Plant Germplasm Registration Notice*

The Plant Germplasm Registration Committee of ICAR in its XXV[th] meeting held on June 01, 2012 at the National Bureau of Plant Genetic Resources, New Delhi approved the registration of following 19 germplasm lines out of 99 proposals considered. The information on registered germplasm is published with the purpose to disseminate the information to respective breeders for utilization of these genetic stocks in their crop improvement programmes. Upon request, the developer(s)/author(s) is/are obliged to distribute the material for crop improvement programme of National Agricultural Research System.

1. DDK 1037 (IC0590877; INGR12001), a Wheat (*Triticum dicoccum*) Germplasm with a Resistance to Loose Smut and Flag Smut Disease

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Emmer wheat (*Triticum dicoccum* (Schrank.) Schubl.), commonly known as d*icoccum* wheat is cultivated in parts of Karnataka, Maharastra, Tamil Nadu and Gujarat. It possesses high protein and dietary fibre content and therefore, is considered as more nutritious compared to bread and durum wheat. Among the major diseases, rusts (stem & leaf), loose smut and flag smut cause yield losses in *dicoccum* wheat. The genotype DDK 1037 is developed from the cross HW-1092/DDK-1006// SHIVANI KHAPLI// DDK-1001 following the pedigree method at UAS, Dharwad. During evaluation stages, it showed high level of resistance to loose smut and flag smut diseases. It also showed resistance to stem and leaf rusts during evaluation (Anonymous, 2009; 2010; 2011).

Morhpo-agronomic characteristics: The genotype DDK 1037 was evaluated along with the check varieties DDK-1009 and MACS-2971 across the *dicoccum* growing zones of India over two years from 2008-09 to 2009-10. Based on yield potential, it was on par with MACS-2971 and showed about 6% yield advantage over another check DDK-1009. It also showed distinct features in terms of profuse tillering, dwarf growth habit and green foliage.

Table 1. Yield and disease data of DDK 1037 and checks under coordinated multi-location evaluation

Genotypes	Mean yield (q/ha)	Loose smut				Flag smut			
		2009-10		2010-11		2008-09		2009-10	
		HS	AS	HS	AS	HS	AS	HS	AS
DDK 1037	37.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DDK 1009 ©	35.0	24.6	9.0	15.6	4.7	-	-	-	-
MACS 2971 ©	37.4	0.0	0.0	0.0	0.0	-	-	-	-

Mean yield of 3 years (2008-09 to 2010-11); HS- Highest Score, AS – Average score

Associated characters and cultivated practices: Genotype DDK 1037 also showed resistance to stem and leaf rusts, foot rot and moderately resistant to *Heterodera avenae* (Anonymous, 2009; 2010; 2011).

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2. Pusa 1602-06-24-5-45 (IC0593847; INGR12002), an Elite Paddy (*Oryza sativa*) Restorer Line with Basmati Quality and Blast Resistance Gene *Piz5*

Ashok Kumar Singh[1], KV Prabhu[1], T Mohapatra[3], S Gopala Krishnan[1], M Nagarajan[2], KK Vinod[2], Devinder Singh[1], Vikas K Singh[1], Atul Singh[1] and Ranjith K Ellur[1]

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Pusa1602-06-24-5-45 is an elite Basmati quality restorer line with blast resistance gene *Piz5* conferring resistance against blast disease caused by *Magnaporthae oryzae*. It has been developed through a breeding strategy involving marker aided foreground selection for the gene *Piz5*, coupled with phenotypic selection for agronomic, grain and cooking quality traits, for recovery of recurrent parent genome. C101A51, an isogenic line in the background of *indica* rice variety CO-39 was used as donor for *Piz5* gene and PRR78, an elite Basmati quality restorer was the recurrent parent. Foreground selection for the gene *Piz5* was performed using linked SSR marker AP5930 (Fjellstorm *et al*., 2006). Since the recurrent parent PRR78 is a restorer line, a microsatellite marker RM6100 linked with fertility restorer (*Rf1*) gene in PRR78 (Prakash, 2003) was employed for selection of *Rf1* gene. Background selection was performed using 62 STMS markers polymorphic between C101A51 and PRR78. The extent of recurrent parent genome in the improved line Pusa1602-06-24-5-45 is 86.66 % and it complete resistance to all the four virulent races under artificial inoculation as well as in hot spot locations in comparison to control PRR78 (Table 1). The agronomic, grain and cooking quality traits of the improved line Pusa1602-06-24-5-45 and its recurrent parent PRR78 are presented in Table 2. The performance of the improved hybrid Pusa RH10-02-3 developed crossing Pusa1602-06-24-5-45 was on par with Pusa RH10 along with high level of resistance to blast disease both under artificial inoculation as well as UBN in hotspot locations (Singh *et al*., 2012).

For 0-5 Scale under artificial inoculation: Score 0-2 Resistant, 3 as Moderately Resistance and 4-5 as Susceptible.

For 0-9 Scale in UBN at hotspot location: Score 0-3 Resistant, 4-5 as Moderately Resistant, 6 as Moderately Susceptible and 7-9 as Susceptible.

Table 1. Reaction of the improved line Pusa1602-06-24-5-45 and the parental lines, PRR78 and C101A51, to rice blast isolates under artificial inoculation and in Uniform Blast Nursery at two hotspot locations

Name of isolate/ hotspot location	Pusa1602-06-24-5-45	PRR78	C101A51
Disease Reaction under artificial inoculation (0-5 Scale)			
Mo-ni-007	2	5	0
Mo-ni-012	2	4	0
Mo-ni-018	0	4	1
Mo-ni-019	0	5	0
Disease Reaction in UBN trials (0-9 Scale)			
ARS, Mugad	1	7	2
VPKAS, Almora	4	7	3

Table 2. Agronomic traits and % recurrent parent genome (RPG) recovery in Pusa1602-06-24-5-45 in comparison of the recurrent parent PRR78

Characters	PRR78	Pusa1602-06-24-5-45
Days to 50 % flowering	88.0	90.0
Plant height (cm)	114.8	126.8
Number of tillers	10.2	12.0
Panicle length (cm)	24.8	27.2
Number of filled grains/ panicle	189.0	214.0
Spikelet fertility (%)	91.34	89.26
Test weight (g)	27.55	29.07
Yield (q/ha)	58.25	66.53
% Superiority over PRR78	-	14.23
Recurrent Parent Genome recovery (%)	-	86.66
Kernel length before cooking (mm)	7.98	8.87
Kernel breadth before cooking (mm)	1.68	1.87
Kernel length after cooking (mm)	14.13	13.67
Kernel breadth after cooking (mm)	2.07	2.27
Kernel elongation ratio	1.77	1.53
Alkali spreading value	7	7
Aroma	2	2

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3. Pusa 1603-06-11-4-19 (IC0593848; INGR12003), an Elite Paddy (*Oryza sativa*) Restorer Line with Basmati Quality and Blast Resistance Gene *Pi54*

Ashok Kumar Singh[1], KV Prabhu[1], T Mohapatra[3], S Gopala Krishnan[1], M Nagarajan[2], KK Vinod[2], Devinder Singh[1], Vikas K Singh[1], Atul Singh[1] and Ranjith K Ellur[1]

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Pusa1603-06-11-4-19 is an elite Basmati quality restorer line with blast resistance gene *Pi54* conferring resistance against blast disease caused by *Magnaporthae oryzae*. It has been developed through a breeding strategy involved marker aided foreground selection for the gene *Pi54* and background selection coupled with phenotypic selection for agronomic, grain and cooking quality traits, for recovery of recurrent parent genome. Tetep, an *indica* rice variety was used as donor for *Pi54* gene and PRR78; an elite basmati quality restorer was the recurrent parent. Foreground selection for the gene *Pi54* was performed using a marker RM206 linked to *Pi54* (Sharma *et al*., 2005). Since the recurrent parent PRR78 is a restorer line, a microsatellite marker RM6100 linked with fertility restorer (*Rf1*) gene in PRR78 (Prakash, 2003) was employed for selection of *Rf1* gene. Background selection was performed using 62 STMS markers polymorphic between Tetep and PRR78. The extent of recurrent parent genome in the improved line Pusa1603-06-11-4-19 is 87.66 % and it complete resistance to all the four virulent races under artificial inoculation as well as in hot spot locations in comparison to recipient parent, PRR78 and donor parent Tetep (Table 1). The improved line Pusa1603-06-11-4-19 is superior to recurrent parent PRR78 for yield by 13.06%. The agronomic, grain and cooking quality traits of the improved line Pusa1603-06-11-4-19 and its recurrent parent PRR 78 are presented in Table 2. The performance of the improved hybrid Pusa RH10-03-4 developed crossing Pusa1603-06-11-4-19 was superior to PusaRH10 (23.23 g/ plant compared to 21.33 g/ plant in PusaRH10) along with maximum level of resistance to blast disease both under artificial

Table 1. Reaction of the improved line Pusa1603-06-11-4-19 and the parental lines, PRR78 and Tetep, to rice blast isolates under artificial inoculation and in Uniform Blast Nursery at two hotspot locations.

Name of isolate/ hotspot location	Pusa1603-06-11-4-19	PRR78	Tetep
Disease Reaction under artificial inoculation (0-5 Scale)			
Mo-ni-007	2	5	0
Mo-ni-012	2	4	0
Mo-ni-018	0	4	0
Mo-ni-019	0	5	0
Disease Reaction in UBN trials (0-9 Scale)			
ARS, Mugad	2	**7**	1
VPKAS, Almora	3	**7**	3

Table 2. Agronomic traits and percent recurrent parent genome (RPG) recovery in Pusa1603-06-11-4-19 in comparison of the recurrent parent PRR78

Characters	PRR78	Pusa1603-06-11-4-19
Days to 50 % flowering	88	88
Plant height (cm)	114.8	119.60
Number of tillers	10.2	11.60
Panicle length (cm)	24.8	28.20
Number of filled grains/ panicle	189	201
Spikelet fertility (%)	91.34	91.34
Test weight (g)	27.55	29.44
Yield (q/ha)	58.25	65.85
% Superiority over PRR78	-	13.06
Recurrent Parent Genome recovery (%)	-	87.66
Kernel length before cooking (mm)	7.98	8.07
Kernel breadth before cooking (mm)	1.68	1.67
Kernel length after cooking (mm)	14.13	12.67
Kernel breadth after cooking (mm)	2.07	2.47
Kernel elongation ratio	1.77	1.57
Alkali spreading value	7	7
Aroma	2	2

References

Fjellstrom R, AM McClung and AR Shank (2006) SSR markers closely linked to the Pi-z locus are useful for selection of blast resistance in a broad array of rice germplasm. *Mol. Breed*. **17**: 149-157.

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Disease Reaction under artificial inoculation (0-5 Scale)			
Mo-ni-007	2	5	0
Mo-ni-012	2	4	0
Mo-ni-018	0	4	0
Mo-ni-019	0	5	0
Disease Reaction in UBN trials (0-9 Scale)			
ARS, Mugad	2	**7**	1
VPKAS, Almora	3	**7**	3

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Characters	PRR78	Pusa1603-06-11-4-19
Days to 50 % flowering	88	88
Plant height (cm)	114.8	119.60
Number of tillers	10.2	11.60
Panicle length (cm)	24.8	28.20
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Kernel elongation ratio	1.77	1.57
Alkali spreading value	7	7
Aroma	2	2

inoculation as well as UBN in hotspot locations (Singh *et al*., 2012).

For 0-5 Scale under artificial inoculation: Score 0-2 Resistant, 3 as Moderately Resistance and 4-5 as Susceptible.

For 0-9 Scale in UBN at hotspot location: Score 0-3 Resistant, 4-5 as Moderately Resistant, 6 as Moderately Susceptible and 7-9 as Susceptible.

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4. Pusa 1509-03-1-7-2 (IC0593942; INGR12004), an Elite, Semi-Dwarf, Basmati Type, Early Maturing Paddy (*Oryza sativa*) Germplasm with Superior Grain and Cooking Quality

Ashok Kumar Singh[1], s Gopala Krishnan[1], M Nagarajan[2], KK Vinod[2], PK Bhowmick[1], SS Atwal[3], Rakesh Seth[3], NK Chopra[3], VP Singh[1], KV Prabhu[1], Devinder Singh[1], Sudesh Kumar[1] and G Raveendran[2]

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Pusa1509-03-1-7-2 was developed from the cross Pusa 1301/ Pusa Basmati 1121 through pedigree method of breeding. It is an elite high quality Basmati rice variety which recorded an average yield advantage of 34.2 % over Taraori Basmati in the National Basmati Trials of the All India Coordinated Rice Improvement Programme over two years. Pusa1509-03-1-7-2 has semi-dwarf stature with non-lodging and non-shattering habit and early maturity and thus overcomes the major weakness of most widely grown Basmati rice variety Pusa Basmati 1121. The agro-morphological description of the genotype Pusa1509-03-1-7-2 is provided in Table 1. Quality wise it has aromatic extra long slender grains (8.41mm) with very occasional grain chalkiness, very good kernel length after cooking (19.1 mm), desirable ASV (7.0) and intermediate amylose content (21.24%). In the panel test conducted at DRR, Hyderabad during *Kharif* 2010 and 2011 in the AICRIP, Pusa1509-03-1-7-2 (IET 21259) has been ranked the best among the Basmati varieties and other cultures tested for two consecutive years for its cooked

Table 1. Agro morphological description of the genotype Pusa 1509-03-1-7-2 (IET21959)

Characteristics	Description
Plant height (cm)	100
Plant type	Semi-dwarf
No. of tillers /plant	10-12
No. of panicles/ m^2	303
Days to 50 % flowering	94
Panicle type	Long panicle
Panicle exertion	Complete
Awning	Occasionally present
Apiculi colour	Straw colour
1000-Grain weight (g)	27.03
Kernel length (mm)	8.41
Kernel breadth (mm)	1.86
L/B ratio	4.52
Elongation ratio	2.25
Kernel appearance	Extra long slender and translucent
Hulling recovery (%)	78.8
Milling recovery (%)	68.9
Head rice recovery (%)	47.3
Alkali value	7.0
Amylose content (%)	21.24

inoculation as well as UBN in hotspot locations (Singh *et al*., 2012).

For 0-5 Scale under artificial inoculation: Score 0-2 Resistant, 3 as Moderately Resistance and 4-5 as Susceptible.

For 0-9 Scale in UBN at hotspot location: Score 0-3 Resistant, 4-5 as Moderately Resistant, 6 as Moderately Susceptible and 7-9 as Susceptible.

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Awning	Occasionally present
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L/B ratio	4.52
Elongation ratio	2.25
Kernel appearance	Extra long slender and translucent
Hulling recovery (%)	78.8
Milling recovery (%)	68.9
Head rice recovery (%)	47.3
Alkali value	7.0
Amylose content (%)	21.24

rice appearance, cohesiveness, tenderness, taste, aroma, elongation and over all acceptability by the panelist at DRR, Hyderabad (Directorate of Rice Research, 2010; 2011). Pusa1509-03-1-7-2 shows moderate resistance to leaf blast and brown spot diseases. Owing to its early maturity, cultivation of Pusa Basmati 1509 can help saving 4 irrigations compared to Pusa Basmati 1121 while economizing the cost of agri-inputs and permitting higher cropping intensity resulting in better economic gains to the farmers.

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5. IPU 99-167m (IC 0594172- INGR 12005), a Unique Urdbean (*Vigna mungo*) Mutant with Protruded Stigma a Case for Functional Male Sterility

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Black gram is a highly self-pollinated crop with cleistogamous diadelphous flowers. While studying the range of morphological variability in black gram germplasm, a spontaneous mutant was isolated from a genotype IPU 99–167 (Kumar *et al.,* 2003; 2009). This mutant resulted the heterostyly condition due to protruded stigma and crumpled petals, leading to functional male sterility. This condition favours the outcrossing which may be helpful not only in artificial hybridization but also for population improvement and F_1 hybrids development in self- pollinated crops. This mutant had potential for use in hybridization program to obtain hybrid seeds without emasculation and thus could have been conveniently used as female parent in hybridization program.

Mutant plants although indistinguishable from normal plants until the onset of flowering have dark green foliage, large number of flowers and a few small pods with one or two seeds as against normal cleistogamous flowers, green foliage and normal pods with 5-7 seeds. The mutant was phenotypically distinct from normal plants in various aspects (Table 1). It attained more height (79.55±9.12 cm) with increased number of nodes (17.00±1.34) and reduced number of primary branches (3.22±0.26) as compared to 45.60±1.90 cm height, 14.40±0.93 nodes and 4.00±0.32 primary branches in normal plants. Peduncle length increased significantly in mutant plants whereas pods per plant, pod length, pods per cluster and seeds per pod decreased drastically. Pods per plant were comparatively very less in number with retarded pods and there was no seed set in earlier studies as well (Seenaiah *et al*., 1990). Flower size was reduced with small inward folded petals. Calyx, keel and standard petals in mutant flowers were smaller in size than those in normal flowers, resulting in a structural anomaly of the corolla. The mutant had protruded stigma due to long pistil (18.30±0.54 mm) as compared to 11.4±1.50 mm in normal flowers. Stamens were shorter with thin filament in mutant than in normal flowers.

Table 1. Morphological and floral characteristics of normal and mutant plants of IPU 99-167 in black gram

Character	Mean ± SE	
	IPU 99-167 (Normal)	IPU 99-167m (Mutant)
Plant height (cm)	45.60±1.90	79.55±9.12
Number of primary branches	4.00±0.32	3.22±0.26
Number of nodes	14.40± 0.93	17.00±1.34
Leaf length (cm)	7.84± 0.45	9.16±0.77
Leaf width (cm)	3.82± 0.54	3.97±0.49
Peduncle length (cm)	5.56± 0.68	9.20±0.82
Pods/plant	65.00±9.12	4.10±0.28
Pod length (cm)	4.24±0.12	2.91±0.12
Pods/cluster	2.60±0.26	1.10±0.08
Seeds/pod	6.00±1.23	1.23±0.09
Calyx	9.2±1.18	7.5±0.46
Keel petals	10.1±0.62	8.2±0.63
Standard petal	11.2±0.58	8.1±0.63
Pistil length	11.4±1.50	18.3±0.54
Stamen length	10.5±0.77	6.2±0.52

rice appearance, cohesiveness, tenderness, taste, aroma, elongation and over all acceptability by the panelist at DRR, Hyderabad (Directorate of Rice Research, 2010; 2011). Pusa1509-03-1-7-2 shows moderate resistance to leaf blast and brown spot diseases. Owing to its early maturity, cultivation of Pusa Basmati 1509 can help saving 4 irrigations compared to Pusa Basmati 1121 while economizing the cost of agri-inputs and permitting higher cropping intensity resulting in better economic gains to the farmers.

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5. IPU 99-167m (IC 0594172- INGR 12005), a Unique Urdbean (*Vigna mungo*) Mutant with Protruded Stigma a Case for Functional Male Sterility

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The mutant classified as functional male sterile invariably exhibited the other plant characteristics described above, indicating that the mutant gene had pleiotropic effect on many traits. The inheritance of this trait was also worked out suggesting single gene control of the trait (Kumar *et al.,* 2011). Flower mutants imparting functional male sterility have been reported in many agriculturally important crops like tomato, egg plant, *Brassica* species, soybean, cowpea, green gram and groundnut

References

Kumar S, S Gupta and B Singh (2003) Natural mutant of urdbean having protruded stigma. *Pulses Newslet.* **14(3)**: 2.

Kumar S, Gupta S, Hena, B Singh and BB Singh (2009) Functional male sterility and its inheritance in black gram (*Vigna mungo* L. Hepper). In: Proceedings of the International Conference on Grain Legumes: Quality improvement, value addition and trade, Abstract, Feb 14-16, 2009, Indian Institute of Pulses Research, Kanpur, India, Indian Society of Pulses Research and Development, Kanpur, p 138.

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6. SPS 5 (IC 0594173; INGR 12006), an Urdbean (*Vigna mungo*) Germplasm with Unique Feature of Sympodial Bearing

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Urdbean is grown in different seasons/ cropping sytemes and, therefore, no single plant type can perform satisfactorily in all the environments. In urdbean, three plant types (erect, semi spreading and spreading) are present. Normal pod bearing is common feature where pods are coming in clusters on each internode having long peduncles and arranged on main and sub branches on the stem. Occurrence of sympodial pod bearing like soybean in urdbean is not a common phenomenon. However, main stem bearing and sympodial bearing have been found in other plant species like cotton, soybean and chilli. Introduction of sympodial branching habit into existing cultivars may lead to increased pod numbers and enhanced harvest index without reduction in biological yield. Rao and Samy (1999) studied the inheritance of different plant types in urdbean and indicated that new plant types had potential for developing genotypes with high biological yield coupled with high level of harvest index of refashioning and compacting the plant type

Evaluation of 300 accessions at Indian Institute of pulses Research resulted in identification of a unique line SPS 5 with sympodial pod bearing habit. This plant type is similar to soybean type which had longer main stem, shorter internodes and short bearing branches leading to better pod setting and pod number per plant. The new plant type has potential to produce higher yield under increased plant density.

References

Rao Koteshwara Y and SR Sreeranga Samy (1999) Inheritance of new plant types in blackgram (*Vigna mungo*). *Legume Res.* **22:** 157-161.

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7. DRMR WFM 1 (IC 0593926; INGR 12007), an Indian Mustard (*Brassica juncea*) Germplasm with White Petal Colour

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Bright yellow petal colour is the characteristics of family Brassicaceae, however, the white petal flowers in mustard (*Brassica juncea* L) are also observed. White/ yellow petal colour, being distinct in phenotype, may be a useful morphological marker for many studies in breeding programme. In the present investigation, white and yellow petal flowers were observed in F_3 generation of a cross B 33 X Sanjucta Asech, both bear yellow flower. These plants were selfed and in the subsequent generations (F_4 – F_7), near isogenic lines (NIL) with white and yellow petal flower colour were developed. Crosses between yellow and white flower plants were attempted during 2005-06 and subsequently (during 2005-06 to 2007-08), F_1, F_2, BC_1 (F_1 X yellow petal) and BC_2 (F_1 X white flower) generations were developed. These generations (P_1, P_2, F_1, F_2, BC_1, and BC_2) were grown during 2008-09 and observations on petal colour were recorded. Inheritance studies revealed that flower colour in *Brassica juncea* is governed by dominant digenic epistasis, yellow colour being dominant over white.

Observations were recorded on days to flower initiation, plant height (cm), main shoot length (cm), primary branches, seeds per siliqua and 1000 seed weight (g) on 5 plants from DRMR WFM 1, Sanjucta Asech and B 33 each. The mean values presented in Table 1 indicated that DRMR WFM 1 is an early maturing line with short plant height and medium size seeds with white flower colour. This line will be useful as a morphological marker for genetic studies as well as in breeding programme.

Table 1. Characterization of DRMR White Flower Mustard 1(DRMR FM1):

Trait	DRMR WFM 1	Sanjucta Asech	B33
Days to flower initiation	43	47	48
Primary branches	4.8	4.5	5.2
Plant height (cm)	140	145	202
Main shoot length (cm)	70	50	85
Seeds/siliqua	14.2	15.6	12.7
1000 seed weight (g)	4.2	3.8	4.1
Days to maturity	125	128	135
Petal colour	white	yellow	yellow

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8. Bast fibre shy (*bfs*) Mutant (IC0593936; INGR12008), a Jute (*Corchorous olitorius*) Mutant with Defective Bast Fibre Development

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A unique secondary phloic mutant of dark jute (*Corchorus olitorius* L.) has been developed at the Central Research Institute for Jute and Allied Fibres (CRIJAF), Barrackpore (Kolkata). It has been registered as a bast fibre-shy (*bfs*) mutant because it is defective in bast fibre development, but develops normal secondary phloic fibre (SPF) bundles and produces lignin-rich fibres upon biological retting (Kundu *et al.*, 2012). This mutant was developed from its wild type *C. olitorius* cv. JRO 632, a leading dark (tossa) jute cultivar in India and neighboring countries, by induced physical mutagenesis (thermal neutron) of dry seeds.

Morpho-agronomic characteristics

The *bfs* is a dwarf mutant, with a significantly shorter plant type than its wild type JRO 632 (Fig. 1). However, its most diagnostic phenotype is dissected ribbon leaves, which are distinguished by minute trifid leaves that, on maturity, are discontinuous in the margins and dissected into irregularly shaped ribbons supported by the major veins. In addition, the *bfs* is distinguished by stunted growth, pre-mature flowering, early maturity and distinct changes in root architecture and system. Chief morpho-agronomic characteristics of this mutant are presented in Table 1.

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Table 1. Important morpho-agronomic characteristics of the *bfs* mutant

Plant part	Description
Whole plant	Type, annual herb; height, short; branching habit, medium; harvest maturity, early
Stem	Color, green; diameter, shorter; internode length, short; Basal stem root primordial modified as spine like outgrowth, present; shape, cylindrical; surface, glabrous
Leaf	Angel, erect; apex, aristate; arrangement, cauline; base, cuneate; filiform appendages, long; lamina color, green; lamina surface, glabrous; margin, palmatipartite; petiole color, green; petiole hair, present; shape, dissected ribbon; stipule color, green; venation, arcuate; vein color, green
Flower	Anther color, pale yellow; calyx pigmentation, green; color distinctness of pedicel articulation, green; corolla color, pale yellow; floral bud color, green; floral stalk color, green; pedicel articulation position, middle; time to 50% flowering, early; type, complete
Capsule	Dehiscence, present; pigmentation, green; shape, cylindrical; seeds per capsule, less; seed color, still grey; seed size, medium; valves per capsule, five; 100 seed weight, less
Root	Root architecture, spreading type
Fibre	Fibre content, very less; fineness, fine; tensile strength, average and weak

Associated characters

The *bfs* mutant has ten- and seven-fold lesser bast fibre and wood yield, respectively than its wild type. Fibre contains about 9% lignin. In contrast to *dlpf* mutant of *C. capsularis* (Sengupta and Palit, 2004), this mutant is normal in SPF lignification, but concurrently defective in wood development. Since it represents a loss-of-function mutation of the vascular cambium, it is a valuable resource for genomics-assisted dissection of bast fibre differentiation and signal transduction pathways controlling its biogenesis *in planta*.

References

Kundu A, D Sarkar, NA Mandal, MK Sinha and BS Mahapatra (2012) A secondary phloic (bast) fibre-shy (*bfs*) mutant of dark jute (*Corchorus olitorius* L.) develops lignified fibre cells but is defective in cambial activity. *Plant Growth Regul.* **67:** 45-55.

Sengupta G and P Palit (2004) Characterization of a lignified secondary phloem fibre-deficient mutant of jute (*Corchorus capsularis*). *Ann. Bot.* **93:** 211-220.

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9. IL-11-239 (IC0593646; INGR12009), a Berseem (*Trifolium alexandrinum*) Germplasm with Black (dark tan) Seed Against Normal Yellow Seed

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Berseem is one of the most important winter season fodder crop grown in 2 m ha area in India. Berseem seeds are invariably yellow in colour. Because of narrow genetic base of the crop, interspecific hybridization using embryo rescue technique was attempted for transfer of traits like disease resistance, quality, yield etc. Several interspecific hybrids of *Trifolium alexandrinum* (berseem clover) with different related wild species have been developed at IGFRI and transferred to field conditions (First world report). One such hybrid of *T. alexandrinum* x *T. apertum* (both parents are yellow seeded) expressed black seed colour (dark tan) in some of the segregating F_2 progenies. However, the heritability of the character was low (20-30%) and displayed varied degree of expressivity. Repeated cycles of artificial selection coupled with selfing in insect proof net house were carried out in these progenies. Except black seed colour emphasis was given to select the plants showing the morphological features closer to *T. alexandrinum*. Heritability of the character (black seed coat) displayed progressive improvement

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Berseem is one of the most important winter season fodder crop grown in 2 m ha area in India. Berseem seeds are invariably yellow in colour. Because of narrow genetic base of the crop, interspecific hybridization using embryo rescue technique was attempted for transfer of traits like disease resistance, quality, yield etc. Several interspecific hybrids of *Trifolium alexandrinum* (berseem clover) with different related wild species have been developed at IGFRI and transferred to field conditions (First world report). One such hybrid of *T. alexandrinum* x *T. apertum* (both parents are yellow seeded) expressed black seed colour (dark tan) in some of the segregating F_2 progenies. However, the heritability of the character was low (20-30%) and displayed varied degree of expressivity. Repeated cycles of artificial selection coupled with selfing in insect proof net house were carried out in these progenies. Except black seed colour emphasis was given to select the plants showing the morphological features closer to *T. alexandrinum*. Heritability of the character (black seed coat) displayed progressive improvement

with advancement of generation. After six generation of selfing, the character showed stability with varying degree of expressivity, suggesting multigenic control of the trait. The seeds are expected to contain higher tannin concentration in its seed coat, which may confer better resistance to pathogens in the early stages of seedling development. Interestingly, both the parents were yellow seeded and there is no report available for accessions showing black seed colour in either of the species. This is possibly arising due to genomic interaction of *T. apertum* and *T. alexandrinum*. Further studies on this trait may lay a greater insight into the nature of inheritance and utility in berseem breeding programme. Further to mention that black (dark tan) seeded Berseem has never been reported. This being the first report of stabilization of such seed colour.

References

Anonymous (2003-04) *Annual Report 2003-04 IGFRI, Jhansi* p 26.

Malaviya DR, AK Roy, P Kaushal, A Yadav and M Chakraborti (2011) Black seed coat colour: *de-novo* expression of novel trait in interspecific hybrid derivative of *Trifolium alexandrinum x Trifolium apertum*. Abstract volume. National Symposium on "Forage resource and livestock for livelihood, environment and nutritional security". Sept. 10-11, 2011, Range Management Society of India. IGFRI, Jhansi India, p 38.

10. IL-11-238 (IC0593647; INGR12010), a Berseem (*Trifolium alexandrinum*) Germplasm with Tetraploid Plant and Pentafoliate Leaves

DR Malaviya, Shalini Pathak, AK Roy, P Kaushal and Mridul Chakraborti
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A plausible approach for increasing yield of Berseem could be through increasing photosynthetic area i.e. leaf area. Presence of multifoliate leaves is supposed to substantially increase the photosynthetic area of the plants. The proportion of leaves in Berseem is associated with number of leaves per plant, with number and size of leaflets on the leaf. Cultivars of Berseem clover possess trifoliate leaves however, occasional occurrence of multifoliate plants is observed sporadically in natural population.

Hence, efforts of a decade resulted in plants types near 100% penetrance and 90% expressivity of pentafoliate. The genetics of the trait is still not clear. Hence, in order to understand the genetics of the trait and to see the effect of ploidy dosage effect induced tetraploid of the line *viz.* Penta 1 (previously registered with NBPGR, INGR 09045) was developed through colchicine treatment (seedlings immersed in 0.1 and 0.2% colchicine solution for 24 and 48 hrs). A distinct characteristic feature observed in C_0 generation of the induced pentafoliate tetraploid plants was the presence of serrate margin and prominent rachis in the leaves and bold seeds. Leaves were thick, succulent, and hairy with apical notch and presence of pigmentation on the outer margin.

The study revealed that the autotetraploids had better expression of pentafoliate trait in induced tetraploid plants than in diploid plants. The morphological characters were well maintained in next generations also. The ploidy in different generations was confirmed through Flow Cytometric leaf scan analysis using Partec PAII ploidy analyzer. The seed lot being submitted is stabilized Tetraploid Pentafoliate in C5 generation.

Further to mention that such a high degree of penetrance and expressivity of pentafoliate trait in a tetraploid has never been reported either in Egyptian clover or in any *Trifolium* species. This being the first report of induction and stabilization of polyploidy in Egyptian clover with pentafoliate leaves.

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Anonymous (2010) *Annual Report 2009-10* IGFRI, Jhansi, p 11.

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11. 190-P3 (IC0593648; INGR12011), a Self-incompatible, Tetraploid Berseem (*Trifolium alexandrinum*) Germplasm

AK Roy, DR Malaviya, and P Kaushal
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Berseem plant possess typical palmate trifoliate leaves and is found in diploid (2n=16) in nature. Efforts of this group of scientists for about decade resulted development of induced tetraploids and study on its mode of pollination. Berseem in its diploid form is also reported to be self incompatible in Egyptian conditions. Indian reports are in favour of self compatible. However, our findings reveal that there lines with different mode of pollination (Roy *et al.,* 2005).

The tetraploid variety Pusa Giant developed by IARI has depolyploidized and in a fresh attempt IGFRI developed few tetraploids of berseem through colchicines treatment. The study revealed that the autotetraploids had bigger leaves with serrate margin and hairiness. Out of some 4x lines evaluated for its mode of pollination, the present line was found to be most vigorous and self incompatible. The proposed line 1-90 P3 showed high seed set under controlled bees visit. In this population, hand tripping had no effect on seed set as the fertilization required pollen transfer from a neighboring plant with different 'S' alleles.

Further, to mention that self incompatibility in Berseem in tetraploid background has never been reported.

References

Roy AK, DR Malaviya and P Kaushal (2005) Pollination behaviour in different breeding populations in Egyptian clover. *Plant Breed.* **124:** 171-175.

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12. EC329299 (INGR12012), Berseem (*Trifolium alexandrinum*) Germplasm as a Self-compatible & Self Pollinating Diploid

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T. alexandrinum commonly known as Berseem or Egyptian clover is an important winter annual fodder legume cultivated in Egypt, Mediterranean basin and Indian subcontinent. For an effective genetic improvement programme, it is imperative to have an adequate knowledge of the breeding system. Its mode of pollination is reported to be cross pollinated in Egyptian conditions. Identification of self-compatible populations and development of inbreds is likely to expose the hidden variability among populations of Berseem. The breeding method entails the development of inbreds and the production of hybrid seed. Hence, the present study was undertaken to estimate the extent of self-compatibility among different populations of Berseem (Egyptian clover) based on seed set per inflorescence under different treatments. Our findings revealed that these lines with different mode of pollination (Roy et al 2005). The proposed line Saidi (EC 329299) belonged to Self compatible and self pollinating group. This ecotype shows considerable seed set under the caged condition indicating that pollinators do not play significant role.

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13. DSG-6 (IC0588956; INGR12013), a Sponge gourd (*Luffa cylindrica*) Germplasm with Highly resistant to *Tomato Leaf Curl New Delhi Virus*

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Sponge gourd is a popular low cost vegetable grown throughout India. Recently *Tomato Leaf Curl New Delhi Virus* (*ToLCNDV*: genus *Begomovirus*, family Geminiviridae), the causal virus of tomato leaf curl has been reported to be associated with sponge gourd and causing a yield loss upto100 % in north Indian plains during *kharif* season under epidemic condition (Sohrab *et al.*, 2003). The diseased plant is characterized by yellow spots appearing on newly emerging leaves, followed by a mosaic appearance and upward curling of the upper leaves. In cases of severe attack, the leaves of the plant are small and distorted and misshapen fruits are produced. The virus is transmitted through sap as well as whitefly (*Bemisia tabaci* Hemiptera-Aleyrodidae). The genotype DSG-6 was developed at Indian Agricultural Research Institute, New Delhi by selection from local material collected from village Bulandi, Hoogly district of West Bengal. It was screened under natural epidemic condition and found to be completely resistant to *Tomato leaf curl New Delhi virus,* during rainy season which is conducive for white fly multiplication and the spread of disease. The result was also confirmed through challenge inoculation with purified strain of the virus under insect proof green house (Islam *et al*., 2010, 2011).

Morpho-agronomic characteristics

Leaves of the genotype DSG-6 are dark green, reniform, six lobed, nearly glabrous, non-hairy, smooth with long petioles. Trailing or climbing vines with stem and tendrils. Stem is angular monoecious with annual vines, inflorescence is clustered, racemose, flowers unisexual, male flower large in number in cluster, yellow and showy with long peduncle. Female flowers are borne solitary on short and round peduncle and are yellow in colour. Fruits are elongated elliptical (20-25cm), straight, attractive dark green with thick skin and superficial stripe, average fruit weight 110 g, flesh tender, suitable for spring-summer and *Kharif* seasons. It is ready for first harvesting in 40-45 days after sowing in *Kharif* season and 50-55 days after sowing in spring summer season. DSG-6 is highly resistant to *Tomato leaf curl New Delhi virus* during rainy season which is conducive for white fly multiplication and the spread of the said disease (Tables 1, 2).

Table1. Screening of DSG-6 under natural epidemic condition during *kharif* season 2008-2010

Genotype	2008		2009		2010	
	Yield (t/ha)	Vulnerability Index & Category	Yield (t/ha)	Vulnerability Index & Category	Yield (t/ha)	Vulnerability Index & Category
DSG-6	14.38	0.00 (I)	14.8	3.21 (HR)	13.75	4.33 (HR)
CHSG-1	1.95	100.00 (HS)	2.36	98.48 (HS)	2.15	97.50 (HS)
CHSG-2	2.01	99.33 (HS)	2.25	96.86 (HS)	2.34	95.25 (HS)
PSG-9	1.84	99.33 (HS)	1.99	95.10 (HS)	2.03	97.55 (HS)
KG-3/134 (IC 284787)	1.92	98.00 (HS)	1.85	99.05 (HS)	2.07	95.88 (HS)

I: Immune; HS: Highly susceptible; HR: Highly Resistant

Table 2. Screening of DSG-6 for resistance to *Tomato leaf curl New Delhi virus* through challenge inoculation (*Bemisia tabaci*) under greenhouse condition during 2008

Genotype	Source	Vulnerability Index	Category
DSG-6	IARI, New Delhi	3.33	Highly Resistant
CHSG-1	HARP, Ranchi	100.00	Highly susceptible
CHSG-2	HARP, Ranchi	100.00	Highly susceptible
PSG-9	PAU, Ludhiana	99.33	Highly susceptible
KG-3/134 (IC 284787)	NBPGR, New Delhi	98.67	Highly susceptible

References

Islam S, AD Munshi, B Mandal, Ravinder Kumar and T K Behera (2010) Genetics of resistance in *Luffa cylindrica* Roem. against *Tomato leaf curl New Delhi virus*. *Euphytica* **174:** 83-89.

Islam S, AD Munshi, M Verma, L Arya, B Mandal, TK Behera, R Kumar and SK Lal (2011) Screening of *Luffa cylindrica* Roem. for resistance against *Tomato Leaf Curl New Delhi Virus*, inheritance of resistance, and identification of SRAP markers linked to the single dominant resistance gene. *J. Hort. Sci. Biotech.* **86:** 661-667.

Sohrab SS, B Mandal, RP Pant, A Varma (2003) First report of association of *Tomato leaf curl New Delhi virus* with yellow mosaic disease of *Luffa cylindrica* in India. *Plant Dis.* **87**: 1148.

14. PreGy-1 (IC0591254; INGR12014), a Bitter Gourd (*Momordica charantia*) Germplasm with Predominately Gynoecious Habit

TK Behera, Anand Pal and AD Munshi

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Bitter gourd is a typical monoecious cucurbit and being a member of Cucurbitaceae it also exhibits various sex forms. In recent past gynoecious sex form has been reported (Behera *et al.,* 2006) in Indian germplasm which is governed by a single recessive gene '*gy-1*' (Behera *et al.,* 2009). Regardless of genetic control, both studies suggest that such gynoecious lines hold promise for the development of gynoecious F_1 hybrids as it avoids manual emasculation and pollination by the by increases the yield and earliness of the hybrid. But, maintenance of gynoecious lines is very difficult and those can be maintained through sib-matting and in-vitro methods. These methods are very cumbersome and time taking. However, the use of predominately gynoecious lines derived from segregating population of gynoecious and monoecious hybrids has significant role in bitter gourd crop improvement.

One improved and commercial monoecious cultivar Pusa Do Mausami was used as male parent to develop cross on gynoecious line, DBGy-201. This gynoecious line was previously developed from one distinct germplasm population, and has been maintained through tissue culture followed by selfing after modifying into hermaphrodite sex form. One F_1 (DBGy-201 x Pusa Do Mausami) plant was selfed using a staminate flower from the same plant to obtain fruits containing F_2 seeds. The successive segregating progenies were also developed by selfing in same fashion. The plants were observed for the presence of pistillate and staminate flowers throughout the growing season. Moreover, in the subsequent generations particularly in F_6 population one line (PDMGy) was extracted having very high percentage of pistillate (female) flowers and high yield potential which was named as PreGy-1.

Morpho-agronomic characteristics of PreGy-1

Vine is medium long 2.3 m with inter nodal length of 4.7-5.9 cm. Leaves dark green, reniform, six lobed, non-hairy, smooth with long petioles. Trailing or climbing vines with stem and tendrils. Stem angular monoecious with annual vines, flowers unisexual, yellow and showy with long peduncle in male flower. This line has high female: male ratio of 5:1 to 7:1 against 1:9 in Pusa Do

Table 1. Performance of PreGy-1 during Spring-Summer season of 2009-10 and 2010-11

Genotype	Yield (q/ha)	
	2009-2010	2010-2011
PreGy-1 (IC-0591254)	272.50	256.00
Pusa Do Mausami (check)	157.0	150.00

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Mausami (check). The fruits reach edible stage in about 45 days from sowing; fruits dark green, long (16-18cm), medium thick (3.2-4.2 cm dia), with 7-8 continuous ridges, fruit weight 85-90g.

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15. CARI Brinjal-1 (IC0585684; INGR12015), a Brinjal (*Solanum melongna*) Germplasm with a Bacterial wilt Resistant

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Brinjal (*Solanum melongen* L.) is one of the most important vegetable crops of Andaman and Nicobar Islands wherein, the production of healthy crop is challenged by the Bacterial wilt caused by *Ralstonia solanacearum*. Bacterial wilt is one of the most important diseases of solanaceous crops in most parts of the country, including Andaman and Nicobar Islands. The disease is devastating in hot and humid climate and can cause up to 100% losses. Unfortunately, the majority of resistant material from mainland does not survive Island wilt conditions. CARI Brinjal 1 is the germplasm developed by repeated selection and purification cycles from the local collection at Central Agricultural Research Institute (CARI), Port Blair.

Morpho-agronomic characteristics

The plant is medium tall, semi spreading type with profuse branching habit, smooth stem and leaves are light greenish in colour. Fruits are oblong in shape, light green in colour, medium compact fruit and pendent fruit position with low seediness. Seeds are medium in shape and size and light yellow in colour. The developed germplasm, CARI Brinjal-1 not only survives under wilt pathogen sick condition but also gives better yield compared to other varieties tested under Island conditions.

Associated characters and cultivated practices

The germplasm has performed consistently well across the years and locations under wilt conditions where other varieties could not survive.

Table 1. Yield performance of CARI Brinjal 1 (CARI B-1) during 2008-09 and 2009-10 at CARI Farm

Varieties/genotypes	2008-09	2009-10	Average yield (t/ha)
CARI Brinjal-1	28.3	34.0	31.1
Manjira Gota	8.6	6.6	7.6
Pusa Purple Long	24.5	28.1	26.3
Arka Keshav	15.3	19.8	17.6
Arka Nidhi	11.7	12.0	11.9
C.D. (p=0.05)	3.3	2.9	
C.V. (%)	9.7	7.6	

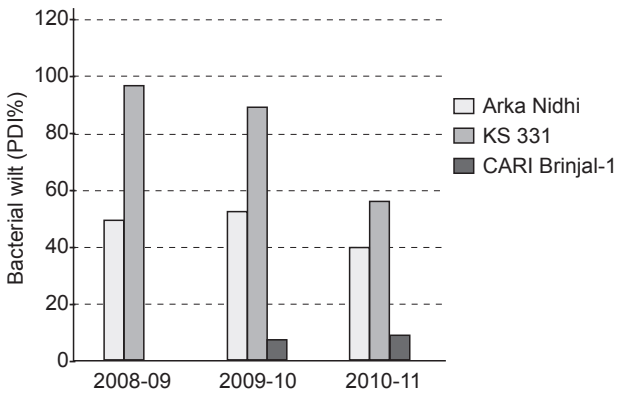

Fig. 1. Bacterial wilt incidence in CARI Brinjal-1 along with checks during 2008-11 at CARI, Port Blair, India

The detailed study and results associated with the germplasm have been published in annual report of the Institute, presented in international and national conferences as given below.

Mausami (check). The fruits reach edible stage in about 45 days from sowing; fruits dark green, long (16-18cm), medium thick (3.2-4.2 cm dia), with 7-8 continuous ridges, fruit weight 85-90g.

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Behera TK, SS Dey. and PS Sirohi (2006) DBGy-201 and DBGy-202: Two gynoecious lines in bitter gourd (*Momordica charantia* L.) isolated from indigenous source. *Indian J. Genet*. **66:** 61-62.

Behera TK, SS Dey, AD Munshi, Ambika B Gaikwad, Anand Pal and Iqbal Singh (2009).Sex inheritance and development of gynoecious hybrids in bitter gourd (*Momordica charantia* L.). *Sci. Horti.* **120:** 130-133.

15. CARI Brinjal-1 (IC0585684; INGR12015), a Brinjal (*Solanum melongna*) Germplasm with a Bacterial wilt Resistant

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Brinjal (*Solanum melongen* L.) is one of the most important vegetable crops of Andaman and Nicobar Islands wherein, the production of healthy crop is challenged by the Bacterial wilt caused by *Ralstonia solanacearum*. Bacterial wilt is one of the most important diseases of solanaceous crops in most parts of the country, including Andaman and Nicobar Islands. The disease is devastating in hot and humid climate and can cause up to 100% losses. Unfortunately, the majority of resistant material from mainland does not survive Island wilt conditions. CARI Brinjal 1 is the germplasm developed by repeated selection and purification cycles from the local collection at Central Agricultural Research Institute (CARI), Port Blair.

Morpho-agronomic characteristics

The plant is medium tall, semi spreading type with profuse branching habit, smooth stem and leaves are light greenish in colour. Fruits are oblong in shape, light green in colour, medium compact fruit and pendent fruit position with low seediness. Seeds are medium in shape and size and light yellow in colour. The developed germplasm, CARI Brinjal-1 not only survives under wilt pathogen sick condition but also gives better yield compared to other varieties tested under Island conditions.

Associated characters and cultivated practices

The germplasm has performed consistently well across the years and locations under wilt conditions where other varieties could not survive.

Table 1. Yield performance of CARI Brinjal 1 (CARI B-1) during 2008-09 and 2009-10 at CARI Farm

Varieties/genotypes	2008-09	2009-10	Average yield (t/ha)
CARI Brinjal-1	28.3	34.0	31.1
Manjira Gota	8.6	6.6	7.6
Pusa Purple Long	24.5	28.1	26.3
Arka Keshav	15.3	19.8	17.6
Arka Nidhi	11.7	12.0	11.9
C.D. (p=0.05)	3.3	2.9	
C.V. (%)	9.7	7.6	

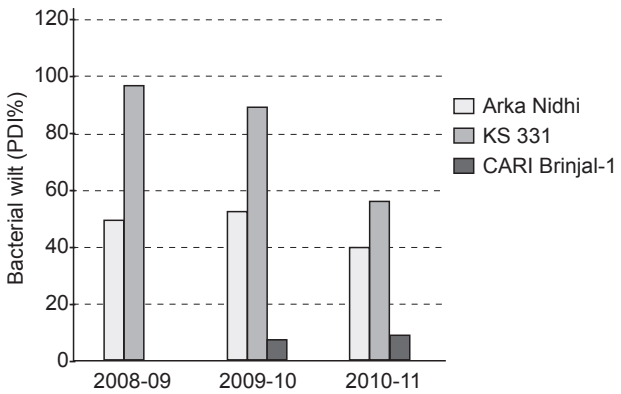

Fig. 1. Bacterial wilt incidence in CARI Brinjal-1 along with checks during 2008-11 at CARI, Port Blair, India

The detailed study and results associated with the germplasm have been published in annual report of the Institute, presented in international and national conferences as given below.

References

Anonymous (2010) Annual Report 2009-10. Central Agricultural Research Institute, Port Blair.

Singh Shrawan, DR Singh, VB Pandey, LB Singh, A Birah, Krishna Kumar and RC Srivastava (2011) Initial screening of indigenous vegetable crops of Andaman Islands for biotic stresses. In "9th National Symposium on Crop Health Management for Sustainable Agri-horticultural Cropping System" held at Central Agricultural Research Institute, Port Blair from 17-19, Feb 2011, pp. 167.

Kumar Krishna, Naresh Kumar, PK Singh, Ajanta Birah, AK Singh, DR Singh and RK Gautam (2012) CARI Brinjal 1: An ideal intercrop in the plantation based cropping system in Islands. Abst. National Seminar on Technologies for Improving Productivity of Spices and Plantation Crops, February, 27-28, 2012, Port Blair, p102.

16. SBIEC 11001 (IC0594462; INGR12016), a Sugarcane (*Erianthus X Saccharum* sp Hybrid) Germplasm with High Biomass Potential

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SBIEC 11001 was developed from cross between IK 76-92 (*Erianthus arundinaceus*) and 98 N1 1405 (interspecific hybrid involving *Saccharum officinarum* and *Saccharum spontaneum*) for introgressing high biomass yield and high fibre content from the former parent. The clone was selected through hybridization and clonal selection method at Sugarcane Breeding Institute, Coimbatore. The germplasm had high biomass potential and recorded harvestable biomass yield of 279.01 t/ha/year which is 92.10% higher compared to a high yielding sugarcane clone ISH 100 with 145.24 t/ha. Dry matter production of this germplasm was 101.23 t/ha and ISH 100 generated 33.90 t/ha which is 198.61 % higher. Fibre % cane of SBIEC 11001 (26.38) was also more compared to ISH 100(16.44) with an increase of 45.92%. The clone is a fast growing, high tillering, amenable for multiple ratooning, medium thick cane without split. Bud is medium size and triangular shaped. Leaf sheath is green with smooth hairs and dewlap is absent. Even under suboptimal management conditions the clones can produce good biomass yield.

Development of energy cane is a viable option for the sugar factories for continuous supply of economically viable feed stock to cogeneration units for the generation of electricity even during the off season. At present there is no energy cane variety to cater the needs of this green power industry and this clone can be cultivated to cater the off-season requirement of feedstock.

Table 1. Performance of SBIEC 11001 for energy cane traits

Clone	Harvestable biomass t/ha	Fibre % cane	Juice Brix %	Dry matter %	Dry matter yield t/ha
SBIEC 11001	279.01	26.38	9.75	36.28	101.23
SBIEC 11002	247.53	22.58	15.92	34.38	85.10
SBIEC 11003	222.53	23.94	15.04	35.97	80.04
SBIEC 11004	193.83	30.21	7.80	39.18	75.94
IA 1167	208.95	22.56	16.88	35.53	74.25
SBIEC 11005	181.79	25.55	16.60	39.88	72.50
SBIEC 11006	197.22	25.77	11.00	35.24	69.50
IA 3135	160.49	23.48	17.51	37.88	60.80
SBIEC 11007	191.05	25.91	8.09	29.38	56.13
ISH 100	145.24	16.44	18.21	23.34	33.90

Reference

Govindaraj P (2011) *Annual Report*. Sugarcane Breeding Institute 2010-11, p 28.

References

Anonymous (2010) Annual Report 2009-10. Central Agricultural Research Institute, Port Blair.

Singh Shrawan, DR Singh, VB Pandey, LB Singh, A Birah, Krishna Kumar and RC Srivastava (2011) Initial screening of indigenous vegetable crops of Andaman Islands for biotic stresses. In "9th National Symposium on Crop Health Management for Sustainable Agri-horticultural Cropping System" held at Central Agricultural Research Institute, Port Blair from 17-19, Feb 2011, pp. 167.

Kumar Krishna, Naresh Kumar, PK Singh, Ajanta Birah, AK Singh, DR Singh and RK Gautam (2012) CARI Brinjal 1: An ideal intercrop in the plantation based cropping system in Islands. Abst. National Seminar on Technologies for Improving Productivity of Spices and Plantation Crops, February, 27-28, 2012, Port Blair, p102.

16. SBIEC 11001 (IC0594462; INGR12016), a Sugarcane (*Erianthus X Saccharum* sp Hybrid) Germplasm with High Biomass Potential

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SBIEC 11001 was developed from cross between IK 76-92 (*Erianthus arundinaceus*) and 98 N1 1405 (interspecific hybrid involving *Saccharum officinarum* and *Saccharum spontaneum*) for introgressing high biomass yield and high fibre content from the former parent. The clone was selected through hybridization and clonal selection method at Sugarcane Breeding Institute, Coimbatore. The germplasm had high biomass potential and recorded harvestable biomass yield of 279.01 t/ha/year which is 92.10% higher compared to a high yielding sugarcane clone ISH 100 with 145.24 t/ha. Dry matter production of this germplasm was 101.23 t/ha and ISH 100 generated 33.90 t/ha which is 198.61 % higher. Fibre % cane of SBIEC 11001 (26.38) was also more compared to ISH 100(16.44) with an increase of 45.92%. The clone is a fast growing, high tillering, amenable for multiple ratooning, medium thick cane without split. Bud is medium size and triangular shaped. Leaf sheath is green with smooth hairs and dewlap is absent. Even under suboptimal management conditions the clones can produce good biomass yield.

Development of energy cane is a viable option for the sugar factories for continuous supply of economically viable feed stock to cogeneration units for the generation of electricity even during the off season. At present there is no energy cane variety to cater the needs of this green power industry and this clone can be cultivated to cater the off-season requirement of feedstock.

Table 1. Performance of SBIEC 11001 for energy cane traits

Clone	Harvestable biomass t/ha	Fibre % cane	Juice Brix %	Dry matter %	Dry matter yield t/ha
SBIEC 11001	279.01	26.38	9.75	36.28	101.23
SBIEC 11002	247.53	22.58	15.92	34.38	85.10
SBIEC 11003	222.53	23.94	15.04	35.97	80.04
SBIEC 11004	193.83	30.21	7.80	39.18	75.94
IA 1167	208.95	22.56	16.88	35.53	74.25
SBIEC 11005	181.79	25.55	16.60	39.88	72.50
SBIEC 11006	197.22	25.77	11.00	35.24	69.50
IA 3135	160.49	23.48	17.51	37.88	60.80
SBIEC 11007	191.05	25.91	8.09	29.38	56.13
ISH 100	145.24	16.44	18.21	23.34	33.90

Reference

Govindaraj P (2011) *Annual Report*. Sugarcane Breeding Institute 2010-11, p 28.

17. SBIEC 11002 (IC0594463; INGR12017), a Sugarcane (*Saccharum* sp) Germplasm with a Dual Purpose Energy Cane

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SBIEC 11002 was selected from cross involving Co 1148 (sugarcane commercial hybrid) and SES 404 (S*accharum spontaneum*) for combining juice brix, high biomass yield and high fibre content by following hybridization and clonal selection method at Sugarcane Breeding Institute (ICAR), Coimbatore. The clone recorded high harvestable biomass yield (247.53 t/ha/year) with 70.43% increase over the high yielding sugarcane clone ISH 100(145.24 t/ha). Dry matter production of this clone (85.23 t/ha) was 151.03% higher than ISH 100(33.90 t/ha). Fibre % cane of this clone (22.58) was also 37.35% more than ISH 100 (16.44). In addition, it has 15.92 % of juice brix which can be used for direct fermentation to produce alcohol. It is a fast growing, heavy tillering, medium thick and erect cane without any splits. Bud is medium size and ovate shaped. Leaf sheath is greenish yellow without spines.

Cogeneration and distillation plants in the sugar factory complex face shortage of feed stock from the sugar factories during off season. Development of energy cane offers great scope for continuous supply of feed stock even during the off season. Dual purpose varieties can simultaneously supply feedstock to cogeneration and distillation units through baggase and sugarcane juice respectively. At present there is no energy cane variety to cater the needs of these industries. SBIEC 11002 is a dual purpose energy cane which combines the high fibre content and juice brix which can be profitably exploited for this purpose.

Table: Performance of SBIEC 11002 for energy cane traits

Clone	Harvestable biomass t/ha	Fibre % cane	Juice Brix %	Dry matter %	Dry matter yield t/ha
SBIEC 11002	247.53	22.58	15.92	34.38	85.23
IA 1167	208.95	22.56	16.88	35.53	74.25
SBIEC 11005	181.79	25.55	16.60	39.88	72.50
SBIEC 11006	197.22	25.77	11.00	35.24	69.50
IA 3135	160.49	23.48	17.51	37.88	60.80
SBIEC 11007	191.05	25.91	8.09	29.38	56.13
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18. Co 0230 (IC0594465; INGR12018), Sugarcane (*Saccharum* sp) Germplasm with High Ratooning Ability for Subtropical Zone

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Co 0230 is a clone with excellent ratooning potential. It is early maturing, high yielding, water logging tolerant and red rot resistant clone selected from the cross CoLk 8102 x Co 775 through hybridization and clonal selection. This clone was identified from Sugarcane Breeding Institute, Research Centre, Motipur and evaluated in Zonal Varietal Trials 2004–05 to 2007–08 under AICRP(Sugarcane). Co 0230 recorded high cane yield of 68.30 t/ha compared to the best standard CoSe 95422 (63.12 t/ha). This accounted for 8.21% improvement. In ratoon crop the proposed clone recorded 68.46 t/ha which is 16.35% improvement over CoSe 95422. The clone was rated as R at Pusa and MR at Motipur and Seorahi by plug method of testing for red rot. Under nodal method of testing the clone was rated as resistant in all the three locations tested. Under water logging condition it recorded 51.34% higher yield than the check BO 99. It has dark purple canes with heavy wax coating, non lodging, medium sized round buds, good tillering with semi droopy canopy, tolerant to water logging and very good ratooner.

17. SBIEC 11002 (IC0594463; INGR12017), a Sugarcane (*Saccharum* sp) Germplasm with a Dual Purpose Energy Cane

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Table: Performance of SBIEC 11002 for energy cane traits

Clone	Harvestable biomass t/ha	Fibre % cane	Juice Brix %	Dry matter %	Dry matter yield t/ha
SBIEC 11002	247.53	22.58	15.92	34.38	85.23
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Ratoon yield is very poor in north central zone and the clone can serve as a parent for improving ratoon performance. Water logging tolerance and red rot resistance are the additional traits which can be also simultaneously transferred from this clone in the varietal development programme.

Reference

All Indian Co-ordinated research programme (Sugarcane). Principal Investigator's Report of Crop Improvement, 2007-08, pp 331-332.

19. DWRL-1 (IC0590878; INGR12019), Wheat (*Triticum aestivum*) Germplasam with Lodging resistance Carrying Dwarfing Genes, High Protein and Resistance to Rust (Lr19)

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Wheat crop in Indo-Gangetic plains *i.e.* high fertility & productive areas is facing the problem of lodging due to erratic weather at milk/dough stage. A dwarf genotypes viz. DWRL-1 was developed in the background of NIAW 34 by incorporating brown rust resistance gene Lr 19 and selected from the population of cross NIAW 34 / Lr 19 (RL 6010)// CMH 81A-575. This genotype is in homozygous condition and is having faster early growth and showed good tillering capacity thus giving higher harvest index. In addition, this line also possesses higher protein content than the best check PBW 343. This is a triple gene dwarf with average height of around 54 cms. It also matures in early thus escaping the late heat of North West Plains Zone and can be used as the donors for dwarfing trait and brown rust resistance in improving tall genotypes.

Characteristic/morpho-agronomic description	Remark/Observation
Brown rust	Resistant under field (natural) and artificial conditions.
Yellow rust	Resistant under field (natural) and artificial conditions.
Black rust resistance	Resistant to predominant pathotypes.

Triple gene dwarf lines with lodging resistance

Genotype	Pedigree	Height (cm)	Spike length (cm)	Tillers/ meter	Protein (%)	Yield (q/ha)
DWRL-1	NIAW 34/Lr 19 (RL 6010) // CMH81A-575	54	11	160	13	56
PBW 343		93	11	150	11.5	50

Dwarfing genes in DWRL-1

DWRL-1 was studied to detect the dwarfing genes with known molecular markers for height reducing genes. Using perfect markers, three most important major height reducing genes, *Rht-B1b*, *Rht-D1b* and *Rht8* were evaluated. A PCR reaction was carried out and we could detect allele of ~ 237 bp of *Rht-B1b* while *Rht-D1b* shows ~254 bp size bands. For detection of *Rht8* gene microsatellite marker *Xgwm26* was used which showed 192 bp dominant allele. This locus is closely linked to the *Rht8* (0.6 cM distally). The presence of this allele as hat redactor of height in genome has been reported by many researchers.

Ratoon yield is very poor in north central zone and the clone can serve as a parent for improving ratoon performance. Water logging tolerance and red rot resistance are the additional traits which can be also simultaneously transferred from this clone in the varietal development programme.

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