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### Introgression of YVMV and ELCV tolerance in okra through wide hybridization

Seven synthetic amphidiploids of okra (*Abelmoschus esculentus*) were developed at RS, Thrissur using *A. angulosus* var. *grandiflorus*, *A. mizoramensis* sp. nova, *A. tetraphyllus*, *A. tuberculatus*, *A. crinitus*, *A. enbeepeegeearensis* and *A. caillei* as paternal parents. The amphidiploids of crosses involving first five species with okra were further advanced and crosses with *A. angulosus* var. *grandiflorus* and *A. mizoramensis* sp. nova were found to have field tolerance to Yellow vein mosaic virus (YVMV) at RS, Thrissur. Subsequently 33 progenies from above two crosses were screened at two hotspot locations - Guntur (Andhra Pradesh) and New Delhi, which resulted in the identification of YVMV and *Enation leaf curl virus* (ELCV) tolerant derivatives, viz., C<sub>2</sub>106mizo6, C<sub>2</sub>106gr1, C<sub>2</sub>741mizo10 and C<sub>2</sub>50mizo27 at Guntur and C<sub>2</sub>741mizo-10 and C<sub>2</sub>741gr-12 at New Delhi. A total of 266 backcrosses involving CF<sub>3</sub> genotypes as maternal and cultivated okra as paternal parent were done to transfer the tolerance to the cultivated okra varieties. Increased number of fruit bearing branches in amphidiploids is a promising trait for genepool advancement. In addition to virus tolerance, all amphidiploids showed continuous flowering and fruiting, up to two years. The cross derivatives were supplied to ICAR-IIHR, ICAR-IIVR, ICAR-IARI and PAU for further utilization in okra breeding programme and is being evaluated under field conditions at New Delhi, Hyderabad and Thrissur centres of ICAR-NBPGR.



Okra amphidiploids with field tolerance to YVMV disease in comparison with the susceptible check varieties



Amphidiploid – *A. esculentus* x *A. angulosus* var. *grandiflorus*  
a. Fruits; b. Habit; c. Flower; d. Fruit of ♀ parent (bottom), amphidiploid (middle) and ♂ parent (top)

## PGR ACTIVITIES

### EXPLORATION AND GERMPLASM COLLECTING

An exploration trip was undertaken by HQ in Alwar, Dungarpur, Jalore and Sirohi districts of Rajasthan, and 19 accessions including *Pennisetum glaucum* (4), *Oryza sativa* (3), *Cucumis melo* (4), *Vigna radiata* (1), and a wild relative of sesame, *Sesamum mulayanum* were collected. Landraces collected during the trip, viz., Kala Badal (highly scented), Baruhar (suitable for low irrigation, good yield) and Huttar (red kernel) in rice; and Pahadi Malan/ Safed Malan in maize deserve a mention.



Local green gram

A total of 72 germplasm accessions were collected by RS, Shimla from Lahaul region in Himachal Pradesh. This comprised *Elymus* spp.

(16), *Amaranthus hypochondriacus* (2), *A. retroflexus* (3), *Bunium persicum* (15), *Allium* spp. (2), *Cicer microphyllum* (3), *Prunus armeniaca* (10), *Medicago sativa* (9), *Pisum sativum* (2), *Hordeum vulgare* (8), and *Linum perenne* (2).

A collaborative exploration with KAU, Thrissur for collection of drumstick germplasm was undertaken by RS, Thrissur and HQ across various districts in Kerala. A total of 50 samples of unique trait-specific, environmentally adapted germplasm were augmented.

An exploration aimed at collection of landraces of maize, chilli, brinjal, and wild *Solanum* spp. from Jaspur, Korba and Koriya districts of Chhattisgarh was carried out by Base Centre, Ranchi and HQ during September. A total of 85 accessions representing significant diversity in maize (43), chilli (19) and brinjal (3) were collected; besides two early maturing rice landraces (Chaina dhan and Dani dhan).



### Exploration in far-flung areas of Kashmir Valley

An exploration in Gurez Valley (including remote localities of Tulail tehsil) in Bandipora dt.; Tanghdar Valley and Machil areas of Kupwara dt.; and remote pockets of Shopian and Budgam dts was carried out by RS, Srinagar and HQ. This resulted in collection of 131 accessions of different crops and their wild relatives belonging to 54 taxa. Salient collections include *Elymus* spp. (23 acc.; 4 spp.), maize (13), minor fruits (11), French bean (10), wheat (7) and rice (5). Wild species *Crataegus pseudoheterophyllus* was collected for the first time. Some germplasm worth mentioning are: proso millet (SHEIKH/KP-700) cultivated only by an age-old farmer in the entire Gurez Valley; hulless barley (SHEIKH/KP-706) from Tulail area; black soybean (SHEIKH/KP/SR-661) and small-sized green gram (SHEIKH/KP/SR-662) from Shopian; climbing soybean (SHEIKH/KP/SR-674) from Budgam; *Malus baccata* (SHEIKH/KP-693; refer figure) from Gurez Valley.



## GERMPLASM EXCHANGE

### Import

A total of 12,294 germplasm accessions were imported from 32 countries. Some promising accessions include: **wheat** (EC919308-09), USA - excellent grain quality, imported for heat tolerance studies; **rice** (EC921289-457), The Philippines - black/purple kernel.

### Export

Ten released varieties of green gram were exported to AVRDC, Taiwan under collaborative research project.

### National Supply

A total of 2,007 samples of various crops were supplied to different institutes/ researchers/ users within the country with Material Transfer Agreement.

## PLANT QUARANTINE

A total of 23,486 samples (8,132 at HQ; 15,354 at Hyderabad) of imported germplasm including transgenics were processed for quarantine clearance. Among the total processed samples, 2,769 samples were found infected with various kinds of pests, out of which 2,750 were salvaged by appropriate treatment while 19 were rejected due to heavy infection/infestation. Need-based prophylactic/ curative treatment was given to the imported germplasm, like hot water treatment, alcohol wash, pesticidal dip treatment to vegetative propagules, tri-sodium phosphate treatment and EDCT fumigation. A total of 655 samples were released for export purpose along with the issuance of 11 phytosanitary certificates.

The pathogen *Aphelenchoides besseyi* was intercepted from rice seeds imported from China, Japan, The Philippines and USA. Among insect pest interceptions, *Ploida interpunctella* was found in maize imported from Thailand. *Colletotrichum graminicola*, *Choanephora* sp. and *Phaeotrichoconis* sp. on sorghum from Mali, and *Colletotrichum acutatum* and *Choanephora* sp. on pumpkin from Vietnam were intercepted. *Sitophilus granarius* was intercepted on maize from Thailand and Mexico.

Other interceptions include *Convolvulus erubescens*, an exotic weed along with chickpea from Australia. A total of 572 samples of *Glycine max* (246), *Psophocarpus tetragonolobus* (8),

*Vigna mungo* (8), *V. radiata* (283), *V. trilobata* (2) and *V. umbellata* (25) are being grown in post-entry quarantine greenhouses and are being observed for virus-like symptoms, if any.



*Colletotrichum acutatum* infection on pumpkin seed from Vietnam. Left to right: acervuli on the seed surface; magnified image of acervuli with setae; acervulus with setae and conidial mass; fusiform conidia under compound microscope

For pest-free conservation of indigenous germplasm in National Genebank (NGB), 4,130 samples were tested for their seed health status. Of these, 668 samples found infected with various kinds of pests, and 657 were salvaged with suitable treatment and sent to genebank for storage while 11 were rejected.



View of post entry quarantine of imported soybean germplasm

## GERMPLASM CONSERVATION

The National Gene Bank (NGB) has been enriched with an addition of 249 germplasm accessions. Landraces of black gram (3), maize (15), sesame (13), and *Perilla* (5) were conserved in NGB. Trait-specific elite germplasm of pigeonpea (long duration with *Fusarium* wilt resistance), wheat (head scab tolerance), and ridge gourd (tolerance to powdery and downy mildew; early flowering and fruiting) were the notable ones that are conserved. Crop Wild relatives belonging to *Sesamum*, *Vigna* and *Ocimum* were added to the base collection. Fifty-one samples of improved cultivars were conserved as a part of the mandatory requirement before their notification and release.

## GERMPLASM CHARACTERIZATION/ EVALUATION

A total of 5,657 accessions of various agri-horticultural crops comprising of maize (796), rice (84), millets (1,000), pulses (2,453), sesame (696), vegetables (594), and medicinal and aromatic plants (118) were grown in experimental farms of Bureau at ICAR-IARI and Issapur for characterization and evaluation. Besides, a set of 3,457 accessions of various crops were characterized for agro-morphological traits in regional stations located at Shimla (1,981 accessions), Bhowali [799 (rice-61, minor millets-10, soybean and other legumes-145, amaranths-525; *Ocimum* spp.-58)], Akola [371 (green gram-23, black gram-35, okra-63, finger millet-150, barnyard millet-45 and winged bean-55)] and Srinagar [306 (wheat-202, barley-104)].

Maize: promising accessions were identified for various traits, viz., earliness (<90 days) - IC97875, IC97877, IC97878, IC97900; multi-cob - IC83103, IC130790, IC130786; dwarf type - IC97875, IC130593, IC130596; low ear



IC97875 with short plant height and low ear placement (left); IC97878 with early maturity (right)

placement - IC98302, IC97875, IC97877; and large cob size - IC77810, IC556421.

Green gram accessions identified include IC76422, IC507492, IC76417, IC507372 for early maturity (<55 days); IC553601 for erect nature and lodging resistance; IC472063, IC148477, IC472115 for high yield potential; EC396116, EC396115, EC310286 for large seed; IC103880, EC398927, EC398930 for high pod length; and IC76367, IC283547, IC12127 for high number of grains per pod. In urdbean, PLU494 recorded highest 100 seed weight (6.71g).

Two accessions (IC244113-1 & IC550570-1) of Malabar tamarind (*Garcinia cambogia*) were found to be early in flowering and fruit maturity (April-May) making easy for processing the rind whereas others mature during monsoon, making processing more labour-intensive.

Under Consortium Research Platform on Agrobiodiversity (CRP-AB), 4,428 germplasm accessions comprising Indian mustard (834), finger millet (722), safflower (592), wheat (499), cotton (370), and sesame (258) multiplied during the preceding *Kharif/Rabi* seasons have been conserved in NGB for replenishing their base collection with fresh seeds of superior viability.

Apart from efforts under CRP-AB, another 5,632 accessions comprising rice including wild species (4,046), wheat (202), barley (104), green gram (209), black gram (13), cowpea (28), horsegram (117), minor millets (44), soybean and other legumes (145), amaranth (525), *Ocimum* spp. (101), wild cucurbits (38), *Hibiscus sabdariffa* (18), and *Abelmoschus* spp. (15) were multiplied/ characterized in regional stations/base centres.

## Vigna germplasm characterization

A total of 2,453 accessions comprising green gram (1,231), black gram (851) and cowpea (371) were characterized during *Kharif* at New Delhi. This includes 770 accessions of green gram and 771 of black gram shortlisted based on earlier screening works for yellow mosaic disease (YMD) resistance under hotspot fields. Of many field-resistant accessions identified in black gram, IC565025, IC530500, IC471995, and IC530503 deserve a mention. However, only a few accessions were tolerant/ resistant to YMD in green gram, with promising ones being IC119006, IC118998, PLM326, IC113890, and IC548274. Only one green gram accession (IC118998) was found to be highly resistant till 55 days after sowing although YMD symptoms appeared later during flowering and fruit set.



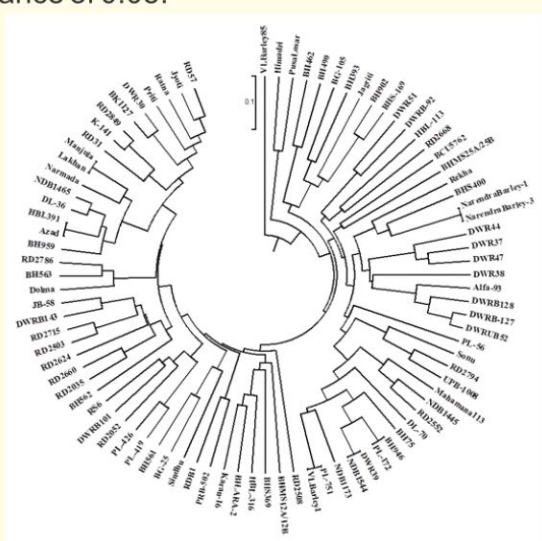
Green gram accession IC118998 (white arrow) showing high resistance to YMD

## GENOMIC RESOURCES AND BIOINFORMATICS

### DNA profiling / fingerprinting

DNA fingerprinting was accomplished in 69 varieties of sesame with 12 SSR markers, and in one pre-released cluster bean (*Cyamopsis tetragonoloba*) variety with 11 SSR markers. DNA profiling/fingerprinting services were rendered for toria (Raj Vijay Toria-2), supplied by Zonal Agricultural Research Station, Morena, Madhya Pradesh (an AICRP centre for rapeseed and mustard), and Indian mustard (RH725, RH406 and RGN48) provided by CCSHAU, Hisar.

Genetic diversity assessment in 88 barley accessions, that included released cultivars and registered germplasm, was conducted with 25 highly polymorphic SSR markers. The average PIC of the SSR markers was 0.40, with an average allele number of 3.4. The average genetic diversity among the germplasm lines was 0.45. The varieties included in this study were developed at the 11 network centres of the barley improvement programme under the AICW&BIP. It was observed that varieties clustered with respect to the centre from which the varieties are developed. RD31 from SKRAU, Rajasthan and HBL391 from CSKHPKV, Himachal Pradesh were most diverse and the varieties DWRB127 and DWRUB52 were least diverse with a genetic distance of 0.05.



UPGMA dendrogram depicting genetic diversity in barley

### GM detection research activities

Visual Loop-mediated Isothermal Amplification (LAMP) assays for rice *actin* promoter (p-ract) and *nos* promoter (p-nos) were developed for

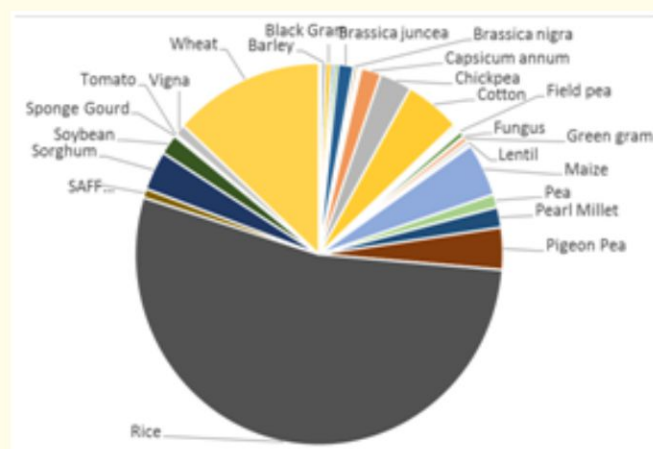
rapid GM detection. Specificity of these assays was confirmed employing a set of 14 and 10 test samples for p-ract and p-nos respectively.

Molecular testing of 24 transgenic samples of *in vitro* cultures of cassava and 27 transgenic cotton samples imported by various organizations for research purpose was done to ensure absence of embryogenesis deactivator gene.

Staff of GM Detection Research Facility has participated in two International Proficiency Testing for quality assurance organized by (i) the Grain Inspection, Packers and Stockyards Administration, United States Department of Agriculture (GIPSA-USDA) to qualitatively and quantitatively test the GM maize events in four test samples and GM soy events in two test samples; (ii) the European Union Reference Laboratory for GM Food and Feed, European Commission-Joint Research Centre (EC-JRC), Ispra, Italy to test and quantify GM soy event(s) in two test samples. All the qualitative and quantitative results are satisfactory and within the Z-score.

### Genomic resources repository

The National Genomic Resource Repository (NGRR) has 5,300 diverse genomic resources belonging to 40 plant species, with largest collections from rice followed by wheat.



### Bioinformatics activities

An interactive on-line database of NGRR (<http://www.nbpgr.ernet.in:8080/NPGRR/Home.aspx>) has been launched for effective utilization of genomic resources of crop species. The database is supported by bioinformatics capacity & infrastructure and handles requests/queries related to availability, submission, updating, retrieval, etc. of conserved genomic resources.

## GERMPLASM FIELD DAYS

Maize field day (796 accessions) was organized by HQ on 16<sup>th</sup> September. It was attended by 40 participants from various ICAR/SAU institutes. During interaction session, discussion was held on various issues like geo-referencing and collection of trait-specific germplasm, screening of germplasm against biotic and abiotic stresses at hotspot locations.



The staff of RS, Shimla organized a field day for *Kharif* pulses (538 accessions) cowpea, Frenchbean, adzukibean, and ricebean, on 28<sup>th</sup> August. Two field days were conducted by RS, Thrissur, one for okra on 11<sup>th</sup> August comprising 1,400 accessions representing 10 species for valuable traits, another for upland rice on 22<sup>nd</sup> September with 200 accessions.



Okra and *Kharif* pulses field day

## OUTREACH ACTIVITIES

### Farmers' meet for on-farm conservation

At RS, Thrissur, around 50 progressive and conservation-oriented farmers participated in the event on 10<sup>th</sup> August for on-farm conservation of landrace diversity of vegetables. Farmers were supplied with the seeds of diverse landraces in cucumber, vegetable cowpea, okra, sweet- and teal- gourd for on-farm maintenance in their home gardens.

A community seed bank (CSB) was established at Lossar Gram Panchayat of Spiti Valley in Himachal Pradesh under a DST funded project. Seeds of field pea and naked barley were purchased from farmers of various villages viz.,

Tekpa, Lossar, Hansa, etc. and kept in the CSB at Lossar. Two farmers' varieties have been facilitated for registration with PPV&FRA, New Delhi.

### Exhibitions/Fairs

The staff of RS, Srinagar had participated in 'Rising Kashmir 2017' - four-day exhibition inaugurated by Hon'ble Union Minister of Agriculture & Farmers' Welfare on 3<sup>rd</sup> July at Sher-i-Kashmir International Conference Centre, Srinagar. A stall was set up showcasing different activities of the station.



### Swachh Bharat Mission

"Swachhata Hi Seva - Swachh Bharat Mission" was organized in HQ and regional stations during the second fortnight of September. Mass cleaning campaign and awareness programme was organized.



### Parthenium awareness programme

The staff of ICAR-NBPGR, New Delhi and regional stations had actively participated in the *Parthenium* awareness programme on August 19<sup>th</sup> through clearing the institute/station premises free of this noxious weed.



## Foundation day celebrated

The staff of ICAR-NBPGR had celebrated its 41<sup>st</sup> foundation day on 2<sup>nd</sup> August with Dr. T. Mohapatra, DG, ICAR & Secretary, DARE as the chief guest. Sh. Pallava Bagla, Science Editor, NDTV delivered 4<sup>th</sup> Dr. Harbhajan Singh Memorial Lecture on "Challenges of communicating science to the public: a journalist's perspective".



## Mera Gaon Mera Gaurav

Under this programme, officials of RS, Bhowali undertook village visit in Almora district, and various community development activities like promoting traditional agriculture, indigenous food sovereignty and food-based approaches to community health and nutrition and creation of off-farm employment opportunities were addressed. About 30 kg seeds of five rice varieties were distributed by the staff of Base Centre, Cuttack to farmers of Itipur, Jayapur Patana and Radhakrishnapur villages for *Kharif* season sowing.



## HRD ACTIVITIES

### Workshop for customs officials

Training workshop for strengthening capacities of enforcement agencies (plant quarantine and customs officials) for transboundary movement of living modified organisms (LMOs) under UNEP-GEF phase-II capacity building project on biosafety was organized at Mangaluru, Karnataka for two days (21<sup>st</sup> and 22<sup>nd</sup> August).

This was organized by ICAR-NBPGR and MoEF&CC in association with Customs, Mangaluru.

### GMO detection workshop

Consultative workshop on "Harmonization of LMO/GM Detection Activities in India" was held on 21<sup>st</sup> August at ICAR-NBPGR, New Delhi. The workshop was sponsored by the UNEP-GEF Capacity Building Phase-II Project on Biosafety and MoEF&CC. Dr. Madhumita Biswas, Adviser, MoEF&CC inaugurated the workshop. Delegates from National Accreditation Board for Testing and Calibration Laboratories (NABL) and GM detection laboratories and MoEF&CC participated in the workshop.



### Brainstorming on "Delhi Declaration"

A brainstorming session was held on 28<sup>th</sup> August at NASC complex, New Delhi to identify the strategies for implementation of 12-point 'Delhi declaration on agrobiodiversity management' in India. The event was organized by ICAR-NBPGR and ISPGR in collaboration with Bioversity international, TAAS, PPV&FRA, and ISGPB.



ICAR-NBPGR celebrated 'Hindi Diwas' on 14<sup>th</sup> September, which was followed by organization of several Hindi literary competitions till 28<sup>th</sup> September.

## PERSONNEL NEWS

### Awards and recognitions

ICAR-NBPGR has been awarded with "Rajarshi Tandon Rajbhasha Puraskar" for the year 2015-16. Dr Kuldeep Singh, Director received this award on the occasion of ICAR Foundation Day celebrations, held at NASC, New Delhi on 16.07.2017.



**Dr. Sanjeev Kumar Singh**, Division of Genomic Resources received best oral presentation award in the National seminar on "Smart farming for enhancing input use efficiency, income and environmental security" organized at ICAR Research Complex for NEH Region, Shillong, Meghalaya from 19-21, September 2017.

**Dr. AK Misra**, RS, Shillong was nominated as member of the working group in Bio-Resource Development Centre, Govt. of Meghalaya, Shillong.

### Appointments/ Transfers/Deputations

**Dr. Gowthami R**, Scientist, joined HQ on 03.07.2017, and posted at TCCU, upon transfer from RS, Jodhpur.

**Dr. Shashi Bhushan Choudhary**, Scientist, joined ICAR-NBPGR, New Delhi on 07.07.2017, and posted at BC, Ranchi, upon transfer from ICAR-CRIJAF, Barrackpore.

**Dr. Vinod Kumar Sharma**, Scientist, joined ICAR-NBPGR, New Delhi on 22.07.2017, and posted at Germplasm Evaluation Division, upon transfer from ICAR-IARI, RS, Katrain (HP).

**Dr. Mamta Singh**, Scientist, joined ICAR-NBPGR, New Delhi on 20.09.2017, and posted at Germplasm Evaluation Division, upon transfer from ICAR-IIVR, Varanasi.

**Dr. Reetu**, Scientist, ICAR-NBPGR, New Delhi was transferred to ICAR-IGFRI, Jhansi w.e.f. 05.07.2017.

**Dr. TV Prasad**, Principal Scientist, ICAR-NBPGR, New Delhi was transferred to ICAR-CRIDA, Hyderabad w.e.f. 06.07.2017.

**Dr. RK Tyagi**, Head, Germplasm Conservation Division, is on deputation to APCoAB at APAARI, Bangkok w.e.f. 11.08.2017.

**Dr. JC Rana**, Head, Germplasm Evaluation Division, is on deputation to Bioversity International, New Delhi w.e.f. 31.08.2017.

**Dr. SK Malik**, Principal Scientist, ICAR-NBPGR, New Delhi was transferred to ICAR-HQ, New Delhi w.e.f. 31.08.2017.

**Sh. Gopal Singh**, Driver, ICAR-NBPGR, New Delhi was transferred to RS, Bhowali w.e.f. 25.08.2017.

### Promotions

Following technical staff has been promoted to the next higher grade as follows:

**Smt. Indira Devi A**, RS Thrissur as STO w.e.f. 12.06.2010.

**Sh. Babu Ram**, HQ as ACTO w.e.f. 11.10.2013.

**Smt. Sangita Tanwar**, HQ as ACTO w.e.f. 27.10.2013.

**Dr. Babu Abraham**, RS Hyderabad as CTO w.e.f. 01.07.2014.

**Sh. MV Reddy**, RS Hyderabad as Tech. Asst. w.e.f. 29.11.2014.

**Sh. YS Rathi**, HQ as ACTO w.e.f. 01.01.2015.

**Dr. BS Panwar**, HQ as ACTO w.e.f. 01.01.2015.

**Sh. OP Dhariwal**, HQ as Tech. Officer w.e.f. 02.05.2016.

**Sh. OS Ahlawat**, HQ as STO w.e.f. 01.07.2016.

**Sh. AP Singh**, HQ as ACTO w.e.f. 21.08.2016.

### Retirements

**Smt. G. Dakhar**, Private Secretary, RS, Shillong retired from her duties on 30.09.2017 after 35 years of service.

**Sh. Girdhar Gopal**, Skilled Supportive Staff, RS, Shimla retired on 31.08.2017.