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MUNG CENTRAL

The IMIN is a collaboration between The World Vegetable Center and international partners across India, Bangladesh, Myanmar, Indonesia, Australia, Kenya, Tanazania and Uganda to breed new mungbean lines with the hope of uncovering desirable traits for improved production across partner countries. This work is funded by the Australian Centre for International Agricultural Research (ACIAR).

Editorial

This edition of the newsletter covers details from a workshop on Demand-Led Breeding (DLB) with mungbean researchers from Asia and Africa, discovery of new sources of resistance to biotic stresses from the screening of the WorldVeg mungbean mini-core collection and *Vigna* species, progress in the development of improved varieties suited to Tanzania and on looking mungbean through a commercial lens in Uganda.

If you are interested in finding out more about collaboration with the IMIN, please email: ramakrishnan.nair@worldveg.org We hope you enjoy this eighth edition of Mung Central.

To access previous editions, visit: https://www.aciar.gov.au/search?search_api_fulltext=mung+central

African and Asian mungbean researchers explored Demand-Led Breeding principles for designing market preferred varieties

Contributed by Sunil Chaudhari and Ramakrishnan M. Nair

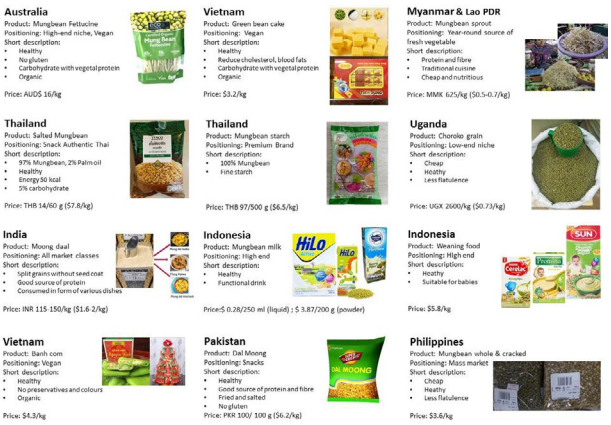
Snapshot of attendees at Demand-Led Breeding workshop

The World Vegetable Center (WorldVeg) in collaboration with Syngenta Foundation for Sustainable Agriculture organized a workshop on Demand-Led Breeding (DLB) through the ACIAR funded International Mungbean Improvement Network (IMIN) project on 8th and 9th December 2020. Over 80 mungbean researchers from 20 countries of Asia and Africa came together virtually for brainstorming on DLB approaches for market segmentation and designing mungbean product profiles for some of the major mungbean growing countries.

The market segmentation identified the dry grain market as one of the leading market segments in Kenya (90%), Myanmar (80%), Indonesia (50%), India (50-55%), and Bangladesh (40-50%). The split grains also known as *dal* is another major market segment in Pakistan (70-80%), India (~50%), and Bangladesh (40-50%) with over 50% market share of total mungbean demand in these countries. However, the confectionary/processing type market segment accounts for 40-50% in Bangladesh, 45-55% in Indonesia (~35% for energy drinks and ~25% for flour) and, 20-30% in India and Pakistan. Sprout is another popular market segment in Indonesia (35%) and Myanmar (20%) whereas it is emerging in India and Bangladesh with <10% of the total mungbean market in both countries. The confectionary/processing type and sprout market segments currently access raw mungbean from dry grain or split grain segments as per specific requirements. Higher yields, short maturity

duration, synchronous maturity, non-shattering type, resistance to mungbean yellow mosaic disease and bruchids along with large seed size are some of the must-have traits across market segments in India, Bangladesh, Indonesia, Kenya, Myanmar, and Pakistan. The large seed size, green seed coat color, shiny luster, uniform round seed shape, and higher dehulling percent are preferred traits by consumers, traders, and processors across these countries. In addition to these, tall and erect plant type with pod bearing on top, suitable for mechanical harvesting are also required traits for different market segments in India and Pakistan. Some of the other biotic stresses such as powdery mildew and leaf crinkle diseases in India, dry root rot in India, Pakistan, and Myanmar, and bacterial blight and anthracnose in Kenya are some of the emerging threats to mungbean production in these respective countries and are preferred to be considered in designing product profiles.

The workshop also exercised virtual demonstration of popular mungbean-based food products from different countries to celebrate diversity in the value chain. Some of the popular mungbean-based food products from different countries with details are shown below.



Popular mungbean based food products from different countries

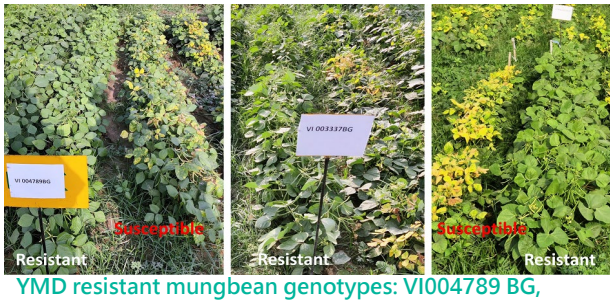
New sources of resistance to yellow mosaic disease identified in mungbean

Contributed by Aditya Pratap, Mohd Akram, Sanjeev Gupta and Ramakrishnan M. Nair

Yellow mosaic disease (YMD) is one of the devastating diseases of mungbean crop, caused by one of the three viruses viz., *Mungbean Yellow Mosaic India Virus* (MYMIV), *Mungbean Yellow Mosaic Virus* (MYMV) and *Horsegram Yellow Mosaic Virus* (HgYMV). YMD is transmitted by whiteflies and spreads quickly in the presence of susceptible host, congenial environment and viruliferous vector. Host plant resistance has always been considered as the most practical and environment friendly approach for the effective management of YMD.

Intensive efforts have been made by the ICAR-Indian Institute of Pulses Research, Kanpur (ICAR-IIPR) during 2017 to 2021 for the identification of new sources of resistance to YMD. Over 450 genotypes comprising of mungbean advanced breeding lines and germplasm from ICAR-IIPR and mini-core accessions from WorldVeg were screened against YMD for five years under field conditions in wet-summer and spring season during 2017-2021. Among these, three advanced breeding lines (IPM 526-11, IPM 08-1 and IPM 312-17) developed at ICAR-IIPR and seven accessions (VI001692 AG, VI003658 BG, VI000815 BG, VI004145 B-BLM, VI004069 BG, VI004789 BG, and VI003337 BG) from WorldVeg mungbean minicore collection were reported as resistant to YMD across years and seasons of evaluations. The disease incidence among resistance genotypes ranged between 0 to 3.1% as compared to 61.1 to 100% in susceptible check (DGGV 2) across seasons and years. Similarly, the disease severity was significantly lower (< 1%) in resistant genotypes compared to DGGV 2 (> 70%).

The identified new sources of YMD resistance will be used as donors in introgression breeding programme for developing superior mungbean cultivars. These could also be used for broadening the genetic base for resistance to YMD and for development of mapping populations to map genomic regions conferring resistance to MYMIV.



YMD resistant mungbean genotypes: VI004789 BG, VI003337 BG and VI004145 B-BLM

A new source of resistance to powdery mildew in mungbean mini-core collection

Contributed by Abhishek Gowda

Powdery mildew (*Podosphaera xanthii*) is a significant threat to global mungbean production. In India, powdery mildew is responsible for around 20 to 100% yield lose depending upon season, location, environmental conditions and variety under cultivation. In India, the disease is reported to cause yield losses of around 35% in Gujarat, 20–40% in Chhattisgarh, 9 to 50% in Uttarakhand, and up to 100% in Maharashtra State under favourable environmental conditions.

Initial symptoms appear as white, powdery patches on the upper leaf surfaces and quickly progressed to grey patches on both sides of the leaves and later turn from purple to brown discoloration on the base of diseased leaf. To identify the source of resistance, 126 mungbean mini-core accessions were screened for powdery mildew at WorldVeg South Asia, Hyderabad, India during post-rainy season, 2020. Natural infection was observed in the field, and the scoring was done on a 0-5 visual rating scale (0= highly resistant and 5 = highly susceptible). The mini-core accessions viz., VI003534 BG, VI005022 BG, VI003882 A-BLM, VI001403 BR and VI003470 BG showed a resistance reaction to powdery mildew. These resistant accessions could be used as potential sources of resistance to powdery mildew in the breeding programs.

VI003534 BG (R) VI005022 BG (R) VI005024 B-BL (S)

Mungbean mini-core accessions VI003534 BG and VI005022 BG showing a resistant (R) reaction against powdery mildew in contrast to susceptible (S) accession VI005024 B-BL

Identification of multiple bruchid species resistance in *Vigna* accessions

Contributed by Revanasidda, Aditya Pratap, Sanjeev Gupta and N.P. Singh

Bruchids are devastative pest in mungbean and other legumes causing serious post-harvest yield losses. A set of 42 accessions from 13 *Vigna* species endemic to India was screened for resistance against three bruchid species (*Callosobruchus chinensis* L., *C. maculatus* F. and *C. analis* L.) in Storage Entomology Laboratory, Division of Crop Protection, ICAR-Indian Institute of Pulses Research (IIPR), Kanpur, India during 2019-2021. The accessions were subjected to 'Free-choice '(FC) and 'No-choice' (NC) tests with three bruchid species to categorize the resistance reaction based on the seed damage scores and susceptibility index (SI).

The lines that exhibited resistance in the preliminary choice screening were further tested for confirming the resistance. Among the 42 accessions, four accessions of *V. umbellata* (IC251439, IC251442, PRR 2007-2 and IC251440) and two accessions of *V. vexillata* (IC248326 and IC248343) were found resistant against *C. chinensis* and *C. maculatus* in FC and NC test.

However, the accessions of *V. khandalensis (*Kumur local) and *V. mungo* var. *mungo* (IC251397, IC251390, IC251385 & IC251387) were found to be resistant only against *C. chinensis* under FC and NC tests. Few accessions belonging to *V. trinervia* (JAP 10-51), *V. trinervia var. bournei* (IC247407), *V. pilosa* (IC210575, IC210580 and IC210576) and *V. dalzelliana* (IC203864) recorded a variable bruchid damage score (5–7) and SI values (0.02–0.07) and were found moderately resistant/susceptible against *C. chinensis* and *C. maculatus*, whereas, the same lines were consistently reported to be moderately susceptible to *C. analis*. The resistant lines need to be further subjected to biochemical analysis to identify the specific seed biochemical components offering resistance to bruchid damage in these *Vigna* species. This is one of the pioneer reports on identifying the multiple bruchid species resistance in different cultivated and wild endemic *Vigna* species. The identified accessions could be deployed in the breeding programs across different *Vigna* species to develop varieties with resistance to bruchid infestation.

Mungbean attracts the "eyes" of commercial farmers in Uganda

Contributed by Emmanuel Mbeyagala

Mungbean cultivation in Uganda is largely carried out by smallholder farmers operating on less than a hectare of land. These smallholder farmers mainly grow the crop as a source of income since they sell off most of their produce (over 70%) in the market keeping some quantity for domestic consumption. The status of mungbean as a 'smallholder crop' in the country is however changing with growing interest from large commercial farms that are targeting the increasing demand of the crop in the region and globally. Large scale farms in the country are quite interested in mungbean cultivation owing to increasing demand and competitive pricing of the produce in the global market and availability of fully mechanized operations starting from land preparation to threshing. The large-scale farms are exploring the opportunities to cultivate the crop twice in a calendar year. As an instance to the expansion of area under mungbean cultivation, one of the farmers planted around 2000 acres of mungbean during the first season of 2021 and has plans to double the acreage in the coming seasons.

National Semi-Arid Resources Research Institute under the National Agricultural Research Organization (NARO-NaSARRI) will continue to support all stakeholders of mungbean value chain in Uganda to ensure the development of mungbean sub-sector in the country for enhanced profitability and secured livelihoods for all stakeholders.

Dr. Mbeyagala Emmanuel (on the right) interacting with a farm manager at one of the commercial farms in Uganda

Mungbean for alleviating hidden hunger and securing livelihoods in Tanzania

Contributed by Papias H. Binagwa and Ester Simfukwe

Tanzania Agricultural Research Institute (TARI) in collaboration with World Vegetable Center is developing improved mungbean varieties with high yield potential and resistance to major diseases and pests for Tanzania. The breeding program is also aimed at developing varieties with seed color, lustre and size to meet the domestic and export market needs.

WorldVeg had shared 57 mungbean advanced breeding lines with TARI for testing their performance in the country. Five shortlisted advanced breeding lines have been selected for multi-location trials. The trials at different locations i.e. Tengeru, Miwaleni and Kilimanajro, Tanzania were visited and inspected by project partners and TARI research team.

In addition, with the support from UKaid (FCDO) and ACIAR funded projects, current focus of this collaboration is to accelerate the adoption of high-yielding mungbean varieties by the smallholder farmers. The project will be ensuring increased seed availability and accessibility to smallholder farmers to increase mungbean yield levels and production for meeting the domestic and global market demand.

Moreover, efforts will also be made to make consumers aware of mungbean nutritional values and health benefits along with its role in alleviating hidden hunger and increased food and nutritional security in the country. To achieve this, all the project partners agreed to demonstrate the benefits of mungbean through health care centers in all the district hospitals. New mungbean recipes via cooking shows and other social media platform are being popularized among the consumers.

TARI and WorldVeg researchers discussed strategies to proceed further with mungbean crop in Tanzania

Multi-location trial inspection by TARI research team and project partners

Recipe- Makende

Contributed by Ester Simfukwe

Makende (in Swahili) or Pure (in Pare) is a traditional food of Pare tribe in Tanzania. It is also commonly consumed in Kenya (Named as Githeri). 'Makende' is a very nutritious and healthy snack prepared by boiling raw maize (carbohydrate source), mungbean (protein source) and coconut milk (healthy fat source) along with different spice flavours.

Ingredients:

- 1 ½ cup dried mungbean grains
- 1 ½ cup green maize (can be substituted with 2 ½ cups frozen corn)
- 1 onion, 1 carrot, 3 medium tomatoes, 1 sweet pepper and 1 hot chili pepper (all chopped)
- 1 ½ tsp turmeric; 3 cloves garlic, minced
- 1 ½ tsp salt
- Coconut cream (optional)

Recipe

For the spicy version add the following to the above: 1-inch of fresh ginger, peeled and minced, 1 tsp cumin, ½ tsp cardamom, ¼ tsp cayenne pepper, ½ cup chopped cilantro.

Instructions

1. Soak the green maize in water overnight or for at least 5 hours
2. Rinse the soaked maize and drain out the water
3. Add 8 cups of water to the pot and cook mungbean and soaked maize
4. Add coconut cream during boiling
5. Add the spices (except salt) and chopped vegetables
6. Simmer over low to medium heat until mungbean and maize are soft and drain out excess water (if water is excess and above the level of cooked grains)
7. Add salt to taste
8. Serve Makende alone with rice/Ugali

Staff featured from India

Abhishek Gowda

Abhishek Gowda has joined as Scientific Officer-Plant Pathology with the World Vegetable Center, South Asia/Central Asia team at ICRISAT Campus, Hyderabad in ACIAR funded International Mungbean Improvement Network (IMIN) project. His work involves development of integrated disease management (IDM) modules for prevailing diseases of mungbean and screening of breeding material for resistance to target diseases in glasshouse and field conditions. He is also responsible for detection and diagnosis of legume diseases and to provide trainings to NARS researchers, extension officers and farmers on IDM. Before joining the WorldVeg, he has worked on identification of host defence inducers and consortia of bio-agents against pomegranate bacterial blight disease, screening of breeding material for resistance to major diseases, molecular detection of plant pathogens and developing integrated disease management modules for *Ceratocystis fimbriata* during his masters and doctoral research dissertations at University of Horticultural Sciences, Bagalkot, India.

Project News & Events

Annual Virtual Group Meet of All India Coordinated Research Project on MULLaRP (Mungbean, Urdbean, Lentil, Lathyrus, Rajmash and Field Pea) organized by ICAR-Indian Institute of Pulses Research, Kanpur, India held on **May, 27-28, 2021.**

National Web Conference on "Sustaining Pulse Production for Self Sufficiency and Nutritional Security" jointly organized by ICAR-Indian Institute of Pulses Research, Kanpur and Indian Society of Pulses Research and Development, Kanpur, India held virtually during **February 9-11, 2021.**

Future Newsletters

The IMIN aims to publish a semi-regular newsletter and is now calling for submissions for the next edition. Please email aparna.shivanna@worldveg.org to submit articles or for furhter information on the newsletter.

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Publications

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Book Release

"The Beans and the Peas" from Orphan to Mainstream Crops edited by Aditya Pratap and Sanjeev Gupta published by Elsevier Woodhead Publishing Limited, Duxford, U.K. (eBook ISBN: 9780128214442) was virtually released by Dr TR Sharma, Deputy Director General (Crop Sciences), ICAR on May 21, 2021.

Awards

The poster entitled "Identification of sources of resistance against dry root rot caused by *Macrophomina phaseolina* in a mungbean mini-core collection" secured Best Poster Presentation Award at the National Web Conference on 'Sustaining Pulse Production for Self Sufficiency and Nutritional Security' jointly organized by ICAR-Indian Institute of Pulses Research, Kanpur and Indian Society of Pulses Research and Development, Kanpur, India held from February, 9-11 2021. The presented research work was conducted by the World Vegetable Center in collaboration with the Department of Agriculture Research, Myanmar.

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