



Vol. 34 No. 1

Quarterly

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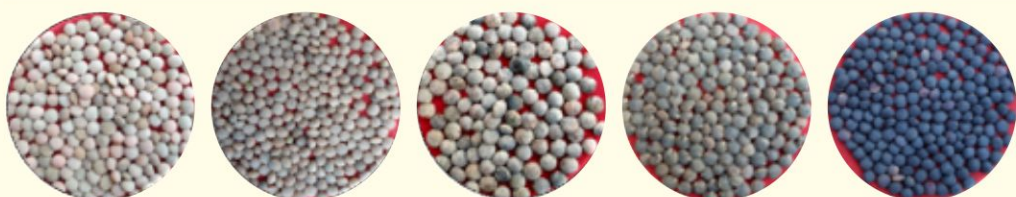
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### Lentil germplasm characterization

A total of 2,314 accessions of lentil conserved in the National Genebank (NGB) was characterized at NBPGR new area farm, New Delhi during *rabi* 2017-18. This includes 518 exotic accessions and 1,796 indigenous collections, which were studied for 17 qualitative and seven quantitative characters. Variability was observed for early plant vigour, early flowering, plant height, number of secondary branches, number of pods per plant, biomass, seed colour and other yield attributing characters while pod pigmentation and number of seeds per pod were less variable. Trait-based sets were identified as per current breeding needs, viz., early maturity with high biomass, and erect nature with lodging resistance. Some accessions with pod formation 25 cm above ground level were identified for mechanical harvesting.



Top: Field view of lentil germplasm; Middle left: IC201722 with high biomass (marked); Middle right: IC60969 with 51 secondary branches; Bottom: Variability in seed shape, colour and testa pattern

## PGR ACTIVITIES

### EXPLORATION AND GERmplasm COLLECTING

An exploration conducted for grain legumes by HQ in Gomati, South Tripura, Khowai and Dhalai districts of Tripura resulted in 51 germplasm collections, including *Cajanus cajan* (10), *Dolichos lablab* (4), *Vigna mungo* (11) and *V. radiata* (1). In pigeonpea, variability for seed shape, size and colour were observed among the collections, including two landraces *khaglang* and *orhor*. It was found that immature fruits are being utilized as a vegetable in the surveyed areas. Variability for seed shape and size was captured in black gram collections.

Another exploration was undertaken by HQ for drought-tolerant wheat and other *rabi* crops germplasm from Shivpuri and Guna districts of Madhya Pradesh and Baran district of Rajasthan. A total of 123 accessions was collected, with 27 being wheat (8-durum wheat). Other salient crops/crop-groups collected were barley (7), chickpea (8), pea (6), faba bean (6), seed spices (11), and crop wild relatives (10).



Tribal women selling vegetable-type pigeonpea in South Tripura

### Exploration in Great & Little Nicobar

An exploration and collection trip was undertaken by RS, Thrissur and HQ in collaboration with ICAR-CIARI, Port Blair in Great Nicobar Biosphere Reserve for 23 days. Pockets rich with plant genetic resources (PGR) like Mount Thullier, Galathea, E-W road, Afra Bay, and the *Nicobari* hamlets like Makachua, Pilopunja and Pilobao were explored and a total of 92 samples was collected. For the first time, Little Nicobar was explored. Crop wild relatives of spices, tuber crops and tropical fruits like *Amorphophallus hirsutus*, *Curcuma rubescens*, *Dioscorea glabra*, *D. piscatorum*, *Garcinia nervosa*, *Musa indandamanensis*, *Myristica andamanica*, *Horsfieldia glabra*, *Knema andamanica*, *Mangifera camptosperma*, *M. nicobarica*, *Piper pedicellosum*, *P. betle* (wild), *Cinnamomum bejolghota*, *Vigna marina*, etc. were collected. Some unique collections include a primitive brinjal (JPJ/18-60); *Alpinia conchigera* (JPJ/18-58), used as spice; *Dioscorea piscatorum* (JPJ/18-72) and *Gossypium barbadense* var. *acuminatum* (JPJ/18-66). Documentation of species of PGR importance, their phenology, locality of occurrence and herbarium was made for fine grid explorations in the near future. Part of the germplasm was being established in ICAR-CIARI as a safe duplicate.



A. Exploration in Great Nicobar; B. Fruits of *Myristica andamanica*; C. Tuber of *Dioscorea piscatorum*

Another exploration trip was undertaken by RS, Akola for collecting *madhunashni* (*Gymnema sylvestre*) germplasm from Betul, Seoni, Balaghat and Chhindwara districts of Madhya Pradesh in collaboration with ICAR-DMAPR, Anand. Collected accessions (17) were from different sources, viz., eight from forests, six from field boundaries, two from private nursery and one from kitchen garden. Pandervani jungle (Bahamn Dehi) in Seoni dt. was observed to have a good population of this species under natural conditions.



Follicle dehiscence in *Gymnema sylvestre*

A survey was conducted by BC, Cuttack for identification of the unique jackfruit germplasm bearing two crops a year in Kolebira block of Simdega district of Jharkhand in collaboration with KVK, Simdega. Five such germplasm and one early type were earmarked for follow-up, besides recording their basic morphological data. Also, two unique tamarind germplasm namely sweet tamarind (*meethi imali*) and a long-fruited (24 cm) tree were identified and marked. It was observed that the surveyed areas exhibited tremendous diversity in tropical minor fruits and systematic exploration needs to be undertaken.



## GERMPLASM EXCHANGE

### Import

A total of 5,089 accessions comprising various crop plants was imported from 16 different countries. Promising accessions were:

**Safflower:** salinity tolerant, high yielding and resistant to *Phytophthora* rot from USA (EC 938657-712); **Seabuckthorn:** superior quality and the best tasting berries from Russia (EC935319-20); **Siraitia:** best known for fruit extract which is about 300 times sweeter than sugar and used as a natural sweetener in China for ages, apart from use in traditional Chinese medicine (EC938819).

### Export

Thirty samples of wheat were sent to UK.

### National Supply

A total of 9,644 samples of various crops was supplied to different institutes/ researchers/ users in the country with Material Transfer Agreement.

## PLANT QUARANTINE

A total of 11,756 samples of imported germplasm, including transgenics was processed (HQ-6,734; Hyderabad-5,022) for quarantine clearance. Out of these, 1,343 samples were found infected/infested with various kinds of pests (fungi-1,293; bacteria-11; insects-5; weeds-2; nematodes-32). Out of the total infected/infested samples, 1,337 were salvaged and released to the indents, while six accessions of maize were detained due to heavy mold infection. Various types of prophylactic as well as curative treatments were given to the imported germplasm as per the need. In addition to import, 10,441 samples were released for export and 24 phytosanitary certificates were issued.

Pathogens intercepted from imported samples include *Alternaria brassicicola* in cabbage from The Netherlands; *Lasiodiplodia theobromae*, *Colletotrichum dematium*, *Pestalotia macrotricha* and *Diplocladiella scaroides* in bittergourd from Thailand; *Pestalotia* sp. and *Lasiodiplodia* sp. on maize from Zimbabwe and Thailand respectively; and *Stemphylium* sp. on sorghum from Egypt.



Interception of *Colletotrichum dematium* on bitter melon seed from Thailand

Immature stages of a bruchid were found in mungbean imported from Afghanistan. Besides, white tip nematode, *Aphelenchoides besseyi* was intercepted in rice seeds imported from The Philippines and Vietnam. Other important

nematode interceptions were *Pratylenchus* spp., *Meloidogyne* spp. and *Tylenchorhynchus* spp. in seabuckthorn germplasm imported from Russia. Tomato germplasm imported from USA was found contaminated with weeds, *Brassica tournefortii* and *Polygonum cuspidatum* (a quarantine weed), which were salvaged by mechanical cleaning.

A total of 17,631 wheat samples, which had been released to indenters on undertaking and grown at indenters' site, was inspected for the presence of quarantine pests/pathogen.

### Seed health testing

Seed health testing of 3,823 samples of indigenous germplasm was done for pest-free conservation in NGB. Out of these, 1,173 samples were found infected/infested (insect-832; fungi-216; weeds-14; nematodes-113). A total of 47 samples was rejected due to heavy infection/infestation while the rest were salvaged and sent for storage at NGB.

## GERMPLASM CONSERVATION

During the period under report, 1,830 new accessions were added in NGB; these included wild species, namely *Elymus longearistatus*, *Ocimum citriodorum* and *Bunium cylindricum*. Guidelines for deposition and conservation of seeds of RILs, BILs, DHs, NAM and MAGIC, CSSL, association panel, NILs and mutants at NGB were formulated based on recommendations of the committee constituted by ICAR, which can be accessed through <http://www.nbpgr.ernet.in/Downloadfile.aspx?EntryId=7465>

### Tissue culture and cryopreservation

A total of 12 accessions belonging to *Dioscorea deltoidea* (2), *Malus domestica* (2), *Hedychium* sp. (1), *Pyrus communis* (5) and *Musa* sp. (4) was added into the *In Vitro* Genebank. Currently, a total of 1,850 germplasm accessions are being conserved in *In Vitro* Genebank and 12,946 accessions in Cryobank.

## GERMPLASM CHARACTERIZATION/ EVALUATION

In New Delhi, 10,404 accessions of various crops including wheat (2,820), barley (2,440), rapeseed-mustard (791) and pulses (2,920) were grown for characterization and evaluation. At RS/BCs, 1,621 germplasm accessions were grown

for characterisation/ evaluation, viz., Akola (124; chickpea-60, safflower-64), Bhowali (330; rabi crops), Cuttack (97; rice-44, *Ocimum*-27, *Mucuna*-8, roselle-18), Jodhpur (343; wheat), Shimla (619; pea) and Thrissur (108; black gram-4, green gram-9, moth bean-10, oriental pickling melon-11, yardlong bean-74).

At RS, Shimla, 220 RILs of F<sub>8,9</sub> in lentil were grown for evaluation and multiplication for long term conservation. In association with ICAR-IARI, RS, Shimla, station staff screened 31 pear accessions for *Apple chlorotic leaf spot virus* (ACLSV) and *Apple stem grooving virus* (ASGV) resistance and virus indexing was made using ELISA and RT-PCR techniques.

### Evaluation at New Delhi

In Indian mustard, trait-specific germplasm were identified for various traits - very dwarf cum (<71 cm) early maturing (<114 days): IC343199; dwarf type (<95 cm): IC426386, IC520747, IC398763, IC261687; 1000-seed weight (>6.5 g): EC764481, EC764700, EC765232, EC765805, IC493018; high number of siliqua on main branch (>95): EC765297, EC765630, EC765805, EC766030. In yellow sarson, IC264824, IC422028, IC422948, IC423455, IC423480, IC433083, IC561347, IC597913 were identified as dwarf (<85 cm) cum early types, maturing at <115 days.

In wheat, trait-specific germplasm were identified for characters such as strong waxiness (IC416164, IC531862, EC578185); early maturity (<120 days) (IC531012, IC73215); long spike (>18 cm) (IC539316, IC539314, IC576640, IC531862); and plant height (>130 cm) (EC697725, IC59610).



Wheat accession IC531862 with waxy peduncle, long spike (19 cm) and high number of grains per spike (72)

### Evaluation at Bhowali

Wheat landraces (38) from Uttarakhand were characterized for nine qualitative and 12 quantitative characters. High level of variation (as



expressed in CV) was recorded for the traits - grain yield per plant (43.8%) and number of effective tillers per plant (38.9%). The majority of the landraces (91.6%) possessed white-coloured glume. Principal Component Analysis clustered these landraces with respect to altitude.

### Evaluation at Thrissur

Data analysis for quantitative (7) and qualitative characters (5) recorded in pods of 74 yard-long bean collections revealed ample variability in the characters studied. Pod colour ranged from light green, green, purple or green with purple splashes. Seed coat colour was apricot buff, deep red, brown, black, mottled brown and mottled grey. Single green fruit weight ranged from 1.14 (KERYLB1249, KERYLB1250) to 24 g (KERYLB1264).

### Monitoring of evaluation programme:

Scientists of ICAR-NBPGR, New Delhi monitored the evaluation programme being carried out at ICAR-CSSRI, Karnal for salinity tolerance in wheat; PAU, Ludhiana for rust and Karnal bunt resistance in wheat; and ICAR-IIPR, Kanpur for *Ascochyta* blight and wilt resistance in chickpea under CRP on Agrobiodiversity.

## GENOMIC RESOURCES AND BIOINFORMATICS

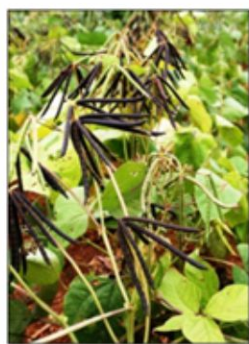
### Genomic resources

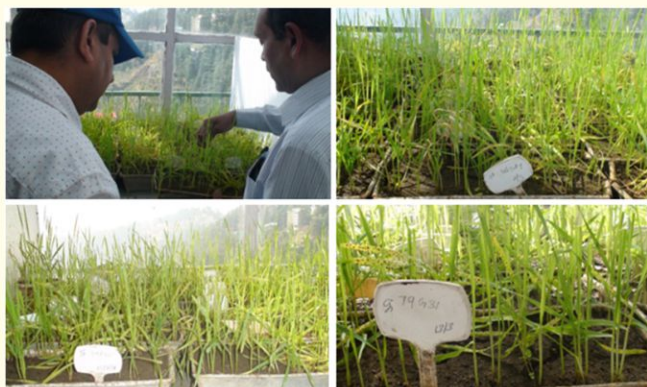
In wheat (*Triticum aestivum*), 521 F<sub>3</sub> progenies originated from two crosses between heat-stress tolerant and susceptible accessions along with parental lines were characterized for plant and seed traits. Among F<sub>3</sub> progenies several variations were observed. Additionally, morphological data and post-harvest grain data were recorded for 473 F<sub>2</sub> populations of two crosses between heat-stress tolerant and susceptible accessions.

A set of 257 wheat germplasm lines including landraces was evaluated at seedling stage against stripe rust pathotypes, viz., 46S119, 110S119 and 238S119, brown rust pathotypes, viz., 29R45, 21R55 and 377R60-1, and stem rust pathotypes, viz., 62G29 and 79G31 at ICAR-IIWBR RS, Shimla. The same set has been genotyped using 35K Axiom® Arrays.

### IC598470 (*Balinta pesalu*): Promising green gram for nutritional traits

The green gram landrace *Balinta pesalu* (IC598470) collected from Adilabad district of Telangana is traditionally consumed by mothers for improved lactation after delivery. Grains of this landrace is characterised by unique yellowish testa colour. Biochemical evaluation (19 parameters) with three check varieties (K-851, LGG-460 and ML-267) revealed that this landrace had significantly higher content for all the important nutritional constituents compared to the checks. High levels of iron and calcium along with high soluble sugars validate the belief that it increases the milk production and provides much needed energy and strength to support lactation. This accession assumes significance as parental material in green gram improvement programme aiming for superior nutritional traits.





Vegetable oils are mainly composed of triacylglycerols (TAGs), and TAG biosynthesis in plants occurs *de novo* through the Kennedy pathway, which involves three acyltransferases, i.e., glycerol-3-phosphate acyltransferase (GPAT), lysophosphatidic acid acyltransferase (LPAAT), and diacylglycerol acyltransferase (DGAT). To date, little is known about the natural variation of above mentioned acyltransferases genes and their association with seed oil production in Indian mustard. From transcriptome analyses of seeds of Indian mustard cv. Varuna, 13 GPAT and ten LPAAT were identified. The analyses of transcripts abundance during seed's four developmental stages revealed that among GPATs, GPAT-1, 2 & 4 and among LPAATs, LPAAT-3, 7 & 9 are critical during the maturing stage of seed.

Genomic DNA of linseed and cluster bean has been conserved at different storage temperatures to check cost-effective approach of genomic resource conservation.

### DNA fingerprinting/profiling

Molecular diversity in 96 accessions of aromatic rice landraces from Indo-Gangetic plains were assessed using 48 microsatellite loci. Another 152 rice landraces were characterized with 36 SSR primers. DNA profiling of 96 released varieties and registered germplasm of barley was performed using 10 SSR markers. Candidate gene based markers for abiotic stress resistance genes were designed and used to identify genetic variations in wild and cultivated barley species. DNA profiling for 40 released varieties of Indian mustard was conducted using 20 genic-SSR markers. Analyses of amplified product didn't reveal a unique profile among varieties, which is consistent with the plausible narrow genetic diversity among released varieties.

In safflower, a total of 58 genomic SSR primers was screened using ten diverse varieties and identified 18 primer pairs for varietal differentiation and such primers were exploited to generate DNA profile for 47 safflower varieties/parental lines available in NGB. DNA fingerprinting of one pre-release cluster bean variety along with reference varieties was also done using 11 SSR primers. Allelic and binary data scoring of 24 germplasm lines and 28 cultivars of bottle gourd has been performed with in-house developed EST and genomic SSR markers. Chloroplast genomes of *Vigna* species were assembled and gaps in assembly were identified. Phylogenetic analyses of 71 accessions of snake gourd were completed at the *rbcL* locus.

### GERMPLASM FIELD DAYS

Three field days were organized at NBPGR, New Delhi during this period. First field day pertains to rapeseed-mustard (791 acc.) organized on 22 February, 2018. More than 40 participants attended this event. Need was felt for the development of network project for effective utilization of mustard genetic resources. The second field day was organised for *rabi* pulses (lentil-2,314 acc.; pea-320) on 26 February, 2018 to showcase the promising lentil and pea germplasm and pre-bred lines (228 progenies) of lentil developed at the institute. The programme was attended by breeders from ICAR institutes, SAUs and DBT-NIPGR, New Delhi. The third field day on wheat (2,820 acc.) and barley (2,440) was organized on 27 March, 2018. Forty-five participants from six ICAR institutes, four SAUs and one Deemed University attended this event.



Participants of field day on rapeseed-mustard

## OUTREACH ACTIVITIES

### Exhibitions/Fairs

A PGR conservation and awareness workshop cum diversity fair was organized on 17 February, 2018 at Koruva village of Jaunsar-Bawar region of Uttarakhand. Over 150 farmers from seven villages participated in the workshop. Dr. Kuldeep Singh, Director, NBPGR addressed the gathering, and Drs. SP Ahlawat, KC Bhatt and RS Rathi shared their views on importance of PGR and need for their conservation. During this programme, seeds of local landraces of crops and farm equipments were distributed to the identified farmers for multiplication and conservation.



Under Tribal Sub-Plan (TSP), similar training was organized by RS, Shimla at Ponda, Kinnaur district, HP on 15 March, 2018. A total of 246 tribal farmers from four village panchayats, viz., Ponda, Nichar, Sungra and Bari had participated. RS, Jodhpur organized a biodiversity fair on 28 March, 2018 at Panchdewal, Sirohi district of Rajasthan.



BC, Cuttack participated in the "State Agriculture Fair - Krushi Odisha" at Bhubaneswar during 6-9 March, 2018 and organized an exhibition stall depicting diversity in rice, vegetables and M&APs. Also the staff organized awareness camp on PGR conservation at Baisinga,

Mayurbhanj district on 28 March, 2018 under TSP, and about 150 tribal farmers participated in that programme. RS, Hyderabad in collaboration with PJTSAU, KVK and ITDA, Utnoor organized similar fair on 21-22 March, 2018 at Utnoor, Adilabad district under TSP. A total of 134 tribal farmers from tribal pockets in and around Utnoor participated.

BC, Ranchi organized a one day fair on PGR awareness programme in Papuda, Simdega district of Jharkhand on 26 March, 2018. Dr. TR Sharma, Director, ICAR-IIAB, Ranchi, graced the occasion as chief guest. He emphasized the importance of traditional crops in eradicating malnutrition prevalent among the native people particularly the women and children. Seed kits of local vegetables were distributed to 150 farmers. Similar programme was organized by RS, Shillong at Thadnongdiew, Ri-Bhoi district, and 133 farmers from adjoining villages attended the programme.



## HRD ACTIVITIES

NBPGR HQ and RS, Akola organized one day learning workshop on 'Digitalization of PGR Management' in collaboration with ICAR-IIMR, Hyderabad on 19 January, 2018 at New Delhi, and on 23 February, 2018 at Dr. PDKV, Akola, respectively. The objective of the workshop was to sensitize the use of Field book, a mobile based application technology for PGR data management. Dr. M Elangovan, ICAR-IIMR demonstrated the app by preparing separate datasheets for collection, conservation and evaluation of germplasm.



NBPGR organized national training programme on 'Management of Plant Genetic Resources' during March 6-19, 2018. The training was attended by 21 participants from 12 different institutes located in 12 states across India. Training was bestowed by 55 resource persons from diverse disciplines through lectures and practicals/ demonstrations covering all aspects of PGR management. Hands-on-training was provided on various aspects of PGR management, including use of newly developed softwares, databases and apps.



## PERSONNEL NEWS

### Awards and recognitions

Eight Postgraduate students of PGR discipline (4-M.Sc.; 4-Ph.D) were awarded degree during the 56<sup>th</sup> Convocation of PG School, IARI, New Delhi.



**Dr. R Parimalan**, Scientist, Division of Genomic Resources was awarded "Dr. RS Paroda Young Scientist" by Indian Society of Plant Genetic Resources (ISPGR) during the award ceremony held on 13 March, 2018 at NBPGR, New Delhi.

**Dr. DB Parakh**, Principal Scientist, Division of Plant Quarantine was elected as Fellow, ISPGR for the year of 2017 during the award ceremony held on 13 March, 2018 at NBPGR, New Delhi.

### Deputation abroad:

**Dr. Gurinderjit Randhawa**, Principal Scientist & Officer-in-Charge, Division of Genomic Resources, represented Asia Region in the Training Workshop on Practical aspects for regulatory GMO control implementation at Geel, Belgium during 6-8 March, 2018.

**Drs. Ruchira Pandey, Neelam Sharma and Sandhya Gupta**, Principal Scientists, TCCU, participated and made oral presentations in '3<sup>rd</sup> International Symposium on Plant Cryopreservation (CryoSymp2018)', Bangkok, Thailand during March 26-28, 2018.

### Promotions

Following scientific staff was promoted:

**Dr. Rajesh Kumar**, HQ as Principal Scientist w.e.f 20.04.2016.

**Dr. Sandeep Kumar**, HQ as Principal Scientist w.e.f 22.12.2016.

**Dr. Jyoti Kumari**, HQ as Principal Scientist, w.e.f 31.12.2016.

**Dr. DP Semwal**, HQ as Principal Scientist w.e.f 31.12.2016.

**Dr. Jameel Akhtar**, HQ as Principal Scientist w.e.f 31.12.2016.

**Dr. Sangita Bansal**, HQ as Principal Scientist w.e.f 01.04.2017.

**Dr. Sheikh M Sultan**, RS Srinagar as Senior Scientist (GP-9,000) w.e.f 01.08.2014.

**Dr. Madhubala Priyadarshi**, HQ as Senior Scientist (GP-9,000) w.e.f 13.11.2014.

**Dr. S Rajkumar**, HQ as Senior Scientist (GP-9,000) w.e.f 26.02.2015.

**Dr. Sherry R Jacob**, HQ as Senior Scientist (GP-8,000) w.e.f 12.06.2016.

**Dr. Ruchi Bansal**, HQ as Scientist (Senior Scale; GP-7,000) w.e.f 27.04.2015.

**Dr. Monika Singh**, HQ as Scientist (Senior Scale; GP-7,000) w.e.f 23.04.2016.

### Retirement

**Dr. Shashi Bhalla**, Principal Scientist, PQD & OIC, PME Cell retired on 31.01.2018.

**Sh. EN Prabakaran**, Senior Technician, RS, Thrissur retired on 28.02.2018.

**Sh. BP Dahiya**, CTO, Division of Germplasm Conservation retired on 31.03.2018.