XXXIV, Kharif* Oilseed Workshop, pp B-15.

Bandyopadhyay A and P Manivel (2001) Groundnut. In: VL Chopra (ed.) *Breeding Field Crops, Theory & Practice*. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, pp 471-530: 327-332.

Chandra Mouli and DM Kale (1982) An early maturing groundnut with foliaceous stipule marker. *Curr. Sci.* **51**: 132-134.

Patil SH, DM Kale, SN Deshmukh, GR Fulzele and BG Weginwar (1995) Semi-dwarf, early maturing and high yielding, new groundnut variety, TAG 24. *J. Oilseeds Res.* **12**: 254-257.

specks start appearing and cover the entire leaflet, resembling rust disease symptom. With the advancement of age, the lower leaves gradually turn green. Unopened leaves on the main axis have a few yellow specks. The $10^{th}$ – $12^{th}$ leaf below the shoot apex has green colour with or without brown specks. Leaves on branches exhibit a similar pattern. Chlorophyll a, chlorophyll b, and total chlorophyll in the upper leaves of mutants were much lower than parent. Two suppressive genes govern the mutant traits, which are also found allelic to disease lesion mimic leaf of somaclonal variant derived from cv. TAG-24 (Badigannavar *et. al.*, 2002). Mutant is inferior to its parent TG-18A with respect to pod yield. It has papery thin shell resulting in very high kernel out turn of 84% (Chandramouli, *et. al.*, 1989).

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Chandramouli, DM Kale and SH Patil (1989) Mutation research on groundnut in India. In: SA Farook and IA Khan (eds.) *Recent Advances in Genetics and Cytogenetics*, Hyderabad, India, pp 141-153.

## TGE-1 (INGR No. 04040; IC296612), Groundnut (*Arachis hypogaea* L.) Germplasm Line with Foliaceous Stipule

**Chandra Mouli and DM Kale**

*Nuclear Agriculture & Biotechnology Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, Maharashtra*

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**References**

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Bandyopadhyay A and P Manivel (2001) Groundnut. In: VL Chopra (ed.) *Breeding Field Crops, Theory & Practice*. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, pp 471-530: 327-332.

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Patil SH, DM Kale, SN Deshmukh, GR Fulzele and BG Weginwar (1995) Semi-dwarf, early maturing and high yielding, new groundnut variety, TAG 24. *J. Oilseeds Res.* **12**: 254-257.

# Small Leaf Mutant (INGR No. 04041; IC296613), Groundnut (*Arachis hypogaea* L.) Germplasm Line

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

A small leaf mutant with light yellow flower colour was isolated in groundnut (*Arachis hypogaea* L.) in M4 generation during 1968 at the Bhabha Atomic Research Centre, Mumbai (Patil and Mouli, 1984), following g-ray treatment to the seeds of Spanish Improved variety. It is characterized by reduced plant height (20-25%) and reduced leaflet size (>50%) compared to its parent variety. Its leaves were light green with approximately 10% imparipinnate and 20% accessory leaflets. The flowering axils were absent on the main stem resembling the ssp. *hypogaea* var. *hypogaea*, with an irregular flowering pattern on the branches. The mutant has greater number of thin branches. The flower colour was light yellow unlike orange in the parent. Pod size was smaller leading to 50% reduced kernel weight. The mutant matured two weeks earlier. It is inferior in yield, however it can be used as a marker. Inheritance study by involving small leaf mutant and its parents indicate a deviation from monohybrid segregation due to reduced frequency of mutant types, presumably due to "preferential" segregation favouring normal leaf size (Patil and Mouli, 1984).

### References

Patil SH and C Mouli (1984) Preferential segregation of two allelic mutations for small leaf character in groundnut. *Theor. Appl. Genet.* **67**: 327-332.

# MH 34 (INGR No. 04076; IC401583), Groundnut (*Arachis hypogea* L.) Germplasm Line with High Oil Content (54%)

**JS Malik[1], TP Yadava[1], DC Nijhawan[1], RK Sheoran[1], Parkash Kumar[2] and SK Gupta[1]**
1. *Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana*
2. *National Oilseed and Vegetable Oil Development Board, 86, Sector-18, Gurgaon, Haryana*

MH 34 is a selection from the germplasm maintained at the CCSHAU, Hisar and was tested in large-scale trials of groundnut with 14 strains/genotypes for six continuous years. On the basis of average of six years, MH 34 was found giving 22.6% higher pod yield and 9.35% higher oil content as compared to check, MH4 (Annual Report 1997-98 to 2002-03). Under Coordinated Initial Varietal Trial of groundnut during *kharif* 2001-02, it gave 54% oil content on average of three locations (Range 52 to 56%) [Annual Progress Report of AICRPO (Groundnut) 2001]. Several other workers have also observed high oil contents in this line (Singh, 2003; Singh and Malik, 2003; Malik and Gupta, 2004).

MH 34 is an erect, tall line with dark green foliage, pods peak absent and pods reticulation very prominent. Kernels are bold (100 kernel wt. above 40 gm) with reddish brown colour and oil content up to 56%. The genotype is tolerant/resistant to diseases like leaf spots compared to existing varieties.

### References

Anonymous (1997-2002) *Annual Progress Reports of Kharif Oilseeds*, Oilseeds Section, CCS HAU, Hisar.

Malik JS and SK Gupta (2004) The effect of kernel size on oil content and quality of oil in groundnut strains. Paper presented in National Symposium on "Recent Advances in Production & Processing Technology of Guar, Mothbean & other industrial Legume" held at CCS HAU, Hisar from Feb. 13-14, 2004.

Singh Paramjeet (2003) *Studies on character association and path analysis in groundnut (Arachis hypogaea* L.), M.Sc. Thesis submitted to Department of Plant Breeding, CCS HAU, Hisar.

Singh Paramjeet and JS Malik (2003) Studies on variability and oil quality character association in groundnut. Paper presented in symposium on "Food & Nutritional Security: Technological Intervention & Genetic option" held at CSKHPKV, Palampur (HP), September 18-19, 2003.

# Small Leaf Mutant (INGR No. 04041; IC296613), Groundnut (*Arachis hypogaea* L.) Germplasm Line

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

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### References

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# MH 34 (INGR No. 04076; IC401583), Groundnut (*Arachis hypogea* L.) Germplasm Line with High Oil Content (54%)

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# TERI-UTTAM, TERI (00) R9903 (INGR No. 04077; IC405232), Mustard (*Brassica napus* L.) Germplasm Line with Canola Quality and Early Maturity

**Abha Agnihotri and Nutan Kaushik**
*Bioresources and Biotechnology Division, TERI, Habitat Place, Lodhi Road, New Delhi-110003*

For development of varieties meeting the nutritionally desired international canola quality standards (<2% erucic acid in the seed oil and <30mm glucosinolate/g oil free meal), work to introgress agronomic and quality traits through intergeneric/interspecific hybridisation was undertaken at the Tata Energy and Resources Institute (TERI). Transgressive segregants with low erucic acid, early maturity and shattering tolerance were selected from the advanced generation backcross progeny of hybrids (*B. napus* ISN-706 x *Raphanobrassica*) x *B. napus* obtained through embryo rescue (Agnihotri *et al.*, 1990, 1995). The selected strains were crossed with exotic canola quality *B. napus* cultivar 'Cyclone' for introgression of the low glucosinolate trait. The seeds were analysed for fatty acids and glucosinolate content by GLC and HPLC (Kaushik and Agnihotri, 1997, 1999). The selected plants were grown in single plant progenies and advanced through pedigree method, selections were made in each generation for the desired agronomic and quality traits (days to maturity, shattering tolerance, fatty acids, oil content and glucosinolate content) to develop double low *B. napus* (Agnihotri and Kaushik, 2003).

TERI-UTTAM, TERI (00) R9903 with low erucic acid (0 to 2%) and glucosinolate content (10 to 25 mm/g), also have high oil content (42 to 44%) and high oleic acid (60 to 64%) content desired for better shelf life, resistant/tolerant to pod shattering and white rust. It yielded 20 percent higher than the *B. napus* national check var. GSL-1 under AICRP R&M, giving 25 percent higher oil yield/ha than GSL-1 and 5 percent higher oil yield than most popularly grown *B. juncea* var. Varuna (Anonymous, 2000-2002). Morphologically, it has erect compact plant with height of 125 to 130 cm, 5 to 6 primary branches and 6 to 7 secondary branches, 40-46 silique on main branch, silique length 6 to 6.8 cm, 20 to 25 seeds per silique, 1000 seed weight 3.2 to 3.5 g, very high self-compatibility, brown medium size seed, days to 50 percent flowering 45 to 47 and days to maturity 130 to 135.

## References

Agnihotri A, KR Shivanna, SN Raina, M S Lakshmikumaran, S Prakash and V Jagannathan (1990) Production of *Brassica napus* x *Raphanobrassica* hybrids by embryo rescue: an attempt to introduce shattering resistance into *B. napus*. *Plant Breed.* **105**: 292-299.

Agnihotri A, JP Raney, N Kaushik, NK Singh and RK Downey (1995) Selection for better agronomical and nutritional characteristics in Indian rapeseed-mustard. In: D Murphy (ed.) *Rapeseed Today and Tomorrow*. **2**: 425-427.

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Anonymous (2000-2002) *Annual Progress Reports of the AICRP on Rapeseed-Mustard*, Sewar, Bharatpur, ICAR, Government of India.

Kaushik N and A Agnihotri (1997) Evaluation of improved method for determination of rapeseed-mustard FAMES by GC. *Chromatographia* **44**: 97-99.

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# TERI-GZ-05 (INGR No. 04078; IC405233), Mustard (*Brassica juncea* L.) Germplasm Line with High Oleic and Linoleic Acid, Double Low and Yellow Seed

**Abha Agnihotri and Nutan Kaushik**
*Bioresources and Biotechnology Division, TERI, Habitat Place, Lodhi Road, New Delhi-110003*

The 'triple low' i.e. yellow seed coat colour, low erucic acid in the seed oil and low glucosinolate in the oil free meal are the most sought for quality traits for genetic enhancement of oilseed brassica. In order to achieve this, a unique three way cross; *B. juncea* (var. Varuna x Zem-1) x BJ-1058 was carried out at the Tata Energy and Resources Institute (TERI) for transfer of double low traits, i.e. low erucic acid in the seed

# TERI-UTTAM, TERI (00) R9903 (INGR No. 04077; IC405232), Mustard (*Brassica napus* L.) Germplasm Line with Canola Quality and Early Maturity

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*Bioresources and Biotechnology Division, TERI, Habitat Place, Lodhi Road, New Delhi-110003*

For development of varieties meeting the nutritionally desired international canola quality standards (<2% erucic acid in the seed oil and <30mm glucosinolate/g oil free meal), work to introgress agronomic and quality traits through intergeneric/interspecific hybridisation was undertaken at the Tata Energy and Resources Institute (TERI). Transgressive segregants with low erucic acid, early maturity and shattering tolerance were selected from the advanced generation backcross progeny of hybrids (*B. napus* ISN-706 x *Raphanobrassica*) x *B. napus* obtained through embryo rescue (Agnihotri *et al.*, 1990, 1995). The selected strains were crossed with exotic canola quality *B. napus* cultivar 'Cyclone' for introgression of the low glucosinolate trait. The seeds were analysed for fatty acids and glucosinolate content by GLC and HPLC (Kaushik and Agnihotri, 1997, 1999). The selected plants were grown in single plant progenies and advanced through pedigree method, selections were made in each generation for the desired agronomic and quality traits (days to maturity, shattering tolerance, fatty acids, oil content and glucosinolate content) to develop double low *B. napus* (Agnihotri and Kaushik, 2003).

TERI-UTTAM, TERI (00) R9903 with low erucic acid (0 to 2%) and glucosinolate content (10 to 25 mm/g), also have high oil content (42 to 44%) and high oleic acid (60 to 64%) content desired for better shelf life, resistant/tolerant to pod shattering and white rust. It yielded 20 percent higher than the *B. napus* national check var. GSL-1 under AICRP R&M, giving 25 percent higher oil yield/ha than GSL-1 and 5 percent higher oil yield than most popularly grown *B. juncea* var. Varuna (Anonymous, 2000-2002). Morphologically, it has erect compact plant with height of 125 to 130 cm, 5 to 6 primary branches and 6 to 7 secondary branches, 40-46 silique on main branch, silique length 6 to 6.8 cm, 20 to 25 seeds per silique, 1000 seed weight 3.2 to 3.5 g, very high self-compatibility, brown medium size seed, days to 50 percent flowering 45 to 47 and days to maturity 130 to 135.

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# TERI-GZ-05 (INGR No. 04078; IC405233), Mustard (*Brassica juncea* L.) Germplasm Line with High Oleic and Linoleic Acid, Double Low and Yellow Seed

**Abha Agnihotri and Nutan Kaushik**
*Bioresources and Biotechnology Division, TERI, Habitat Place, Lodhi Road, New Delhi-110003*

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oil and low glucosinolate in the oil free meal. The fatty acids and glucosinolates were analysed through improved methods of GC and HPLC respectively (Kaushik and Agnihotri, 1997, 1999). The progenies of selected plants were advanced through pedigree and recurrent selection method to derive yellow seeded double low strain of *B. juncea* having low erucic acid, high oleic and linoleic acid in the seed oil, and low glucosinolate 10-27mm/g in the oil free meal (Agnihotri and Kaushik, 1999, 2000).

TERI-GZ-05 has high oleic (42 to 47%) and high linoleic acid (37 to 43%), low erucic acid (0 to 2%), low glucosinolate in the oil free meal (10 to 28 mm/g), and yellow seed coat colour. The low glucosinolate and yellow seed coat imparts improved meal quality with low fibre content, while high oleic acid gives better oxidative stability, increasing the shelf life of the oil. Morpho-agronomically, it is erect with plant height of 200 to 220 cm, 6 to 7 primary branches, 10 to 12 secondary branches, 30 to 40 silique on main branch, silique length 2.5 to 3.0 cm, number of seeds per silique 10 to 15, 1000 seed weight 1.5 to 2.0 g, high self-compatibility, days to 50 percent flowering 90 and days to maturity 145 to 150.

### References

Agnihotri A and N Kaushik (1999) Genetic enhancement for double low characteristics in Indian rapeseed mustard. *Proceedings, X International Rapeseed Congress*, September 26-29 1999 Canberra, Australia.

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Kaushik N and A Agnihotri (1997) Evaluation of improved method for determination of rapeseed mustard FAMES by GC. *Chromatographia* **44**: 97-99.

Kaushik N and A Agnihotri (1999) High performance liquid chromatographic method for separation and quantification of intact glucosinolates. *Chromatographia* **49**: 281-284.

## DCH-7 (INGR No. 04042; IC296674), Castor (*Ricinus communis* L.) Germplasm Line with Short Duration and Multiple Resistance

**DS Jatasra[1], RS Sangwan[2] and Ashwani Kumar[1]**

1. *Dryland Agriculture Research Farm*
2. *Department of Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana*

DCH-7 is a castor (*Ricinus communis* L.) short duration multiple resistance line developed at the Dryland Research Farm CCSHAU, Hisar using mass selection (Kumar et al., 2003). The plant of DCH-7 has early plant vigour, green petiole, leaf lamina and stem with about four secondary and four tertiary branches. Its capsule is spiny with spotted brown collared seeds. It is early in flowering (38 days) with very bold seeds (32g/100 seeds). It is a very good yielder with 28q/ha seed yield. It is drought tolerant and disease resistant genotype. Hairy caterpillar and semi-looper attack is also very low. Comparative performance of the DCH-7 (Table 1) was significantly better than the national check (Aruna) and local check (CH 1) with 54 and 34 per cent more seed yield than these checks, respectively (Reddy *et al.*, 1999). Seeds are much bolder than the checks. It was 5 and 25 days early than the checks and can escape terminal drought.

### References

Kumar A, RS Sangwan and DS Jatasra (2003) Correlation and path coefficient analysis in castor (*Ricinus communis* L.) under dryland conditions. *Indian J. Dryland Agric. Res. & Dev.* **18**: 89-91.

Reddy PR, M Vanaja, GRM Sankar, CH Rao, S Venkateswarlu and JD Eastin (1999) Yield components in castor germplasm under irrigated and rain-fed conditions. *J. Maharashtra Agric. Univ.* **24**: 36-41.

**Table 1. Seed yield and its attributes of DCH-7 with respect to National and Local Check**

| Genotype | Days to 50% of flowering | | Days to maturity | | Height (cm) | | Average spikes per plant | Capsules per raceme | Seeds per raceme | 100-Seed weight(g) | Oil content(%) | Seed yield per plant (g) | Increase over checks (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DCH-7 | 38 | 118 | 45 | 621 | 34 | 85 | 32 | 50 | 122 | - | | | |
| Aruna (NC) | 60 | 145 | 85 | 409 | 26 | 64 | 24 | 50 | 79 | 54 | | | |
| CH 1 (LC) | 45 | 120 | 38 | 406 | 27 | 76 | 26 | 49 | 91 | 34 | | | |

*DCH-7 yielded 54 per cent more than the Aruna and 34 per cent more than the CH 1
**NC = National check; LC = Local check

oil and low glucosinolate in the oil free meal. The fatty acids and glucosinolates were analysed through improved methods of GC and HPLC respectively (Kaushik and Agnihotri, 1997, 1999). The progenies of selected plants were advanced through pedigree and recurrent selection method to derive yellow seeded double low strain of *B. juncea* having low erucic acid, high oleic and linoleic acid in the seed oil, and low glucosinolate 10-27mm/g in the oil free meal (Agnihotri and Kaushik, 1999, 2000).

TERI-GZ-05 has high oleic (42 to 47%) and high linoleic acid (37 to 43%), low erucic acid (0 to 2%), low glucosinolate in the oil free meal (10 to 28 mm/g), and yellow seed coat colour. The low glucosinolate and yellow seed coat imparts improved meal quality with low fibre content, while high oleic acid gives better oxidative stability, increasing the shelf life of the oil. Morpho-agronomically, it is erect with plant height of 200 to 220 cm, 6 to 7 primary branches, 10 to 12 secondary branches, 30 to 40 silique on main branch, silique length 2.5 to 3.0 cm, number of seeds per silique 10 to 15, 1000 seed weight 1.5 to 2.0 g, high self-compatibility, days to 50 percent flowering 90 and days to maturity 145 to 150.

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*DCH-7 yielded 54 per cent more than the Aruna and 34 per cent more than the CH 1
**NC = National check; LC = Local check

## Chawghat Green Dwarf (IND 029) (INGR No. 04043; IC296656), Coconut (*Cocos nucifera* L.) Germplasm Line with Dwarfness, Early Flowering and Tolerance to Root Wilt Disease

**MM Krishna Marar, MC Nambiar, K Sathybalan, KUK Nampoothiri, RV Pillai and CK Sukumaran**
*Central Plantation Crops Research Institute, Kasargod-671124, Kerala*

Chowghat Green Dwarf is a coconut cultivar with trees attaining a height of 4.5 m. The stem is thin without a 'bole'. The leaves are shorter (about 4 m long) with 196 leaflets. The leaf scars are closer with about 56 in one metre of stem. It starts flowering 3-4 years after planting. The inflorescence is short with a length of 87 cm. The palms are self-pollinating, as there is an overlapping of male an female phases within as well as between the inflorescence. The nuts are green in colour and oblong in shape with characteristic beak when the nuts are fully matured. The kernel shells are thin.

The palm yields from 10$^{th}$ year onwards and produces about 9 branches per annum. At Kasargod, the number of nuts per palm per year is 75 with a range of 30 to 100 nuts. At Veppankulam Tamil Nadu, the palm produces 35 nuts with 2 kg of copra per palm per year (Anon., 1999). The fruits are small weighing about 0.45 kg. The weight of the husked nut is about 190 g. The husk portion is high with 58.4 percent of the whole fruit weight. The copra content is low with a mean of 75 g per nut (38-100 g). Oil content of copra is 66 percent (Ratnambal *et al.*, 1995). Detailed characterisation has been done at CPCRI, Kasargod (Ratnambal *et al.*, 1995).

### References

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## Andaman Giant Tall (AGT) (IND 006) (INGR No. 04044; IC296657), Coconut (*Cocos nucifera* L.) Germplasm Line with Large Fruits and High Copra Yield

**JS Patel, CM John and MC Nambiar**
*Central Plantation Crops Research Institute, Kasaragod-671124, Kerala*

Andaman Giant Tall (AGT) (IND 006) is a cultigen collected and identified from Andamans and Nicobar Islands and evaluated at the Central Plantation Crops Research Institute, Kasargod. This cultivar is also called 'gigantea'. The palm is very strong and robust exhibiting gigantic morphological features. The height of the palm reaches up to 12 m. with about 34 leaves on the crown. The leaves are long (5.1 m) with strong petiole of about one-thrid of the length of the leaf. The leaf has 235 leaflets, which are 121 cm long and 6.4 cm wide. The trunk is thick with about 95 cm girth, with a distinct bole. It takes 95-98 months to flowering. It produces 8-13 inflorescence per annum. The setting percentage is 36.5 percent (Ratnambal *et al.*, 1995). The palms are highly heterozygous due to the cross-pollinating nature. The fruit is very large, oval in shape and green in colour.

It yields from 12$^{th}$ year onwards and is a regular bearer. The fruits are bigger weighing around 1200 g with 692.7 g nut weight. The copra content is 193.6 g. per nut with 65.5 percent oil. The nut yield varies from 58 to 110 nuts under rain-fed conditions with an average of 80 nuts per palm. The average copra yield per hectare is 1.8 t (Ratnambal *et al.*, 1995). At Ratnagiri, Maharashtra, this cultivar gives 61 nuts/ palm. At Veppangulam, the mean yield of nuts per palm is 72 with 7.5 Kg of copra (Anonymous, 1999). Due to the high copra content, this variety can be popularised among farmers and used for the production of T x T hybrids.

### References

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The palm yields from 10$^{th}$ year onwards and produces about 9 branches per annum. At Kasargod, the number of nuts per palm per year is 75 with a range of 30 to 100 nuts. At Veppankulam Tamil Nadu, the palm produces 35 nuts with 2 kg of copra per palm per year (Anon., 1999). The fruits are small weighing about 0.45 kg. The weight of the husked nut is about 190 g. The husk portion is high with 58.4 percent of the whole fruit weight. The copra content is low with a mean of 75 g per nut (38-100 g). Oil content of copra is 66 percent (Ratnambal *et al.*, 1995). Detailed characterisation has been done at CPCRI, Kasargod (Ratnambal *et al.*, 1995).

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## Kenthali Orange Dwarf (KDOT) (IND 074) (INGR No. 04045; IC296658), Coconut (*Cocos nucifera* L.) Germplasm with Dwarfness, Orange Fruits and Tender Nut

**MC Nambiar, KUK Nampoothiri, RV Pillai, CK Sukumaran and G Vijayakumar**
*Central Plantation Crops Research Institute, Kasargod-671124, Kerala*

Kenthali Orange Dwarf (KDOT) (IND 074) is a coconut cultivar collected from Karnataka. This palm grows up to 4-5 m in height. The stem is rather thin without 'bole' and with compressed internodes. The girth of the stem at one m, height is 64 cm and the number of nodes of one m length is 52.7. It comes to bearing in about 6-7 years. The inflorescence is of 98 cm. with overlapping of male and female phases. The setting percentage of fruit is about 30 percent. The colour of the fruit is deep orange with oval shape. The husked nut is more flat at the bottom. The husk, kernel and shell are thinner.

The fruiting starts at about 9 years. The water in 7 month-old nut is sweet with 6.0 g. of total sugar content in 100 ml of water, but the quantity of tender nut water is somewhat less i.e. 198-250 ml per nuts. The average number of fruits per annum per tree is 52 with range of 45 to 58 nuts. At Aliyarnagar the palm gives 36 nuts/palm while at Konark (Orissa) the palm produces 43 nuts (Anon., 1999). The fruits are small and weigh 456 g. The husk constitutes 30 percent of the whole fruit weight and meat contributes 59 percent to the husked nut. Copra content per nut is 116.5 g. with 64 percent oil. The copra and oil yield in one hectare are 1.1 tonnes and 0.7 tonne, respectively, at Kasargod (Ratnambal *et al.*, 1995). At Konark (Orissa), the copra content per nut is 134 g. (Anon., 1999). This genotype is fairly tolerant to burrowing nematode-*Radopholus similis*. This cultivar can be used for tender nut water. This can be used as pollen and pistil parent in breeding work.

### References

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## CYTOPLASMIC MALE STERILE LINE IN COTTON

## CAK–84635 A (Rajat) & AK-84635 B (INGR No. 04046; IC296639 & IC296640), Cotton (*Gossypium hirsutum* L.) Cytoplasmic Male Sterility Line with *G. aridum* Cytoplasm

**LD Meshram, BR Patil and MB Wadodkar**
*Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Akola-444104, Maharashtra*

CAK-84635 A (Rajat) is a cytoplasmic male sterile (CMS) line based on *Gossypium aridum* cytoplasm. Earlier, CMS lines have been developed at USA using *Gossypium harknessii* Brandgee by Mayer (1975). To obtain a diverse CMS lines, efforts were made at the Cotton Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, resulting in production CMS using *G. aridum* (Meshram *et. al.*, 1997). The genotype, which is used for conversion in CMS background, is a popular variety of Maharashtra. PKV Rajat or AKH – 84635 is a selection made from a cross between (AC-938 x SRT-1) x derivative of (*G. anomalum* x *G. thurberii*). It was selected for conversion, because of being suitable for rain-fed conditions and high yielding with semi-naked seeds. The cytoplasmic male sterility (*G. aridum* based) has been transferred into AKH-84635 by backcross breeding method.

It has leaves with two broad lobes and slightly hairy, flower yellow with cream anthers, boll round pointed at tip with four locules of medium size. Semi-naked seeds would provide better oil recovery. It posses high ginning out turn and better survival under saline soils. Other characters are- days to 50 percent flowering 65-70, to 1st boll bursting 110-115 and to maturity 170-180, boll weight 3.0-3.5 g, seed index 7-8 g, lint index 4.5-5.0, ginning percentage 38-39 percent, 2.5

## Kenthali Orange Dwarf (KDOT) (IND 074) (INGR No. 04045; IC296658), Coconut (*Cocos nucifera* L.) Germplasm with Dwarfness, Orange Fruits and Tender Nut

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*Central Plantation Crops Research Institute, Kasargod-671124, Kerala*

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The fruiting starts at about 9 years. The water in 7 month-old nut is sweet with 6.0 g. of total sugar content in 100 ml of water, but the quantity of tender nut water is somewhat less i.e. 198-250 ml per nuts. The average number of fruits per annum per tree is 52 with range of 45 to 58 nuts. At Aliyarnagar the palm gives 36 nuts/palm while at Konark (Orissa) the palm produces 43 nuts (Anon., 1999). The fruits are small and weigh 456 g. The husk constitutes 30 percent of the whole fruit weight and meat contributes 59 percent to the husked nut. Copra content per nut is 116.5 g. with 64 percent oil. The copra and oil yield in one hectare are 1.1 tonnes and 0.7 tonne, respectively, at Kasargod (Ratnambal *et al.*, 1995). At Konark (Orissa), the copra content per nut is 134 g. (Anon., 1999). This genotype is fairly tolerant to burrowing nematode-*Radopholus similis*. This cultivar can be used for tender nut water. This can be used as pollen and pistil parent in breeding work.

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## CYTOPLASMIC MALE STERILE LINE IN COTTON

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It has leaves with two broad lobes and slightly hairy, flower yellow with cream anthers, boll round pointed at tip with four locules of medium size. Semi-naked seeds would provide better oil recovery. It posses high ginning out turn and better survival under saline soils. Other characters are- days to 50 percent flowering 65-70, to 1st boll bursting 110-115 and to maturity 170-180, boll weight 3.0-3.5 g, seed index 7-8 g, lint index 4.5-5.0, ginning percentage 38-39 percent, 2.5

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## CYTOPLASMIC MALE STERILE LINE IN COTTON

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It has leaves with two broad lobes and slightly hairy, flower yellow with cream anthers, boll round pointed at tip with four locules of medium size. Semi-naked seeds would provide better oil recovery. It posses high ginning out turn and better survival under saline soils. Other characters are- days to 50 percent flowering 65-70, to 1st boll bursting 110-115 and to maturity 170-180, boll weight 3.0-3.5 g, seed index 7-8 g, lint index 4.5-5.0, ginning percentage 38-39 percent, 2.5

percent span length 24-25 mm, bundle strength 17.7 g/tex, uniformity ratio 49, fibre fineness 4.5.

The maintainer of this line is AKH-84635 (PKV Rajat), has given higher seed cotton yield and lint yield than DHY-286, SRT-1 and LRA-5166 in all trials conducted at different locations in different regions during last ten years. The fibre qualities are more or less comparable with DHY-286, SRT-1 and LRA-5166. This is moderately resistant to major pests and diseases. The percentage infestation of bollworms in green bolls is more or less similar to LRA-5166, but less than DHY-286, but in loculi damage this has shown superiority over LRA-5166, DHY-286 and SRT-1.This is suitable for cotton growing tract of Maharashtra. This genotype is non-lodging, suitable for rain-fed conditions and can be grown at 60 x 60 cm or more spacing for crossing, with a fertilizer dose of 50:25:0 kg NPK/ha.

**References**

Meshram LD, MB Wadodkar and PP Jain (1997) An alternative source of cytoplasmic male sterility in cotton. *J. Indian Soc. Cotton Improv.* pp 93-95.

Meyer Vesta G. (1975) Male sterility from *G. harknesii*. *J. Hered.* **66**: 23-27.

## RCMS 3A & 3B (INGR No. 04047; IC296644 & IC296645), a Cotton (*Gossypium hirsutum* L.) Line, Incorporating Cytoplasmic Male Sterility in a Variety with Resistance to Cotton Leaf Curl Virus

**CJ Kapoor, BS Meena and P Pundhir**
*Agricultural Research Station, (Rajasthan Agricultural University) Karni Marg, Sriganganagar-335001, Rajasthan*

In cotton (*G. hirsutum* L.) both genetic and cytoplasmic genetic male sterility has been used in hybrid breeding. In hirsutum cotton partial to complete male sterility have been identified (Meyer, 1969; Bowmen *et al.*, 1978). Cotton leaf curl virus (CLCuV) caused by *Gemini* virus of genus *Begomovirus* and transmitted by cotton whitefly (*Bemisia tabaci*) has posed threat to cotton cultivation with yield losses up to 50 to 70 percent in North India. Considering the economic importance of the disease, a leaf curl virus resistant and well adapted variety RS-2013 derived from a cross (F-520 X (LH-511 X Bombasa) and developed at Agricultural Research Station (Rajasthan Agricultural University), Sriganganagar was selected for diversification of male sterility. The cytoplasmic genetic male sterile line (RCMS-3) has been developed through backcross breeding, using JCMSK2 as the male sterility source. It has robust plant habit with plant height of 130-135 cm, light green leaves, yellow petal and pollen grains completely sterile. The line is resistant to CLCuV. Beside CLCuV, it has tolerance for whitefly and jassids too. The RCMS-3 B line, the counterpart is also having multiple resistances. Morphologically it has yellow flower, light green leaves, GOT 34 percent, boll weight 2.95 g, lint index 4.01 g, micronaire value 4.6, 2.5 percent, span length 24.6 mm, uniform ratio 47 percent and strength 22.4 g/tex.

**References**

Bowman DI, JB (Jr) Weaver and DB Walker (1978) Analysis of a dominant male sterile character in upland cotton: I cytological studies. *Crop Sci.* **18**: 730-736.

Meyer, VG (1969) Some effects of gene, cytoplasm and environments on male sterility of cotton (*Gossypium*). *Crop Sci.* **9**: 237-242.

## RGMS-3 (INGR No. 04048; IC296646), a Cotton (*Gossypium arboreum* L.) Line Incorporating Genetic Male Sterility in an Adopted Variety

**CJ Kapoor, P Pundhir and Bhim Singh Meena**
*Agricultural Research Station, Rajasthan Agricultural University, Sriganganagar-335001*

In desi cotton (*G. arboreum* L.) genetic male sterility have been used in the development of hybrids. Nuclear genes cause the genetic male sterility. Some workers from India have reported male sterility in *arboreum* cotton (Singh and Kumar, 1993 and Meshram *et. al.*, 1994). In diploid cotton (*G. arboreum* L.) two loci have been identified for male sterility, which are governed by single recessive gene ($ams_1$, arms). In

percent span length 24-25 mm, bundle strength 17.7 g/tex, uniformity ratio 49, fibre fineness 4.5.

The maintainer of this line is AKH-84635 (PKV Rajat), has given higher seed cotton yield and lint yield than DHY-286, SRT-1 and LRA-5166 in all trials conducted at different locations in different regions during last ten years. The fibre qualities are more or less comparable with DHY-286, SRT-1 and LRA-5166. This is moderately resistant to major pests and diseases. The percentage infestation of bollworms in green bolls is more or less similar to LRA-5166, but less than DHY-286, but in loculi damage this has shown superiority over LRA-5166, DHY-286 and SRT-1.This is suitable for cotton growing tract of Maharashtra. This genotype is non-lodging, suitable for rain-fed conditions and can be grown at 60 x 60 cm or more spacing for crossing, with a fertilizer dose of 50:25:0 kg NPK/ha.

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## RGMS-3 (INGR No. 04048; IC296646), a Cotton (*Gossypium arboreum* L.) Line Incorporating Genetic Male Sterility in an Adopted Variety

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order to generate variability for male sterility, a germplasm line AC-6 has been selected to convert into genetic male sterility using GMS-1 as a source in backcross breeding. The newly developed RGMS-3 line has robust plant habit; narrow lobed green leaves, wider adaptability and tolerance to root rot disease. RGMS-3 line has shown 50:50 sterile: fertile segregation ratios at Sriganganagar and Central Institute for Cotton Research, Nagpur. The line is being utilized for the development of GMS based arboreum hybrids.

**References**

Meshram LD, Ghogade RA and Marawar MW (1994) Development of male sterility systems from various sources in cotton. *PKV Res. J.* **18**: 83-86.

Singh DP and R Kumar (1993) Male genetic sterility in Asiatic cotton. *Indian J. Genet.* **53**: 99-100.

## HGMS-1 (INGR No. 04049; IC296648), Cotton (*Gossypium hirsutum* L) Germplasm Line Incorporating Genetic Male Sterility in an Adopted Variety

**BS Chhabra, RS Sangwan, BPS Lather, SS Siwach and SS Nehra**
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HGMS-1 is a new genetic male sterile line of American cotton (*Gossypium hirsutum* L). It was developed at the CCSHAU, Hisar through hybridisation between B-59, an old GMS line and H 777, a commercial variety of Haryana state (Chhabra *et al.*, 2003), followed by backcross breeding. It has a lanky tall plant of 170-180 cm height, with normal cup shaped medium broad green and hairy leaves. The monopods are 4-6 with normal flower bracts. Petals are cream coloured with no pollen formation in sterile homozygous plants. Balls are round and medium with pointed tips and with 11.0 g of seed index. Ginning percent is 35 with white lint colour, micronair value 4.2 and strength of 22.7 g/tex and fibre quality index (FQI) value is 352 spins at 40's. It is tolerant to Cotton Leaf Curl Virus. This GMS line is maintained by crossing the sterile recessive homozygous plants with the fertile dominant heterozygote plants within the population.

**Reference**

Chhabra BS, RS Sangwan, BPS Lather, SS Siwach and SS Nehra (2003) A new genetic male sterile line in American cotton; HGMS-1. *J Cotton Res. Dev.* **17**: 242

## CINA-316 (INGR No. 04079; IC296596), Cotton (*Gossypium arboreum* L) Germplasm Line with High Locule Retention and Low Short Fibre Content

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CINA 316 is a genotype of desi cotton with high locule retention and low short fibre content (*Gossypium arboreum*). It was developed at the Central Institute for Cotton Research, Nagpur, through a cross between AKA 8401 (*G arboreum* race *bengalense*) x Bisnoor (*G. arboreum* race indicum), followed by pedigree selection. Under All India Coordinated trial and technology mission on cotton it recorded good performance for locule retention and short fibre content.

*Gossypium arboreum* Linn. is a native of India, which covers about 25 percent of the total cotton area of India, contributing about 18 percent to the total production. Shedding or scattering of locules from fully opened mature bolls is a serious problem. Keeping this in view research programme was initiated. In CINA 316 double vascular supply was observed from placental region to locular compartment. With the gradual increase in age of capsule, these double vascular supplies convert into thread like structure and make unbroken attachment between basal portion of placenta and seed cotton loaded locules. It has five narrow lobed leaf and short stalk, reticulate and palmate divergent venation. Flowers are yellow with long pedicle, and petal blotch red, anthers yellow with short filaments. It has three small bracteoles with serrated margins at acute apex and 3-4 teeth present at anterior portion. Capsules are big with 3-4 locules, oval shaped, tapering apex with average volume of 10.8 cc. Capsules surface is sparsely pitted. Boll weight is 3.29 g and locule retention capacity is 17 to 23