Plant Germplasm Registration Notice*

The Plant Germplasm Registration Committee of ICAR in its XXXIst meeting held on April 21st, 2015 at the National Bureau of Plant Genetic Resources, New Delhi approved the registration of following 13 germplasm lines out of 65 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. DRR-BL-150 (IC0611701; INGR15001), a Rice (*Oryza sativa* L.) Germplasm with Resistance to Leaf and Neck Blast

Kuldeep Singh, M Sheshu Madhav*, M Srinivas Prasad, BC Virakatamath, SJS Rama Devi, B Umakanth and V Ravindra Babu

ICAR-Indian Institute of Rice Research (IIRR), Rajendra Nagar, Hyderabad-500030, Telangana, India

(Email: sheshu24@gmail.com)

Rice blast disease, caused by *Magnaporthe oryzae*, is a major constraint for sustainable rice production. Though many resistant varieties to *M. oryzae* have been developed, the resistance is not long lasting. This is due to the high pathogen plasticity exists in the field make to breaks down single gene resistance within 3 to 5 years release of cultivation (Bonman *et al.,* 1986; Lang *et al.,* 2009). Hence, development of broad spectrum and durable blast resistant varieties is essential for combating this disease, which requires continuous efforts of breeders and pathologists. In this scenario, we identified an introgression line, DRR-BL-15 (developed using *O. glaberrima*-AA) in the background of PR114 (*indica* line) have shown consistent resistance to leaf and neck blast disease resistance when screened at multiple locations across India through All India Coordinated Rice Improvement Programme (AICRP).

Morpho-agronomic characteristics: DRR-BL-150 has shown the plant height of 91.4 cm, with eleven panicles per plant. The panicle length, panicle weight, yield/ plant and dry weight/ plant of DRR-BL-150 are 18.8 cm, 2.45 g, 32.02 g and 27.72g respectively. The (50%) days of flowering of the DRR-BL-150, is 110 days with long slender type of grain.

Associated characters and cultivation practices: The DRR-BL-150 was screened for blast resistance under UBN (artificial screening) during January year 2010 and 2011, June 2011 in two replications using artificial screening methods. The result indicated a mean resistance score of 1.0 for leaf blast.This line was screened under Donor Screening Nursery (DSN) of AICRIP 2012 and 2013 in replication for leaf and neck blast resistance.

The blast scores were recorded with reference to standard SES scale and this line showed high level of resistance to leaf and neck blast resistance across location, indicating its potential of resistance. The line also showed resistance for brown spot during AICRIP 2012 with SI 3.6. The phenotyping results of DRR-BL-150 is as follows –

Compiled and edited by: Anjali Kak and RK Tyagi, Division of Germplasm Conservation, ICAR–National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi-110 012

		DRR		AICRIP 2012		AICRIP 2013	
		Leaf Blast Score	Neck Blast Score	Leaf Blast Score	Neck Blast Score	Leaf Blast Score	Neck Blast Score
Resistant checks	**DRR-BL-150**	**1.0**	–	**3.6*@**	**3.2*#**	**2.9*$**	**2.4*#**
	TETEP	1.8	–	3.0*@	3.5*#	2.7*$	2.3*#
	IR64	1.7	–	4.4*@	3.5*#	3.3*$	3.9*#
	C101LAC	1.6	–	4.0*@	3.1*#	3.1*$	3.8*#
	C101A51	1.6	–	3.9*@	3.6*#	4.6*$	4.1*#
Susceptible Checks	HR12	9.0	–	6.6*@	6.2*#	5.9*$	5.3*#
	TN1	8.5	–	5.2*@	4.1*#	5.4*$	5.0*#

* Selection of promising entries is made from the centers where Susceptible Check SI ≥5.0
@: SI calculated from 26 centers; #: SI calculated from 8 centers; $: SI calculated from 27 centers.

References

Bonman JM, TIV Dedios, MM Khin (1986) Physiological specialization of *Pyricularia oryzae* in the Philippines. *Plant Dis.* **70**: 767-769.

Lang NT, T Luy, PT Ha and Buu BC (2009) Monogenic lines resistance to blast disease in rice (*Oryza sativa* L.) in Vietnam. *Int. J. Genet. Mol. Biol.* **1**: 127-136.

2. DRR-BL-31 (IC0611702; INGR15002), a Rice (*Oryza sativa* L.) Germplasm with Resistance to Leaf and Neck Blast

Kuldeep Singh, M Sheshu Madhav*, M Srinivas Prasad, BC Virakatamath, SJS Rama Devi, B Umakanth and V Ravindra Babu
ICAR-Indian Institute of Rice Research (IIRR), Rajendra Nagar, Hyderabad-500030, Telangana, India
**(Email: sheshu24@gmail.com)*

Rice blast disease, caused by *Magnaporthe oryzae*, is a major constraint for sustainable rice production. Though many resistant varieties to *M. oryzae* have been developed, the resistance is not long lasting. This is due to the high pathogen plasticity exists in the field make to breaks down single gene resistance within 3 to 5 years release of cultivation (Bonman *et al.,*1986; Lang *et al.,* 2009). Hence, development of broad spectrum and durable blast resistant varieties is essential for combating this disease, which requires continuous efforts of breeders and pathologists. In this scenario, we identified an introgression line, DRR-BL-31(developed using *O. glumaepatula* (AA) as donor) in the background of PR114 (*indica* variety as recurrent parent) has shown consistent resistance to rice leaf and neck blast disease when screened at multiple locations across India through All India Coordinated Rice Improvement Programme (AICRP).

Morpho-agronomic characteristics: DRR-BL-31 has shown the plant height of 79.2 cm, with eighteen panicles/plant. The panicle length, panicle weight, yield per plant and dry weight/ plant of DRR-BL-31 are 21.8 cm, 1.78 g, 36.68 g and 30.84 respectively. The (50%) days of flowering of the DRR-BL-150, is 110 days with long slender type of grain.

Associated characters and cultivation practices: The DRR-BL-31 was screened for blast resistance under UBN (artificial screening) during January in the year 2010 & 2011, June-2011 in two replications using artificial screening methods. The result indicated a mean resistance score of 1.0 for leaf blast. The line was screened under Donor Screening Nursery (DSN) of AICRIP 2012 & 2013 in replication for leaf and neck blast resistance. The blast scores were recorded with reference to standard SES scale and this line showed high level resistance (1.9 -3.8) for neck blast and moderate resistance (2.9-4.1) to leaf blast. The result of DRR-BL-31 is as follows.

		DRR		AICRIP 2012		AICRIP 2013	
		Leaf Blast Score	Neck Blast Score	Leaf Blast Score	Neck Blast Score	Leaf Blast Score	Neck Blast Score
	DRR-BL-31	1.0	–	4.1*@	3.8*#	2.9*$	1.9*#
Resistant checks	TETEP	1.8	–	3.0*@	3.5*#	2.7*$	2.3*#
	IR64	1.7	–	4.4*@	3.5*#	3.3*$	3.9*#
	C101LAC	1.6	–	4.0*@	3.1*#	3.1*$	3.8*#
	C101A51	1.6	–	3.9*@	3.6*#	4.6*$	4.1*#
Susceptible Checks	HR12	9.0	–	6.6*@	6.2*#	5.9*$	5.3*#
	TN1	8.5	–	5.2*@	4.1*#	5.4*$	5.0*#

* Selection of promising entries is made from the centers where Susceptible Check SI ≥5.0
@: SI calculated from 19 centers; #: SI calculated from 8 centers; $: SI calculated from 21 centers.

The line has shown moderate resistance for sheath rot during AICRIP 2012 with SI 3.4. Also, the line has shown moderate resistance for sheath blight during AICRIP 2013 with SI 5.8.

References

Bonman JM, TIV Dedios, MM Khin (1986) Physiological specialization of *Pyricularia oryzae* in the Philippines. *Plant Dis.* **70**: 767-769.

Lang NT, T Luy, PT Ha and Buu BC (2009) Monogenic lines resistance to blast disease in rice (*Oryza sativa* L.) in Vietnam. *Int. J. Genet. Mol. Biol.* **1**: 127-136.

3. Kasota (BCU 5762) (EC0532635; INGR15003), a Barley (*Hordeum vulgare* L.) Germplasm with High Antioxidant Activity

Sneh Narwal*, Dinesh Kumar, RPS Verma and Indu Sharma
ICAR-Indian institute of Wheat and Barley Research (IIWBR), Karnal-132001, Haryana, India
**(Email: snehdagar@yahoo.co.in)*

Whole grains, including wheat and barley, contain several compounds that are capable of minimizing the damaging effects of oxidation reactions. Barley and malt are now gaining renewed interests as ingredients for the production of functional foods due to their concentration of soluble fibre β-glucan and many bioactive compounds having antioxidant activity. Barley can thus serve as an excellent dietary source of antioxidants with antiradical and antiproliferative potentials for disease prevention and health promotion. Therefore, identification of barley genotypes with high antioxidant activity is the first step towards this process.

In the year 2011-12, 265 barley lines grown at DWR, Karnal farm in malt barley crossing block were screened for their antioxidant potential using two radical scavenging methods *viz.* ABTS assay and DPPH assay. Kasota is hulled, six-row spring feed barley (*Hordeum vulgare* L.). It was developed at the Field Crop Development Centre, Alberta Agriculture, Food and Rural Development, Lacombe, Alberta, Canada from the cross Celaya/Mezquita/Godiva/3/Trompillo (Helm *et al.*, 1996). Using both the assay methods, the line Kasota showed the highest antioxidant activity (11.95 μM Trolox Eq/g by ABTS assay and 70.25% discoloration by DPPH assay) (Narwal *et al.*, 2014). Next two years (2012-13 & 2013-14), it was grown in multi-location trials under AICRP on Wheat & Barley along with check and another barley line. There were year to year differences in the level of antioxidant activity which is due to the variations in the climatic conditions each year. In the year 2013-14, higher activity range was obtained. But the trend was the same at different growing centers. It showed significantly high activity than the control K551 at all the centres (Barley Network AICRP Reports, 2012-13 & 2013-14).

Although Kasota has been registered as a feed barley variety, it has been found to have very high antioxidant activity. Also, it has yellow aleurone which might be rich in many yellow pigments having high antioxidant activity. It cannot be used directly as food but the flour from its grains can be used in various food preparations to enhance the antioxidant content of the food. Also it can be used in breeding programs for developing high antioxidant food and malt barley varieties.

References

Anonymous (2013) Progress report of All India Coordinated Wheat & Barley Improvement Project 2012-13. Barley Network **VI**: 5.53.

Anonymous (2014) Progress report of All India Coordinated Wheat & Barley Improvement project 2013-14. Barley Network **VII**: 5.54.

Helm JH, MJ Cortez, RI Wolfe, PE Jedel, DF Salmon and WM Stewart (1996) Registration of Kasota barley. *Crop Sci.* **36**:1409.

Narwal S, D Kumar, RPS Verma and I Sharma (2014) Identification of barley genotypes with high antioxidant activity. *J .Wheat Res*. **6**: 96-97.

4. DWRB-127 (IC0612434; INGR15004), a Two Rowed Barley (*Hordeum vulgare* L.) Germplasm Immune to Yellow Rust (*Puccinia striiformis* f. sp. *hordei*)

Vishnu Kumar*[1], RPS Verma[2], R Selvakumar[1], Dinesh Kumar[1], Jogendra Singh[1], AS Kharub[1] and Indu Sharma[1]
[1]*ICAR-Indian institute of Wheat & Barley Research (IIWBR), Karnal-132001, Haryana, India*
[2]*International Centre for Agricultural Research in the Dry Areas, Rabat, Morocco*
(Email: vishnupbg@gmail.com)

Barley is an ancient crop and fourth largest cereal in the world with a share of 5.5-6% of the global cereal production. It is mainly used for feed, food and malt production. Like other cereals, rusts are the most devastating diseases of barley. Notably, yellow rust is an invasive disease and caused by fungus, *Puccinia striiformis* f. sp. *hordei* in barley. It is wide spread in high input production conditions *i.e.* North Western Plain Zone (NWPZ) and with high to medium natural incidences in North Eastern Plain Zone (NEPZ). In India five races of barley stripe rust are known *i.e.* 57, 24, M, G and Q. Presently, yellow rust resistance sources are very limited in barley and existing cultivars with good resistance are being utilized into breeding programmes. Chemical controls for yellow rust are available, however, inbuilt resistance mechanism is eco-friendly and best tactics for sustainable agriculture coupled with high benefit ratio.

DWRB127 (BK1222) is an advance malt barley (two-row) high yielding genotype, which was developed by pedigree method (DWR45/DWR46) at DWR, Karnal. It was screened for disease reactions at multi-locations for consecutive two seasons *viz. rabi*, 2012-13 and 2013-14 under Initial Barley Disease Screening Nursery (IBDSN) and National Barley Disease Screening Nursery (NBDSN), respectively. During *rabi,* 2012-13, the genotype DWRB127 was evaluated at four locations namely, Bajaura, Durgapura, Dhaulakuan and Ludhiana and immune response (0 reaction) was observed for yellow rust under artificial inoculations (Anonymous, 2013). The check variety K551 exhibited susceptible

Table 1. Performance of DWRB127 and checks for yellow rust during *rabi*, 2013-14

2013-14	Yellow rust							
Genotypes	Bajaura	Dhaulakuan	Durgapura	Ludhiana	Karnal	Hisar	Almora	HS*
BK1222 (DWRB127)	0	0	0	0	0	0	0	0
Infector	80S	100S	100S	60S	80S	80S	60S	100S
BH902 (c)	0	20S	0	tS	0	0	5MS	20S
DWRB92 (c)	0	0	20S	tS	0	0	5MS	20S
DWRUB52 (c)	0	0	10S	0	0	0	0	10S
K551 (c)	30S	0	80S	5S	20S	20S	40S	80S

*HS-highest reaction

yellow rust reactions of 60S followed by BH902 (20S), DWRB92 (5S) *etc*. in same fields under NBDSN during *rabi*, 2012-13.

Similarly, during *rabi*, 2013-14, DWRB127 was again evaluated under artificial inoculation for yellow rust and was found immune (0) at Durgapura, Dhaulakuan, Karnal, Hisar, Almora, Ludhiana and Bajaura centres (Anonymous, 2014; Kumar *et al*., 2014) (Table 1).

All the check varieties showed susceptible reactions for yellow rust during *rabi*, 2013-14. The genotype DWRB127 is not only immune for yellow rust but also depicted very high 1000 grain weight (53.8g) and overall malting quality scores (23/30) after multi-location evaluation. Therefore, it can be concluded that DWRB127 is a high yielding valuable genetic resource for yellow rust resistance and as well as for 1000 grain weight and other malting quality traits, which would be gainfully utilized in future barley improvement programmes.

References

Anonymous (2013) Progress report of All India Co-ordinated Wheat & Barley Improvement Project 2012-13, Vol. VI, Barley Network. In: AS Kharub, Vishnu Kumar, Dinesh Kumar, R Selvakumar, Jogendra Singh, Anil Khippal, Satyavir Singh, Randhir Singh, Rekha Malik, Ajay Verma, RPS Verma and Indu Sharma (eds). Directorate of Wheat Research, Karnal, India, 327 p.

Anonymous (2014) Progress report of All India Co-ordinated Wheat & Barley Improvement Project 2013-14, Vol. VI, Barley Network, In: AS Kharub, Dinesh Kumar, Jogendra Singh, Vishnu Kumar, R Selvakumar, Anil Khippal, Rekha Malik, Ajay Verma, and Indu Sharma (eds). Directorate of Wheat Research, Karnal, India, 327 p.

Kumar V, RPS Verma, R Selvakumar, Dinesh Kumar, AS Kharub and Indu Sharma (2014) DWRB127: Yellow rust resistance barley with good grain characteristics. *Wheat & Barley Newsletter* (ISSN 0972-6071), **8**: 3-4.

5. CNA-405 (IC0613959; INGR15005), a Cotton (*Gossypium arboreum* L.) Germplasm with Narrow Leaf Lobes and Brown Lint

Punit Mohan*, BR Rode, KR Kranthi, Sujata Saxena, Ravi Nagarkar and V Santhy
ICAR-Central Institute for Cotton Research (CICR) Shankar Nagar, P.O., Nagpur-440010, Maharashtra, India
**(Email: punitmohan@gmail.com)*

A light brown linted genetic stock, CNA-405 (INGR 15005) of *Gossypium arboreum* was developed by pedigree selection. The unique feature of this genotype is that it possesses: staple length (26.3mm); fibre uniformity ratio (49 %); micronaire (4.3); fibre tenacity (19.2 g/tex) and fibre maturity (76 %). The genetic stock is characterized by okra leaf shape, yellow flower petal with presence of spot, yellow pollen colour, pigmented anther filament, green and ovate boll, pitted boll surface, pointed boll tip and light brown seed fuzz colour which are major DUS characters. The lint colour is light brown with good colour stability.

6. NRCSFR-07-5 (IC0611700; INGR15006), a Sorghum (*Sorghum bicolor* (L.) Moench.) Germplasm Resistant to Shoot Fly

C Aruna*, PG Padmaja, VR Bhagwat and JV Patil
ICAR-Indian Institute of Millets Research (IIMR), Rajendranagar, Hyderabad-500030, Telangana, India
**(Email: aruna@sorghum.res.in)*

Sorghum shoot fly, *Atherigona soccata* Rondani is one of the major pests that destabilizes the performance of sorghum cultivars and ultimately reduces sorghum production in many parts of the world. It causes damage to the late sown crop in *kharif* and early sown crop in *rabi.* The seriousness of the shoot fly problem in sorghum, combined with the high costs and toxicity hazards of using chemical control, renders it necessary to develop new varieties or hybrids that possess resistance to this pest. In order to incorporate resistance into sorghum parental lines, intensive breeding efforts were initiated at DSR, by crossing the elite parental lines with shoot fly resistant germplasm.

A series of crosses were made during 2003-2006 by using the elite parental lines and the shoot fly resistant sources from germplam such as IS18551, IS2312, IS2122 and RSE 03. The F_2 population was sown by mid July, so that the plants are exposed to sufficient shoot fly pressure. From F_3 onwards, selections were made in the shoot fly nursery where high pest population is build up. The seed of the resistant F_6 progenies was multiplied and the genotypes were tested in multilocation under AICSIP.

The line NRCSFR 07-5 is the derivative of one such cross involving 27B x IS 2122. This line was tested under AICSIP for 4 years (*Kharif* season of 2007 to 2010). NRCSFR 07-5 was observed to perform better than the elite parent, 27B which recorded 71.5% shoot fly deadhearts

The data on shoot fly eggs/ plant, flowering and plant height of this improved source of resistance is given Table 1. It showed less number of shoot fly eggs compared to its elite parent, 27B. The plant height is also less than the resistant check, IS18551 showing improvement in agronomy over the resistant check.

Table 1. Ancillary data of the improved sources of resistance for *kharif* across years in AICSIP trials

Genotype	Shoot fly eggs/ 5 plants	Days to 50% flowering	Plant height (cm)
NRCSFR 07-5	6.13	68	154.5
27 B	12.2	69	124.7
IS18551	5.7	78.4	220.4
DJ 6514	13.7	70.7	158.7
CD 5%	3.87	8.85	62.2
CV (%)	31.7	5.66	22.3

NRCSFR 07-5 with resistance and improved agronomy can be used as the source in the shoot fly resistance breeding program aiming at development of parental lines and genotypes with shoot fly resistance along with agronomic acceptability.

7. JI-258 (IC0611596; INGR15007), an Early Maturing Male Line of Castor (*Ricinus communis* L.) with Resistance to Wilt

Rajnikant H Kavani*, Rajesh Kumar Madariya and Keshavji L Dobariya
Main Oilseeds Research Station (MORS), Junagadh Agricultural University, Junagadh-362001, Gujarat, India
(Email: rhkavani@rediffmail.com)

Castor (*Ricinus communis* L.) is an important industrial non-edible oilseed crop grown in various countries throughout the world. Castor oil is used for number of industrial products. During the year 2014-15, the area under castor crop in India was 10.99 lakh ha, which contributed 13.51 lakh metric tonne production with a productivity of 1229 Kg/ha. Gujarat is the leading state in the country with respect to area, production and productivity of castor covering an area of 7.34 lakh ha with the production to 10.69 lakh tonne and average productivity of 1454 Kg/ha (Anonymous, 2015). Continuous cultivation of castor in the same areas has led to several fold increase in the occurrence of soil-born wilt disease caused by *Fusarium oxysporum* f.sp. *ricini* (Wr) Gordon. It is one of the major yield reducing factors in castor and cause 39-77% yield loss depending on the stage at which the plants wilt (Pushpavati, 1995). Chemical treatments are not efficient in controlling the disease (Siddaramaiah *et al*., 1980). Cultivation of wilt resistant cultivars was proved to be an effective strategy to minimize losses. There is a need for identification of diverse sources of resistance to wilt to sustain wilt resistance in castor since the existing wilt resistant cultivars are no more effective in controlling the disease as they showed moderate to high susceptibility (40-100% wilt incidence). This was because of utilization of the same source of resistance repeatedly in wilt resistance breeding programme.

The line JI-258 was developed by Junagadh Agricultural University, Junagadh using different sources for wilt resistant following pedigree selection in a segregating population of a double cross (SKP-92 x JI-85) x VP-1 x EC-97704). This genotype was found to be resistant in wilt sick plot at DOR, Hyderabad, SK Nagar and Palem during different years of testing and also early maturing with high yield potential. JI-258 was also found resistant reaction against most of the isolates of Fusarium wilt. The genetic stock has a potential to use in the heterosis breeding as a diverse source of Fusarium wilt resistance. The chief botanical and morpho-agronomic traits of JI-258 are given in Table 1.

Table 1. Chief botanical and morpho-agronomic traits of JI-258

Trait	JI-258
Stem color	Red
Bloom	Triple bloom
Capsule	Spiny
Nodes up to primary raceme	16
Internode type	Elongate
Days to 50% flowering	49
Plant height up to primary raceme	48 cm
Branching nature	Divergent
Interspersed staminate flower	Present
Spike compactness	Loose
Capsule size	Medium
100-seed weight	34-35 g
Seed color	Light chocolate
Seed mottling	Conspicuous (High)
Seed caruncle	Present

References

Anonymous (2015) Castor crop survey 2014-15. The Solvent Extractors Association of India.

Pushapavati B (1995) Role of *Fusarium oxysporum* f.sp. *ricini* (Wr) Gordon in castor wilt complex. Hyderabad, India: Andhra Pradesh Agricultural University, *M. Sc (Ag) Thesis.*107 p.

Siddaramaiah AL, SA Desai and RK Hegde (1980) A new collar rot disease of castor from India. *Curr. Sci*., **49**: 37.

8. RG 19 (IC0612166; INGR15008), an Extra-Early Maturity, Non-Spiny Castor (*Ricinus communis* L.) Germplasm

K Anjani

ICAR-Indian Institute of Oilseeds Research (IIOR), Rajendranagar Hyderabad-500030, Telangana, India

*(Email: anjani_kammili@rediffmail.com)

RG19 is an extra-early castor germplasm selection which flowers in 30 days and matures in 82 days after planting. It was selected in 1991 from a heterogeneous population of an exotic collection EC168752 introduced from Hungary. EC168752 segregated for low node number ranging from 5 to 14. Since node number is associated with days to maturity in castor, the plants having less than 10 nodes with similar morphological traits were selected from the source and the plants with 7-8 nodes were finally stabilized through pedigree selection for low node number. These plants were then bulked and the original ID No. RG19 was given to this bulk for maintaining as an extra-early maturing germplasm accession in castor germplasm repository. RG19 was further self-pollinated for seven generations to bring in genetic homogeneity for the unique trait. It has red stem with single bloom and elongated internodes. Its capsules are non-spiny, medium size, non-dehiscent and green in colour. It flowered and matured about 42 and 44 days earlier than the early check variety, DCS-9. It has 7-8 nodes on main stem. Its 100-seed weight was 23 g, and the yield realized at 120 days after planting was 67 g/plant and the total yield was 131 g/plant while these were 86 g/plant and 202 g/plant, respectively in the early check variety DCS 9 (Anjani, 2010)

References

K Anjani (2010) Extra-early maturing germplasm for utilization in castor improvement. *Ind. Crops Prod.* **31**:139-144.

9. VRP-500 (IC610501; INGR15009), a Garden pea (*Pisum sativum)* Germplasm with Triple Pods at Every Node

Satish Kumar Sanwal*, **Rajesh Kumar and B Singh**

ICAR-Indian Institute of Vegetable Research (IIVR), Shahanshahpur, Varanasi-221 305, Uttar Pradesh, India

(Email: satishsanwal@rediffmail.com)

In garden pea, most of the varieties/germplasm lines have single pod on each node while few varieties have double pod. But this is the first genetic stock which has triple pod on every node. Due to higher number of pods, the yield/ plant is just double than other pea varieties. Developing three pods per node increased yield over one pod and two pods per node (Gritton, 1986). This line was developed through hybridization between VRP-5 (single pod at each node and early in maturity) and PC-531 (double pods at each node and medium in maturity) followed by selection. Crosses were made in 2007 at research farm of Indian Institute of Vegetable Research (IIVR), Varanasi. Single plant selection was done in F3 generation and plant to row progeny was maintained. Now this line is almost homozygous and stable.

Morpho-agronomic characteristics: The plant height of VRP-500 varies from 130-137 cm with an average of 134.7 cm. It takes 52 days for days to 50% flowering. First flower appears on 13th node. First green pod harvesting can be done 70-75 days after sowing. Pods are 8-9 cm in length, green in colour and slightly curved and have 8-9 seeds/pod. Average yield/plant is 176-190 g and shelling percent is 48-49.

Associated characters and cultivation practices: VRP-500 is susceptible to powdery mildew but can escape if sowing is done from 25th October to 5th November. It is tolerant to leaf minor. Pea requires cold and dry climate while longer cold spell increases its yield. In north India, it is sown during October-November, while in hilly areas (Shimla), June-July is ideal sowing time. The optimum temperature for seed germination is about 22±2^{o}C, however, it can germinate up to 5^{o}C but at slow rate. Sowing should be done in lines at a spacing of 30 x 5 cm. Spraying of Stomp 30 EC (pendimethalin) @2.5 liter per ha within 72 hours of sowing checks weed population up to 30-35 days. Irrigation should be applied at flowering stage through sprinkler system. Harvesting of green pods must be done at a proper stage.

References

Gritton ET (1986) Pea breeding. In: MJ Bassett (ed.) *Breeding Vegetable Crops*, AVI Pub. Comp. Inc., Connecticut, USA.

Table 1. Morpho-agronomic characters of VRP-500

Characters/genotypes	VRP-500	Characters/genotypes	VRP-500
Plant height (cm)	134.7	Pod width (cm)	1.46
Days to 50% flowering	52	No. of pods/plant	22-24
First flowering node	13.0	10 pod weight (g)	80
Pod colour	Green	Seed/pod	8.0
Pod shape	Slightly curved	Yield/plant (g)	176-190
Pod length (cm)	8.2	Shelling percent	48.5

10. L-4602 (IC0595543; INGR15010), a Lentil (*Lens culinaris* Medikus.) Germplasm with Tolerance against Aluminium Toxicity under Low pH Conditions

Dharmendra Singh*, Harsh Kumar Dikshit, Dayachand and Dulichand
ICAR-Indian Agricultural Research Institute (IARI), Pusa Campus-110112, New Delhi, India
**(Email: dharmendrapbg@rediffmail.com)*

L-4602' is aluminium tolerant line developed at Indian Agricultural Research Institute, New Delhi, through hybridization followed by pedigree method involving parents L-830 and Precoz. The genotype is unique with respect to high level of tolerance to aluminium.

Morpho-agronomic characteristics: L-4602 produces light green foliage with erect and profuse branching. The plants are medium tall with light green leaf colour. The seeds are bold with light green testa and yellow cotyledons.

Associated characters and cultivation practices: Aluminium stress tolerant line 'L-4602' alongwith check were evaluated under hydroponic, soil culture and natural field conditions at four locations. The line 'L-4602' revealed higher root and shoot length, dry weight of root and shoot and seed yield/plant than check L-4076 under long term hydroponic and soil culture conditions. This line was also evaluated at various locations of Central Agricultural University, Imphal (Manipur) and ICAR Research Complex for NEH region, Basar centre (Arunachal Pradesh) during 2012-13 and 2013-14. 'L-4602' provided better yield than the check variety ('L-4076') under the most severe conditions (pH 5.0 and 5.1). Less retention of Al in roots of L-4602 restricting its transport to shoot suggests its efficient exclusion mechanism. The aluminium tolerance of 'L-4602' along with low accumulation of aluminium and callose makes it highly useful for incorporating aluminium tolerance in high yielding genotypes (Singh *et al.,* 2015). Standard agronomical cultural practices are required to raise the crop.

Reference

Singh D, HK Dikshit and A Kumar (2015) Aluminium tolerance in lentil with monogenic inheritance pattern. *Plant Breeding*, **134**: 105-110

11. CIAHZN-J (IC0598427; INGR15011), a Ber (*Ziziphus nummularia* (Burm. f.) Wight & Arn.) Germplasm with Low Moisture Stress Tolerance

PN Sivalingam, Dhurendra Singh, R Bhargava and SK Sharma
ICAR-Central Institute for Arid Horticulture (CIAH), Bikaner, Rajasthan, India
**(Email: pnsivalingam@gmail.com)*

Ziziphus nummularia is well distributed and growing as wild in Jaisalmer district, the north-western parts of Rajasthan where the average annual rainfall is less than 150mm (Pareek, 2001; Pandey *et al.,* 2010). The stones of CIAHZN-J were collected and tested for moisture stress tolerance and compared with *Z. nummularia* from Bikaner and Godhra (Gujarat), *Z. mauritiana* and *Z. rotundifolia.* Seeds of CIAHZN-J had 64 per cent germination at -0.5 MPa and it has ability to germinate at- 0.73 MPa. Whereas *Z mauritiana*, *Z. rotundifolia,* Z. *nummularia* from Bikaner and Godhra had 10, 28, 42 and 57 per cent germination, respectively at -0.5 Mpa. Increased root length from 10 to12 cm and the ratio of root dry weight to fresh weight was 0.5 found in CIAHZN-J genotype at 0.5MPa. Withdrawing water up to 15 days to three months old seedlings of CIAHZN-J genotype showed the average cumulating morphological stress rating of 3.0, maintaining relative water content of more than 60 %, downward rolling of leaves and maintaining membrane stability at normal level during stress are the unique features of this genotype. Stomatal conductance of CIAHZN-J was 256.5 mmol/m^2/sec, proline level was increased by 35 fold and catalase increased by two fold during stress compared to control. Other genotypes reached average cumulating morphological stress rating of 3.0 lesser than 15 days and increased proline level by 10-25 fold during stress compared control. This genotype has very higher tolerance to moisture stress compared *Z. mauritiana* and *Z. rotundifolia*.

References

Pandey A, R Singh, J Radhamani and DC Bhandari (2010) Exploring the potential of *Ziziphus nummularia* (Burm. f.) Wight et Arn. from drier regions of India. *Genet. Resour. Crop Evol.* **57:** 929-936.

Pareek OP (2001) Ber. International Centre for Underutilized Crops, Southampton, UK, p 290.

12. Sel-13 (IC0610821; INGR15012), a Makhana (*Euryale ferox* Salisb.) Germplasm with Bold Seeds (Seed Diameter: 14 mm). Highest 100-Seed Weight (141g)

Lokendra Kumar
ICAR-RCER Research Centre for Makhana (RCM), Darbhanga-846005, Bihar, India
*(Email: dr.lokendrakumar@yahoo.com)

In makhana, the size and color of lawa (popped seeds) are the two main criteria of its market value (Choudhary *et al.,* 2003).The bigger and white lawa is considered the best one while the small and yellowish one is the poorest in its marketing. In this way, bold seeded genotypes of makhana are highly desirable as they are more remunerative for farmers.

Morpho-agronomic characteristics: The seeds of Sel-13 genotype are bold in size (13.47 mm) and deep black in colour (Table1). Leaves are large (142.30 cm) and green. The number of fruits/plant is low (10.25) but their size is large (7.20cm). The number of seeds /fruit is medium (42.50). Bigger size of seeds is a highly desirable trait in makhana crop. Owing to this trait, the line can be utilized as a potential material for incorporating the bold seeded trait in makhana crop.

Table 1. Descriptor and descriptor state of Sel-13 (IC0610821) genotype of makhana (average over 4 years)

Descriptor	Descriptor state
Days to seedling emergence	37.25
Seedling vigor	High
Leaf shape	Orbicular
Leaf diameter	142.3cm
Flower size	Large
Flower color	Purple
Days to 50% flowering	133.75days
Fruit shape	Spheroid
Fruit color	Whitish brown
Status of fruit prickles	Dense
Size of fruit prickles	1.3 cm
Fruit diameter	7.20cm
Number of seeds/fruit	2.50
Number of fruits/plant	10.25
Seed yield /fruit	55.72 g
Seed yield /plant	580.62 g
Seed color	Deep black
Seed shape	Spherical
100-seed weight	134.97 g
Seed diameter	13.47 mm

Reference

Choudhary JN, Om Prakash, PK Jha and ON Jha (2003) Economic analysis of production and marketing of Makhana in Bihar. *In:* RK Mishra, Vidyanath Jha and PV Dehadrai (eds.) *Makhana.* Indian Council of Agricultural Research, New Delhi, India, pp 107-123.

13. Sel-14 (IC0610822; INGR15013), a Makhana (*Euryale ferox* Salisb.) Germplasm with Irregular Seed Shape (mutant), Large Fruit Size (Fruit Diameter: 8.1 cm). Highest Number of Seeds/Fruit (139)

Lokendra Kumar
ICAR-RCER Research Centre for Makhana (RCM), Darbhanga-846005, Bihar, India
(Email: dr.lokendrakumar@yahoo.com)

Makhana is an important plant of low land ecosystem of north Bihar, West Bengal, Assam, Manipur and Orissa. Matured seeds are the most economic part of makhana which are transformed into their popped form for its utilization as a dry fruit commodity (Jha and Barat, 2003) .The seed yield of makhana is determined by various traits, such as, fruit diameter, number of fruits per plant, number of seeds per fruit, number of seeds /plant, seed size and 100-seed weight (Kumar *et al.,* 2011).

Morpho-agronomic characteristics: In contrast of round seeds (normal shape), the seeds of sel-14 genotype are irregular in shape and deep black in colour (Table1). Leaves are large and green. The diameter of fruits is large (7.9cm) and number of seeds per fruit is high (1507.7). Fruits are covered with sharp and dense green prickles. Large fruit size and high number of seeds per fruit is the two main components of seed yield in makhana. These two desirable attributes may be exploited for development of high yielding genotypes of makhana. Further, this genotype is very peculiar due to its seeds' shape (irregular shape). Owing to this trait, this genotype may be utilized for inheritance study of seed shape in makhana crop.

Table 1. Descriptor and descriptor state of Sel-14 (IC0610822) genotype of makhana (Mean over 4 years)

Descriptor	Descriptor state
Days to seedling emergence	51.75
Seedling vigor	High
Leaf shape	Orbicular
Leaf diameter	144.52cm
Flower size	Large
Flower color	Purple
Days to 50% flowering	162.0days
Fruit shape	Spheroid
Fruit color	Brownish
Status of fruit prickles	Dense
Size of fruit prickles	1.5 cm
Fruit diameter	7.92cm
Number of seeds/fruit	129.75
Number of seeds /plant	1507.75
Number of fruits/plant	11.75
Seed yield /fruit	73.92g
Seed yield /plant	878.05g
Seed color	Black
Seed shape	irregular
100-seed weight	59.6 g
Seed diameter	6.0 mm

References

Jha V and GK Barat (2003) Nutritional and medicinal properties of *Euryale ferox* Salisb. *In:* RK Mishra, Vidyanath Jha and PV Dehadrai (eds.) *Makhana.* Indian Council of Agricultural Research, New Delhi, India, pp 107-123.

Kumar L, VK Gupta, BK Jha, IS Singh, AK Singh and BP Bhatt (2011) Status of Makhana (*Euryale ferox* Salisb.) cultivation in India. ICAR-RCER, Patna, *Technical Bulletin* No.R- 32/ PAT-21. 31p.