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Plant Germplasm Registration Notice*

The Plant Germplasm Registration Committee of ICAR in its XXXVth meeting held on September 1st, 2016 at the ICAR-National Bureau of Plant Genetic Resources, New Delhi approved the registration of following 14 germplasm lines out of 40 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. HI KK1 (NP4+*Lr1*) (IC0620368; INGR16024); HI KK2 (NP4+*Lr2a*) (IC0620369; INGR16025); HI KK3 (NP4+*Lr2c*) (IC0620370; INGR16026); HI KK4 (NP4+*Lr3a*) (IC0620371; INGR16027); HI KK5 (NP4+*Lr9*) (IC0620372; INGR16028); HI KK6 (NP4+*Lr10*) (IC0620373; INGR16029); HI KK7 (NP4+*Lr15*) (IC0620374; INGR16030); HI KK8 (NP4+*Lr17a*) (IC0620375; INGR16031) and HI KK9 (NP4+*Lr20*) (IC0620376; INGR16032) Wheat (*Triticum aestivum*) Lines Locally Adapted to Host Differentials for Indian Pathotypes of Wheat Leaf Rust (*Puccinia triticina*)

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Leaf rust caused by *Puccinia triticina* Eriks. (*Pt*) is most common among three rust diseases of wheat (*Triticum aestivum* L.). Leaf rust differentials being used in India consist of sets 0, A and B (Nayar *et al.*, 2001). Majority of the leaf rust differentials in set 'A' and most varieties in set 'B'are winter types, which require a long photoperiod for flowering. Hence, maintenance of these differentials is difficult, particularly in the plains of India due to their long duration and often there is either seed set failure or production of shriveled grain. Hence, need was felt for developing near-isogenic *Lr* lines in the background of a locally adapted variety. NP 4 was selected as a background parent which is not known to carry any *Lr* gene or suppressor factor (Kaushal *et al.,* 1982) for leaf rust resistance, and being early maturing, slow rusting, lodging-tolerant, non-shattering, heat and drought tolerant and bold seeded variety. Hence, a back cross programme was initiated in 1997-98 for transferring the *Lr1, Lr2a, Lr2c, Lr3a, Lr9, Lr10, Lr15, Lr17a* and *Lr20*genes into NP 4 background. Tc-backcross lines carrying the target *Lr* genes *viz*., RL 6003 (Tc+*Lr1*), RL 6016 (Tc+*Lr2a*), RL 6047(Tc+*Lr*2c), RL 6002 (Tc+*Lr*3a), RL 6010 (Tc+*Lr*9), RL6004 (Tc+*Lr*10), RL 6052 (Tc+*Lr*15), RL 6008(Tc+*Lr*17a) and RL 6092 (Tc+*Lr*20) were used as donors. Six backcrosses were attempted followed by intense selection during each generation for selecting NP 4 plant type (awnless spikes and pubescent glumes) coupled with resistance phenotype of the target gene. Leaf rust pathotype (pt) 12-2 (1R5) was used for selecting resistant plants carrying singly the genes *Lr1*, *Lr2a*, *Lr15*; pt 12-5 (29R45) for *Lr*9, *Lr10*, *Lr20*; pt 17 (61R24) for *Lr2c, Lr3a* and pt 107 (45R3) for *Lr17a*.

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Table1. Comparison of seedling infection types (at 16-20ºC) to selected avirulent leaf rust pathotypes of the newly developed near-isogenic lines (HI KK 1-9) with the corresponding donor *Lr* lines (RL Nos.) and the recurrent parent NP 4

Wheat genotypes	Seedling infection type[1]	A virulent leaf rust pathotypes used for testing
HI KK 1 (NP4+*Lr1*)	0;	11, 12, 12-2, 12-1, 12-3, 12-5, 63, 106, 12-8, 162-1, 162A
RL 6003 (Tc+*Lr1*)	0;	
NP 4	3+	
HI KK 2 (NP4+*Lr2a*)	0;	2 11, 12, 12-2, 12-3, 12-5, 12-8, 17, 63, 104-2, 106
RL 6016 (Tc+*Lr2a*)	0;2+	
NP 4	3+4	
HI KK 3 (NP4+*Lr2c*)	0;1	16, 16-1, 17, 77-9, 77-10, 77-11
RL 6047 (*Lr2c*)	0;1	
NP 4	3+	
HI KK 4 (NP4+*Lr3a*)	0;	17, 20, 104-1, 106, 107, 108, 108-1
RL 6002 (*Lr3a*)	0;	
NP 4	3+	
HI KK 5 (NP4+*Lr9*)	0;	11, 12-5, 16, 17, 63, 77-5, 77-9, 77-11, 104-2
RL 6010 (*Lr9*)	0;	
NP 4	3+	
HI KK 6 (NP4+*Lr10*)	;2	10, 12-2, 12-5, 63, 77, 107, 107-1, 162-3
RL 6004 (*Lr10*)	;2	
NP 4	33+	
HI KK 7 (NP4+*Lr15*)	0;	10, 11, 20, 63, 104-4, 106, 107, 107-1, 108, 108-1
RL 6052 (*Lr15*)	0;	
NP 4	3+	
HI KK 8 (NP4+*Lr17a*)	0;2	10, 12, 12-1, 12-3, 63, 106, 107, 107-1
RL 6008 (*Lr17a*)	0;2+	
NP 4	33+	
HI KK 9 (NP4+*Lr20*)	;1	10, 12-1, 12-2, 12-3, 77-4, 77-6, 104-2, 104B, 162-2, 162-3
RL 6092 (*Lr20*)	;1	
NP 4	3+	

[1]As described by Roelfs *et al*., (1992)

The lines developed were seedling tested with several a virulent pathotypes for confirming homozygosity for target *Lr* gene (D.R. Knott, Pers. comm.).

Close similarity between seedling infection types of the newly developed backcross lines and the corresponding donor lines confirmed successful transfer of the target *Lr* genes in NP 4 background (Table 1).

Homozygous resistant lines carrying singly nine genes *viz*., *Lr1, Lr2a, Lr2c, Lr3a, Lr9, Lr10, Lr15, Lr17a* and *Lr20* have been developed. These near-isogenic lines having early maturity and other desired agronomic traits of NP4 are easy to maintain under Indian conditions, and hence, should be widely useful for virulence analysis and genetic studies.

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2. TCP129 (IC0615165; INGR16033), a Turmeric (*Curcuma longa*) Genotype, Highly Tolerant to *Colletotrichum* Leaf Spot and *Taphrina* Leaf Blotch Diseases

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Turmeric crop (*Curcuma longa* L.) is affected by two major diseases caused by *Colletotrichum* leaf spot (Reddy *et al.*, 1963) and *Taphrina* leaf blotch (Rao, 1995). The genotype TCP129 (IC0615165; INGR16033) is found to have unique characters having highly tolerant to leaf blotch (*Taphrina maculans* L.) (PDI-12.78) and leaf spot (*Colletotrichum capsici* L.) (PDI-7.26)diseases. TCP 129 (IC0615165) was collected from Gairkata (26.69 ºN and 89.03 ºE, alt. 98 asl) in Jalpaiguri district of West Bengal in the year 2001. Co ordinated Varietal Trials (CVT) under AICRP on Spices (IISR, Calicut) were taken up from 2013 to 2016 for resistance to leaf spot and leaf blotch foliar diseases along with local and national check in this region. Breeding of turmeric was done by clonal selection. The investigation was done in Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar, West Bengal.

Table 1. Average performance of TCP-129 (IC0615165, INGR-16033)

Genotype	Germi nation (%)	Leaf Blotch (PDI)	Reduction Over local check	Reduction Over National check	Leaf Spot (PDI)	Reduction Over local check	Reduction Over National check	Yield (3m2) (kg/plot)	Projected Yield (t/ha)
TCP-129	98.06 (78.69)	12.78 (20.87)	46.48	55.17	7.26 (15.47)	70.03	42.24	14.34	28.91
TCP-2 Local check	95.44 (72.63)	23.88 (29.49)	-	-	24.23 (29.31)	-	-	7.36	14.84
Prativa National check	95.46 (72.66)	28.51 (32.27)	-	-	12.57 (20.76)	-	-	7.56	15.24
SEm(±)	2.37	0.92			1.28			0.77	
C.D.	4.73	1.92			2.57			1.45	
C.V.(%)	15.18	13.85			10.08			15.56	

(Figures in the parenthesis are angular transformation values)

Morpho-agronomic characteristics: It has long plant height (100.93cm.), few number of shoots (2-4), petiole length intermediate, lamina length long, width broad, pseudostem habit open, leaf disposition erect and leaf margin wavy. Mother rhizome was found (1-3), dry recovery (%) high (23.75%), rhizome habit intermediate, rhizome shape straight, tertiary rhizome present. Rhizome yield per plant was 206.28gm. yield per plot (Kg/3m^2) 14.34kg/plot, projected yield 28.91t/ha (Table 1).

Associated characters and Cultivated Practices: Curcumin (3.8%), Oleoresin (9.08%), essential oil content (7%). It was found highly resistant to leaf spot (PDI-7.26) and leaf blotch (PDI-12.78) diseases (Table.1) . Cultivation practices should be done having bed size: 3m ×1 m with spacing 30 (row to row) and 20 cm plant to plant. FYM was given prior to sowing in February- March at the rate of 2-5t/ha. Sowing was done in April-May and area of adaptation of this genotype was found in West Bengal, Uttar Pradesh, Bihar, Kerala, Himachal Pradesh, Telangana, Gujarat and Tamil Nadu.

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3. RILHF-2 (IC0616051; INGR16034), a Pea Germplasm Highly Resistant to Rust (*Uromyces fabae* Pers. de-Bary)

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Pea rust caused by *Uromyces fabae* Pers. de-Bary is a major disease of pea in tropical and sub-tropical regions of the world. Under favorable condition (warm and humid weather) the rust disease causes substantial yield losses and it may result in complete loss in yield under prolonged epidemic conditions.

RILHF-2 was developed from the cross between pea genotypes HUVP 1 (susceptible) and FC 1 (resistant) at the Agriculture Research Farm, Banaras Hindu University, Varanasi, India. Two hundred fifty single F_2 plants were harvested separately in 2000-01, seeds from each of the 250 F_2 plants were planted in bulk in the Rabi season of 2001-02, and the later generations i.e. F_4, F_5 and F_6 generations were raised following single seed descent method in successive years (Singh *et al.*, 2012). Each progeny was planted in a single row of 2.0 m and the spacing was kept at 40 × 10 cm. A highly rust susceptible check i.e., HFP-4 was planted after every 10th row and also at the borders surrounding the experiment as spreader row for uniform disease

expression in the field subsequent to artificial inoculation by spore suspension (Singh *et al.*, 2012). The data were recorded on five randomly chosen plants from each F_6 progeny for disease severity scored at three different dates. Each F_6 plant progeny was separately harvested in bulk to obtain $F_{6:7}$ seeds.

Single plant progenies were evaluated for rust disease in the field during 2005-06, 2006-07 and 2007-08 as $F_{6:7}$, $F_{6:8}$ and $F_{6:9}$ generations. Among progenies, the RILHF-2 was found to be highly resistant to pea rust on the basis of above three years of initial field screening conducted at Banaras Hindu University, Varanasi. Seed of RILHF-2 was sent for multi-location rust screening at hot spots across India during 2008-09 and 2009-10 under AICRP on MULLaRP. On the basis of performance, it was recommended to be included in 'National genetic Stock Nursery' (NGSN). The RILHF-2 is a tendril-less genotype with normal stipule. It matures in 120 days and has the seed weight of 20.10 g/100-seed. The major components of slow rusting are longer latent period, lesser pustule size and lower infection frequency (Singh *et al.*, 2015). RILHF-2 possibly possesses these components of slow rusting thereby imparting higher resistance to rust disease, thus it will serve as a donor parent for rust resistant breeding programme in pea.

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4. UUHF/ACM/Garlic-11-1 (IC0598236 (INGR16035), a Garlic (*Allium ampeloprasum* var. *ampeloprasum* L.) Genotype with Bolder Size of Bulbs, Bears Umbels with Micro-Cloves, Suitable for Cultivation in Frost Prone Hills

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A few plants of great headed garlic were found as admixture in the garlic samples collected by the Department of Vegetable Science, Uttarakhand University of Horticulture and Forestry, Ranichauri Campus, Tehri-Garhwal from different areas of the district. The selected material was clonally multiplied and evaluated for different morpho-agronomic and tuber yield and quality traits over the years. The genetic material IC0598236 was identified as *Allium ampeloprasum* var. *ampeloprasum*L. (great headed garlic, levant garlic or elephant garlic) on the basis of longer, dark green, broad and leathery leaves, bigger size of bulbs weighing 70-75 g composed of 10-12 cloves (6-8 g each) and terminal umbel consisting of a large number (150-175) of micro cloves (Brewster, 1994 & 2008; Mishra, 2016). The geographical distribution of great headed garlic is confined to restricted areas of South-western England and France (Bohanec *et al.*, 2005). Occurrence of this *allium* in India though has not been documented so far was probably because of old introductions from European countries. The umbels consist of sterile stamens and ovaries. The ovaries owing to storage of food materials behave as vegetative propagules in the form of micro-cloves/bulbils. The bulbils or micro-cloves have ability to sprout and develop new plantlets. However, the bulbs produced as a result of planting these plantlets, were not comparable in size to those obtained from the crops raised from commercial cloves and therefore, commercial bulbs could not be obtained from the micro-cloves in the same year. The miniature bulbs (weighing 12-15 g) produced from transplanting the micro-clove grown plantlets also consist of 10-12 tiny cloves (miniature cloves). Raising crop by planting miniature cloves, however, exhibited almost *at par* bulb yield with comparable size and compactness to those produced from commercial cloves (Mishra and Pandey, 2015). By sowing 8-10 kg of micro-cloves/bulbils of great headed garlic in nursery beds, sufficient quantity of plantlets can be produced to plant one hectare area at 10x10 cm spacing and about 54-65 q of miniature bulbs can be harvested. Thus, miniature cloves separated from miniature bulbs could be used as planting material at the

S.No.	Name of the genotypes	Bulb weight (g)	10 Clove weight (g)	Total soluble solids (%)	Dry matter content in cloves (%)	Marketable bulb yield (q/ha)
1.	*A. ampeloprasum* var. *ampeloprasum* L. (IC0598236)	66.8	64.4	41.9	46.8	250.32
2.	*A. sativum* L. (Agrifound Parvati)	30.03	31.03	39.3	46.1	160.05
3.	*A. sativum* L. (Ghansali Local)	34.1	36.13	44.3	56.2	119.71
	CD at 5%	3.8	4.7	2.4	3.2	15.9
	CV (%)	13.6	11.8	5.6	7.9	14.6

rate of 1.5 q/ha for raising commercial crop in against higher seed rate of commercial cloves (8.0 q/ha).

The experimental trials on great headed garlic were conducted by planting the cloves at 20x10 cm spacing during second fortnight of October cloves of the years 2012-13, 2013-14, 2014-15 and 2016-17. The crop was supplemented with manures @ 15 t/ha and NPK @ 100:80:60 kg/ha. For maintaining proper soil moisture, the crop was irrigated by sprinkling water as and when required. Mulching with dried grasses was also done to conserve soil moisture and keep the field free from weeds. The bulbs were harvested during first fortnight of May.

The data averaged over four years (2012-13 to 2015-16) indicated that the marketable bulb yield in IC0598236 was 250.32 q/ha which was considerably higher than that in checks Agrifound Parvati (160.05 q/ha) and *Ghansali Local* (119.71 q/ha), cultivars of *Allium sativum* L. The cloves of IC0598236 have TSS as high as 41.9% in against 39.3% in *Agrifound Parvati* and 44.3% in *Ghansali Local*. Similarly, bulb and clove weight were also found to be much higher in IC0598236 (66.8g and 6.4g, respectively) as compared to Agrifound Parvati (30.03g and 3.1g, respectively) and Ghansali Local (34.1 g and 3.6 g, respectively). The dry matter content of the cloves was found to be 46.8% in IC0598236 at par to *Agrifound Parvati* (46.2%), however, *Ghansali Local* registered quite higher dry matter content in cloves (56.2%) as given in the Table:

The great headed garlic genotype IC0598236 was found to be tolerant to foliar diseases like purple blotch and downy mildew. However, incidence of root rot is realized during prolonged, high soil moisture conditions. There was no conspicuous infestation of common pests in alliums of temperate hills. This species is also tolerant to severe and prolonged frost. About 10-12 cloves are loosely arranged on a hydroscopic basal plate and covered with two layers of papery sheath (Fig.1B). Larger inherent interspaces between cloves and enlargement of basal plate during *Monsoon* further widen the same and this inclusively lower the storability of bulbs beyond the month of October.

The studies indicated that the great headed garlic genotype IC0598236 with Registration No. INGR16035 had almost 36% higher bulb yield as compared to *A. sativum* cultivars. The IC0598236 was also promising in respect of bulb weight, TSS, dry matter content in cloves and tolerance to diseases, insects and frost as compared to commercial cultivars of *A. sativum*. Owing to number beneficial traits, *A. ampeloprasum* var. *ampeloprasum* genotype IC0598236 holds the potential as a commercial crop in western Himalaya.

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5. NAIP (PB)-01 TCR W390 (IC0599974; INGR16036), a Musk Mallow (*Abelmoschus moschatus* subsp. *moschatus* × *A. moschatus* subsp. *tuberosus*) Perennial Germplasm with Bright Red Flower

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Two infra-specific taxa of *Abelmoschus–A. moschatus* subsp. *moschatus* and *A.moschatus* subsp. *tuberosus* were hybridized to produce an ornamental hybrid. The hybrid can be easily produced by hand pollination and F_1 can be propagated through stem cuttings. The hybrid has perennating tap roots which makes it flourish for many years. Year round cultivation and flowering under equatorial climate has been observed. The hybrids came to flowering within 50-55 days after sowing. The progenies were intermediate between the parents for most of the quantitative traits but exceptional for bright red flower colour, big petal size, prolificacy and extended flowering span which makes it a worthy candidate for ornamental horticulture. Compared to parents, long flowering span exceeding 9 months was observed in the F_1 hybrids. On an average, the potted hybrid produced 20 primary branches with 5-6 flowers per day. Flowers open fully by about 8.00 am and remain till sunset. Flowers can also be kept as cut flower for around 8-10 hours in indoor. Rooted cuttings and seedlings can be used to raise beds which offer a contrasting canopy of red and green on borders and back grounds of gardens and parks.

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6. IC0560611 (IC0560611; INGR16037), a Jasmine (*Jasminum malabaricum*. Wight) Germplasm with High Concrete Recovery (0.375%) and Higher Percentage (17%) of Esters Group of Volatiles

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Jasmine is an important traditional flower crop belonging to the family Oleaceae. In, India it is grown for different uses which includes traditionally for loose flowers, gardening purpose, making garlands and for the extraction of concrete and absolute and essential oils, used in high grade perfumery industry. It is the major flower crop of Southern parts and also grown in some of the northern parts of the Country. *Jasminum malabaricum* germplasm (IC0560611)is unique because of its high concrete recovery (0.375%) with significantly higher percentage (17%) of esters group of volatiles in flowers. It was collected from northern parts of Western Ghats and successfully domesticated at IIHR, Bengaluru, Karnataka (13^{o} 58' N Latitude, 78^{o}E Longitude and 890 m above mean sea level) (IIHR Annual Report, 2012-13).

Morpho-agronomic characteristics: It is a large climber and responds well to pruning with opposite membranous leaves, which are broadly ovate in shape. Flowers are white in colour with slightly pinkish corolla and up to 6cm long and 3cm wide at the mouth. Flowers have 6-8 petals of 1.8 to 2.3 cm in size. And corolla is pinkish in colour. Number of flowers per cyme varies from

60-80. Flowers are born in cymes and bloom from February to May and sets seeds which are very rare in the jasmine species.

Associated characters and cultivated practices: *Jasminum malabaricum* germplasm (IC0560611) produces high concrete recovery (0.375%) with significantly higher percentage (17%) of esters group of volatiles in flowers. There are only three species which are commercially exploited for this purpose. New species with high concrete recovery can boost the perfumery industry. Therefore *Jasminum malabaricum* has a potential for commercial flower production and can be used in future breeding programmes. *Jasminum malabaricum* grows well in well drained rich sandy loam soils. The ideal conditions for successful cultivation are warm summer with ample water supply and sunny days.

Table 1. Evidence of Esters present in *Jasminum malabaricum*

Name of the Compounds	K.I.*	*J.malabaricum*
Esters		
2-Hexenyl propanoate	1111	8.299
Benzyl ethanoate	1168	0.150
Hexyl butanoate	1190	0.082
Methyl salicylate	1198	0.695
Hexyl 2-methylbutanoate	1237	0.897
Ethyl salicylate	1270	0.007
Sabinyl acetate	1298	0.156
(Z)-3-Hexenyl pentanoate	1308	0.082
Isobutyl benzoate	1322	0.140
cis 3-Hexenyl tiglate	1324	3.880
Hexyl tiglate	1351	0.627
Butyl benzoate	1352	0.288
Isoamyl benzoate	1422	0.472
cis-3-Hexenyl Benzoate	1570	0.545
Phenyl benzoate	1668	0.382
5-Hydroxypentyl benzoate	1708	0.463
Methyl hexadecanoate	1926	0.116
Ethyl hexadecanoate	1975	0.015
		17.182

*Kovat index

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