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### 1<sup>st</sup> International Agrobiodiversity Congress (IAC 2016)

For the first time ever, an international congress, IAC 2016, exclusively dedicated to deliberate and discuss on conservation and use of agrobiodiversity in all its forms was organized from 6-9 November, 2016 in New Delhi. The objective of the Congress was to provide a platform to all the stakeholders engaged in genetic resource conservation and management to deliberate on thematic issues of global importance, with major emphasis on rational and effective use of agrobiodiversity for food, nutritional and environmental security.

Organized by Indian Society of Plant Genetic Resources (ISPGR) and Bioersivity International in collaboration with ICAR, PPV&FRA, National Biodiversity Authority, Trust for Advancement of Agricultural Science (TAAS), NAAS, MSSRF and APAARI along with many national and international sponsors, the congress was attended by over 1,050 participants from 60 countries. The Congress was inaugurated by Hon'ble Prime Minister of India, Shri Narendra Modi along with Minister of Agriculture & Farmers Welfare, Shri Radha Mohan Singh, at Vigyan Bhawan, New Delhi. Based on the deliberations, the delegates unanimously adopted a 'Delhi Declaration on Agrobiodiversity Management'. The Declaration calls upon nations to accord top priority to the shared vision of agrobiodiversity conservation and their sustainable use towards achieving targets of Sustainable Development Goals (SDGs) and the Aichi Targets of the Convention on Biological Diversity (CBD) relating to poverty alleviation, food and nutritional security, good health, gender equity and partnership. United Nations was urged to declare a 'Year of Agrobiodiversity' to draw worldwide attention towards agrobiodiversity and catalyze actions for its effective management.

All the Bureaux for agrobiodiversity, including ICAR-NBPGR participated actively in the IAC 2016, including a very successful exhibition on Agrobiodiversity (see page 7).



Hon'ble Prime Minister of India inaugurating the IAC 2016 (left) and Prof. M.S. Swaminathan receiving a memento from the PM as an honour for being the first World Food Laureate



Participants of IAC 2016

# PGR ACTIVITIES

## Exploration and Germplasm Collecting

### Collecting forage genetic resources



Seeds of white clover (*Trifolium repens*) and red clover (*T. pratense*) collected from J&K

An exploration on forages from Kashmir province of Jammu & Kashmir was undertaken by ICAR-NBPGR, Regional Station (RS), Srinagar in collaboration with ICAR-IGFRI, RS, Srinagar, during July to October, 2016. Total 92 diverse forage accessions belonging to 12 wild taxa were collected, including *Festuca arundinacea*, *Dactylis glomerata*, *Bromus unioloides*, *Trifolium pratense*, *T. repens*, *Phleum pretense*, *Sorghum halepense*, *Elymus semicostatus*, *Lolium perenne*, *Convolvulus arvensis*, *Medicago sativa*, *Onobrychis viciifolia* and *Dichanthium annulatum*.

### Plant exploration and collection from Eastern India

The NBPGR, HQ, New Delhi undertook an exploration in districts of Chhattisgarh, Jharkhand and Odisha during Sept.-Oct. 2016. A total of 73 accessions belonging to 30 taxa including *Pennisetum pedicellatum*, *P. maximum*, *Sorghum bicolor*, *Heteropogon contortus*, *Momordica dioica* were collected from Singhbhum, Simdega and Saraikela Kharsawan districts of Jharkhand. In another exploration to Jaspur, Sarguja, Surajpur, Koriya, Korba, Raigarh districts of Chhattisgarh and Bargarh district of Odisha, 134 accessions of millets, niger and horsegram belonging to 11 species were collected by NBPGR, Rs, Ranchi.

### Targeted collecting from Western Ghats

An exploration was carried out by ICAR-NBPGR, RS, Thrissur, in Western Ghats of Kerala and Karnataka for wild relatives of *Momordica*. Total 17 collections

comprising six of *M. sahyadrica*, two each of *Solanum viarum*, *S. indicum*, *M. charantia* var. *muricata*, *M. sahyadrica* subsp. *anamalayanam* (subsp. nova), one each of *M. dioica* and *S. torvum* and one of cultivated oriental pickling melon were collected.

### Tuber crops collecting from Assam

ICAR-NBPGR, RS, Shillong in collaboration with ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, undertook an exploration during Nov. 28 to Dec. 10, 2016, for collecting tuber crops from southern districts of Assam (Karbi Anglong, Dima Hasao, Hailakandi and Karimganj). A total of 89 germplasm accessions of *Dioscorea*, *Colocasia*, *Xanthosoma*, sweet potato, Cassava, arrowroot, and elephant-foot yam were collected and retained by ICAR-CTCRI. Out of four districts covered, hilly regions of Karbi Anglong and Dima Hasao has considerable diversity in tuber crops.

### Collecting of *Euryale ferox* germplasm



*Euryale ferox* growing in a wild habitat in Jorhat. Inset shows close-up of seeds

A collection tour undertaken by ICAR-NBPGR, RS, Shillong in collaboration with Bihar Agricultural University, Sabour, during Nov. 13-20, 2016, in two districts of Assam (Jorhat and Sivasagar) for collection of makhana (*Euryale ferox*). A total of 52 accessions were collected. Phenotypic variability for seed coat, seed size, fruit size, fruit colour and spine density was observed. Assamese are not very aware about the use of makhana seeds, being absent in their food habits. Most harvested seeds are sent to Bihar through middlemen/contractors who process (popping) and sell it. There is a lot of scope for popularization of post-harvest technology of makhana in Assam.

## Collecting CWR and landraces of millets, oilseeds and vegetables



Finger millet diversity collected from Odisha

The ICAR-NBPGR, RS, Hyderabad, undertook three exploration and collecting missions in Odisha (Koraput, Nawarangpur and Kalahandi districts), Karnataka (*South-West Central region*) and Andhra Pradesh (*Rayalaseema region*) for collecting crop wild relatives (CWR) and landraces of important crops. In the first mission (Nov. 25 - Dec. 4, 2016), millets and oilseeds germplasm collected in collaboration with Indian Institute of Millets Research, Hyderabad and Indian Institute of Oilseeds Research, Hyderabad. A total of 202 germplasm samples were collected during the survey. During the second exploration undertaken in collaboration with UAS-Bengaluru in Karnataka, a total of 66 samples of landraces (legumes and vegetables) and 47 samples of CWR were collected. Another 71 samples of CWR were collected in collaboration with ANGRAU, Hyderabad (Dec. 12-18, 2016) from Andhra Pradesh.



*Setaria viridis*, a wild relative of foxtail millet collected from Odisha

## Germplasm Exchange

### Import

A total of 3,564 accessions of various crops were introduced from 16 countries. Some of the promising introductions are listed below:

**Cucumber (EC894754-59), Taiwan:** White and light green fruit type gynoecious and monoecious lines

**Onion (EC894772-77), Taiwan:** Red, early, large and good storability lines

**Pumpkin (EC894747-53), Taiwan:** Oblong, globular, flat with orange and dark orange lines

**Quinoa (EC896059-329), USA:** Wild species germplasm

**Macadamia nut (EC896466-78), USA:** Diverse germplasm

**Rubber (EC898373-77), Ghana:** South American leaf blight (SALB) resistant varieties

### Export

ICRISAT mandate crops (1,503 accessions) exported to Bangladesh, Belgium, China, France, Haiti, Italy, Kenya, Nepal, Pakistan, Senegal, Somalia, South Africa, Uganda, Ukraine, USA, Vietnam and five varieties of pigeon pea to Mozambique.

### National Supply

A total of 2,452 samples of various crops were supplied to different institutes/ researchers/ users in the country under the Material Transfer Agreement.

## Plant Quarantine

A total of 81,720 samples of imported germplasm including transgenics were processed for quarantine clearance. Out of these samples, 544 were found infected/ infested with various pests and were salvaged with suitable treatments. Major interceptions were *Claviceps purpurea* in *Hordeum vulgare* and *Fusarium oxysporum* f. sp. *lentis* in *Lens culinaris* imported from Lebanon, *Carpophilus truncatus* in *Zea mays* from USA, *Bruchus* sp. in *Lens culinaris* from Lebanon, *Aphelenchoides besseyi* in *Oryza sativa* from Philippines, *Polygonum convolvulus* and *Salsola kali* in *Lens culinaris* imported from Canada.

Another 12,101 samples consisting of import germplasm (7,564 samples), export germplasm (3,733 samples) and Svalbard samples (804) were processed from quarantine point of view at ICAR-NBPGR, RS, Hyderabad. A total of 804 samples of ICRISAT mandate crops, viz., sorghum (162), pearl

millet (183), pigeon pea (417) and groundnut (42) along with 25 duplicate samples for viability test, sent to Svalbard Genebank for conservation. Import germplasm (6,150 samples) consisting of paddy, wheat, barley, maize, sunflower, pearl millet, bean (*Phaseolus* spp.), chickpea, sweet potato, tobacco, and marigold was released to the consignees after necessary mandatory treatments.

### Post-entry quarantine growing/ inspection

Post-entry quarantine inspections were carried out for a total of 1,442 samples of exotic *Zea mays* (1,138), *Capsicum annuum* (66) and *Solanum lycopersicum* (238) germplasm grown at Research Farms of Syngenta India Ltd. in Aurangabad and Hyderabad and Monsanto Holding Ltd. in Bengaluru.

### Quarantine interceptions

During processing, *Alternaria porri* on pearl millet from Kenya, *Alternaria crassa* on marigold from USA, *Botryosphaeria obtusa* and *Pestalotia* sp. on bittergourd from Thailand were intercepted.



Quarantine pest interceptions on bitter gourd seed from Thailand. Left picture shows *Pestalotia* sp. and right shows *Botryosphaeria obtusa*. Inset shows respective conidia at higher magnification

### Seed health testing for pest-free conservation

Seed health testing of 3,325 samples of various crop germplasm was done for pest-free conservation in National Genebank. Out of these, 752 samples were subjected to X-ray radiography. A total of 644 samples were found infected with different kind of pests, out of which 622 were salvaged while 22 were rejected and sent to MTS.

### Germplasm Characterization and Evaluation

#### Germplasm characterization at Akola

At ICAR-NBPGR, RS, Akola, post-harvest observations in accessions of barnyard millet (45),

foxtail millet (59), finger millet (50), winged bean (50) and okra (62) were recorded. In winged bean germplasm, high variability was observed for days to 50% flowering (62-94 days), pod length (9.72-14.88 cm), number of seeds/ pod (3.60-13.00) and 100-seed weight (12.91-25.74 g).



Pod variability in winged bean germplasm

Best performing accessions identified for different traits in foxtail millet were for days to 50% flowering: IC120251 (39 days), IC120257 (48 days) and IC097196 (50 days); plant height: IC097293 (132.2 cm), IC120348 (127.05 cm) and IC120213 (120.50 cm); number of tillers/plant: IC120214 (7.4), IC097185 (5.9) and IC120165 (5.7); 1000-seed weight - IC120251 (3.38 g), VS-68 (3.30 g) and IC097194 (3.27 g).

In barnyard millet, best performing accessions were for plant height: IC097031 (117.7 cm), DP/AK2220 (117 cm), IC3388960 (113.5 cm); number of tillers per plant: IC326752 (18.8) and IC340204 (15.4); 1000-seed weight: IC326752 (3.69g), IC340224 (3.45g) and IC597315 (3.32g).

#### Germplasm characterization at Delhi

At ICAR-NBPGR, New Delhi, a total 10,404 accessions of various agri-horticultural crops comprising wheat (2,600), barley (5,000), brassica (1,268), pulses (1,536), maize (200), rice (387) were grown for characterization, evaluation and screening purposes. In rice, promising accessions identified for early maturity (<70 days) were RSR-2/JLM-7, RSR-2/JLM-12, NR-3, NR-27, IC460045, IC568287; for dwarf stature (<80cm) - RSR-2/JLM-13, RSR-2/JLM-32, SKY-14, DPS/OPD-180, NR-3, NR-18, IC424569; for high effective tillers (>20) - RSR-2/JLM-7, RSR-2/JLM-19, NR-4, NR-5, IC469305; for long panicle (>20cm) - RSR-2/JLM-7, RSR/SKY-8, KP-2086, KP/VT/SM-2066, SK/SS-1, SK/SS-3.

## Dwarf genotype in Okra



Dwarf type okra accession (PSRJ-12952)

At ICAR-NBPGR, RS, Hyderabad, an okra accession (PSRJ-12952) with 29.5 cm plant height, dense branching, early flowering (40 days), desirable fruit length of 14.5 cm and with good fruit quality was identified. The accession was compared with check varieties Arka Anamika, P-8 and Pusa A-4. This dwarf landrace could be utilized in ideotype breeding for the development of semi-dwarf varieties/ hybrids of okra.

## Genomic Resources

### Genomic resource generation

Analyses of a subset of 200 SSRs (from 6,000 SSRs designed from genomic sequence data) in mungbean, urdbean and mothbean resulted in identification of 35 highly polymorphic SSRs. These were subsequently used to characterize 55 and 45 released varieties of mungbean and urdbean, respectively.

Sequencing of chloroplast genomes of *Vigna* species completed with 100X coverage. Sequence polymorphism in rice ALK gene, involved in starch biosynthesis, was analyzed through sequencing of exon regions of this gene from 20 *Oryza* germplasm lines. The analyses revealed SNPs at various places.

An HKT family gene was also amplified and sequenced from 16 diverse wheat genotypes. In little millet, five glutamine synthetase (GS) genes (four cytoplasmic and one plastidic) were identified from its transcriptome data. Phylogenetic analysis of such GS genes with those of GS genes of Poaceae family members revealed close proximity with foxtail millet followed by maize.

### Molecular profiling

Bottle gourd accessions (24) were profiled with 659 SSR markers generated from transcriptome sequences. Additionally, from 191 sponge gourd SSR markers developed from its transcriptome, 131 were transferred to ridge gourd and satputia.

Genotyping of 108 rice accessions of mini-core, identified through morphological markers, have been accomplished with 50K SNP gene-chip. A panel comprising 22 SSR markers have been developed for varietal differentiation in safflower based on their demonstrated polymorphic profiles. Registered varieties of cotton (80) and maize (85) were profiled using respective five SSR markers.

In little millet, 200 EST-SSRs designed from leaf transcriptome and subsequently validated in three accessions showed amplification in 70 such markers. Similarly, in finger millet, a set of 630 transcriptome based EST-SSRs were analyzed in four varieties, which demonstrated amplification in 455 markers.

In pigeonpea, expression profiling of ICE-1 (Inducer of CBF Expression-1), a basic helix-loop-helix transcription factor, under drought and cold stress was studied using semi-quantitative RT-PCR. Additionally, allelic variations were studied in key flowering related genes (Cryptochrome 2, FRIGIDA, FRIGIDA like-1, FRIGIDA like-2 and Terminal flowering-1) in two varieties of pigeon pea differing in maturity time. In Indian mustard, out of 14 NBS-LRR genes (BjNBS-LRR), five genes were analyzed on aphid infested samples of *Brassica juncea* and two genes revealed significant up-regulation compared to control.

### GMO detection technology

Molecular testing of 50 imported transgenic accessions of *Brassica napus*, *Arabidopsis* and rice for specific transgenic elements and also for absence of embryogenesis deactivator gene was undertaken and none of the tested accessions were found positive for embryogenesis deactivator gene.

Developed protocols based on real-time PCR and LAMP assays for barstar gene in GM mustard. Detection strategies for multiplex LAMP targeting marker genes in GM maize events were developed. Comparison of DNA-based (PCR, real-time PCR, LAMP) and protein-based (ELISA, dipstick) methods was made for checking adventitious presence of transgenes in *ex situ* germplasm collections.

Adventitious presence of transgenes in 100 maize *ex situ* accessions was checked with PCR/real-time PCR based assays; none of the tested accessions were found positive. GMO matrix of soybean has been developed comprising promoters, terminators and transgenes corresponding to all the 34 events from different databases. GMO matrix developed for 42 GM events of *Brassica* (including 39 globally commercialized GM events of *B. napus*; three GM events of *B. juncea*) with information of 45 genetic elements.

## PGR UTILIZATION

### Mera Gaon Mera Gaurav (MGMG) Programme



Farmers meet under the MGMG programme organized at Ananthapuram village, Kerala

Scientists and staff from ICAR-NBPGR, RS, Thrissur along with the Assistant Agricultural Officer of the Krishi Bhavan, Mattathur and the ward member of Vellikulangara Grama Panchayat visited the Sasthampooвам tribal colony and discussed with the farmers regarding various agricultural issues faced by them and suggested remedial measures. Seed material of improved varieties of leafy amaranth, snake gourd, ash gourd and cucumber were distributed. The team also visited the agricultural farms of progressive farmers cultivating highly pungent chilli (*Kodali*), banana (*Kadali*), landraces of yard long bean, melon and ash gourd and suggested control measures for certain pests and diseases. Procedures for protecting intellectual property rights by geographical Indication registration of local *Kodali* Chilli and *Kadali* banana was also discussed with Agricultural Officer of Mattathur Krishi Bhavan.

Another interactive meet with farmers was held on Oct. 24, 2016 at Ananthapuram village, in co-operation with Krishi Bhavan, Muriyad and ATMA, Irinjalakuda, to discuss various agriculture related issues in that area and suggested remedial measures. The seeds of promising released varieties of Chinese spinach, ash gourd, snake gourd and cucumber suitable for cultivation in that area during rabi season were distributed to the farmers free of cost. A total of 25 farmers from Muriyad and Ananthapuram village participated in the meeting.

With the co-operation of the Krishi Bhavan, Kavaserry, Palakkad, third meeting was convened with farmers at Kavaserry Panchayat hall on Nov. 30, 2016. Lectures on MGMG programme and activities of NBPGR were delivered. The seeds of promising released varieties of Chinese spinach, ash gourd, snake gourd and cucumber suitable for cultivation in that area during *rabi* season were distributed to the farmers. A total of 26 men and four women farmers from the village participated in the meeting.

### Germplasm Field Day on Pulses



Participants in the germplasm field day in cowpea field

A germplasm field day on pulse crops was organized at ICAR-NBPGR, New Delhi, on October 15, 2016. It was attended by over 50 scientists from different State Agricultural Universities and ICAR institutes. Dr Kuldeep Singh, Director, ICAR-NBPGR, extended warm welcome to the delegates and emphasized the importance of organizing field days which enable scientists to assess and examine the genetic variability on the spot and interact with experts from different areas of research for enhancing the use of germplasm in crop improvement. Dr J.C. Rana, Head, Division of Germplasm Evaluation, ICAR-NBPGR, urged the participants for making best use of genetic diversity available in the field. The participants appreciated the genetic variability and selected desired germplasm accessions for different traits for crop improvement.

### Plant Germplasm Registration Committee Meeting

The XXXV<sup>th</sup> Plant Germplasm Registration Committee (PGRC) meeting was held at ICAR-NBPGR, New Delhi, on Sept. 1, 2016 under the Chairmanship of Dr J.S. Sandhu, DDG (CS), ICAR, New Delhi. In this meeting, total 40 proposals (22 new and 18 revised) were considered for registration. Finally, 14 (10 new and 4 revised) proposals belonging to six species were approved for registration. Some notable registered germplasm were: Wheat line carrying *Lr1* for Indian pathotypes of wheat leaf rust (*Puccinia triticina*); Turmeric highly tolerant to leaf spot and leaf blotch; Jasmine with high concrete recovery (0.375%) and high esters group of volatile compounds (17%) in flowers; Garlic with bolder size of bulbs, bears umbels with bulbils, suitable for cultivation in frost prone hills.

# EXHIBITIONS

## ICAR-NBPGR participated in the IAC 2016 Exhibition on 'Glimpses of Agrobiodiversity'



A collage of the ICAR-NBPGR stall in the IAC 2016

During the 1<sup>st</sup> International Agrobiodiversity Congress held in New Delhi from November 6-9, 2016, a unique exhibition was organized to showcase the enormous diversity of genetic resources available in Indian gene centre. Besides all the ICAR Bureaux of plants, animals, fish, microbes and insects, several other ICAR institutes, SAUs and NGOs participated in the exhibition. The ICAR-NBPGR stall had an interesting display of live samples to depict the diversity in several crop plants and was visited by many participants and important dignitaries. It received an appreciation certificate from the organizers in the form of consolation prize for Best Exhibition Stall.

## Participation in the Mega Science & Industrial Expo and Krishi Kumbh Mela

ICAR-NBPGR participated as part of ICAR's exhibition stall in the 'Mega Science and Industrial Expo' organized as a part of 'India International Science Festival', organized by CSIR-National Physical Laboratory, New Delhi, from Dec. 7-11, 2016. ICAR exhibition was awarded the best stall. ICAR-NBPGR also participated in 'Krishi Kumbh Mela' held from Nov. 28-30, 2016 at Numaish Maidan (Exhibition Ground), Muzaffarnagar, Uttar Pradesh.



ICAR-NBPGR activities displayed at 'Mega Science and Industrial Expo'

## PERSONNEL NEWS

### Retirements



**Smt. Rita Rani**, T-7/8, Division of Germplasm Conservation, ICAR-NBPGR, New Delhi, superannuated on Sept. 30, 2016.



**Sh. Rajiv Mathur**, T-7/8, Directors' Technical Cell, ICAR-NBPGR, New Delhi, superannuated on Nov. 30, 2016.



**Sh. D.K. Pokhriyal**, T-3, Division of Genomic Resources, ICAR-NBPGR, New Delhi, superannuated on December 31, 2016.

### New appointments



**Dr Kartar Singh**, Scientist (Plant Pathology), joined ICAR-NBPGR on Oct. 10, 2016. He is posted in the RS, Jodhpur.



**Mr Rahul**, Scientist (Economic Botany & Plant Genetic Resources), joined ICAR-NBPGR on Oct. 13, 2016. He is posted in the RS, Shimla.



**Ms Gowthami R.**, Scientist (Genetics and Plant Breeding), joined ICAR-NBPGR on Oct. 13, 2016. She is posted in the Tissue Culture and Cryopreservation Unit (TCCU), New Delhi.



**Ms Neelam Shekhawat**, Scientist (Genetics and Plant Breeding), joined ICAR-NBPGR on Oct. 14, 2016. She is posted in the RS, Jodhpur.



**Ms. Pooja Kumari**, Scientist, joined ICAR-NBPGR on Oct. 15, 2016. She is posted in the Division of Plant Quarantine, New Delhi.

### Promotions

**Mr B.L. Meena** was promoted to Assistant Chief Technical Officer (ACTO) (T-7/8) from Senior Technical Officer (T-6) w.e.f. Jan. 1, 2010.

**Mr Devender Nerwal** was promoted to Assistant Chief Technical Officer (ACTO) (T-7/8) from Senior Technical Officer (T-6) w.e.f. Jan. 18, 2014.

### Deputation Abroad

**Dr Ruchi Bansal**, Scientist, Division of Germplasm Evaluation, completed six months deputation for availing 'Endeavour Research Fellowship' at University of Western Australia, WA, and joined for duty w.e.f. Nov. 15, 2016.

### Obituaries

ICAR-NBPGR mourns the untimely and sudden demise of two of its scientists.

**Dr Kuldeep Singh Negi**, Principal Scientist (Economic Botany), ICAR-NBPGR, RS, Bhowali, Uttarakhand passed away on Dec. 14, 2016, after a brief illness. Dr Negi joined NBPGR in 1986 as an ARS Scientist and was posted in Bhowali station. He went on



to become a very proficient plant explorer and taxonomist, and a great authority on the flora and diversity of Uttarakhand region. He was instrumental in development of the Bhowali station, especially during his tenure as Officer-in-Charge (2003-2012). A man of great diligence and tenacity, he was known for his soft-spoken nature and ever-smiling face. His untimely demise is a big loss for the PGR community.

**Dr (Ms) Anju Jain**, Senior Scientist (Economic Botany), Tissue Culture and Cryopreservation Unit, ICAR-NBPGR, New Delhi, expired on Dec. 17, 2016 due to a fatal road accident. She had joined NBPGR in 2009, after direct selection to the post of Senior Scientist. She worked in the area of *in vitro* conservation and cryopreservation of spice crops. During this period, she made concerted efforts to develop some novel protocols for *in vitro* multiplication and conservation, including low-cost methods. She was a very hard working individual, who contributed in several general activities of TCCU and NBPGR. Her sudden demise is a great loss to NBPGR.

