National Conference on
Strengthening Food Systems through Increased Fruit Cultivation

18-19 November 2025
NASC Complex, New Delhi

ABSTRACT BOOK

National Conference on Strengthening Food Systems through Increased Fruit Cultivation

18-19 November 2025

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PREFACE

We are delighted to present the Abstract Book of the National conference on Strengthening food systems through increased fruit cultivation, 2025. The national conference spanning two days comprises one plenary session, three technical sessions, one panel discussion and one valedictory session with more than 32 oral presentations and >5 posters.

This publication is unique as it carries abstracts based on the research and development in conservation and use of fruit genetic resources. The abstracts included here offer a cross-sectional view of the ongoing work in the area of fruit nutrition, pest resistance, resource management, and germplasm characterization. Organizers acknowledge the contributors who submitted the abstracts in camera ready form and the editors for compiling the publication by racing against the time.

Date: November 16, 2025 **Editors**

ACKNOWLEDGEMENTS

National conference on Strengthening food systems through increased fruit cultivation, 2025 is a great opportunity for us, as both organizers and participants, to share mutual experience in such an important field of fruit genetic resources. The conferece would ne attended by 150 delegates from ICAR institutes, international organizations, agricultural universities, NITI Aayog, NGO, private stakeholders, and farmers, besides participation from overseas.

We sincerely thank for the excellent technical and administrative support provided by Bioversity International.

The national conference is projected to be a mega-event in recent times to deliberate on science, technology, policy, and partnership, driving the fruit resources and management. An event of this scale and of national importance cannot be successful without financial support from our organizing partners, co-organizers and sponsors. We draw our strength from the support of colleagues from different participating institutes in this conference. We thank each one of them for their role in organizational steps.

Date: November 16, 2025 **Editors**

ABSTRACTS

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ABSTRACTS

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A-1

Morphological diversity in Jackfruit (*Artocarpus heterophyllus* Lam.) in selected districts of Uttar Pradesh

Abhishek Pratap[1*] A. K. Srivastava[2], Om Prakash[3], S. V. Dwivedi[4] and Vishwajeet Singh[1]

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Jackfruit (*Artocarpus heterophyllus* Lam.) is a commercially significant evergreen tree species cultivated extensively across India, particularly at altitudinal ranges between 450 and 1200 meters. India ranks as the second-largest global producer of jackfruit, with its cultivation concentrated in states such as West Bengal, Tamil Nadu, Karnataka, Odisha, Kerala, Assam, Bihar, Tripura, and Uttar Pradesh. Despite its economic relevance, comprehensive studies on the genetic diversity of jackfruit within India remain limited. Jackfruit is predominantly cross-pollinated and propagated through seeds, resulting in substantial phenotypic and physico-chemical variability among natural populations. This variability encompasses traits such as fruit yield, weight, shape, rind and flake coloration, flake number, and

texture. However, due to farmer-driven selection based on market preferences and the absence of formally released cultivars, the genetic resource base is under threat. Only a few local landraces—such as 'Champa', 'Gulabi', 'Rudrakshi', and 'Hazari'—are recognized for their distinct morphological traits.

To address the urgent need for genetic improvement and conservation, a systematic survey was conducted during 2023–2024 across eight districts of Uttar Pradesh: Banda, Fatehpur, Lalganj, Pratapgarh, Ayodhya, Sultanpur, Varanasi, and Ghazipur. The objective was to identify and characterize promising jackfruit genotypes using standardized morphological descriptors as per the guidelines of the International Plant Genetic Resources Institute (IPGRI), Rome. The survey revealed considerable variation among genotypes in traits such as tree architecture, bark texture, leaf morphology, fruit shape, rind coloration, peduncle attachment, spine morphology, spine density, and latex exudation—highlighting the rich genetic diversity present in the region and underscoring the potential for selection and breeding of superior types.

Keywords: Jackfruit (*Artocarpus heterophyllus* Lam.), promising genotypes, variability, diversity.

A-2

Unveiling Genetic Diversity in Guava: Morpho-biochemical segregation and hybridity validation through SSR markers in guava full-sibs

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Guava is an important fruit crop valued for its high nutritional and health-promoting properties. Growing awareness of guava's health benefits has boosted the demand for varieties with enhanced nutritional value and superior fruit quality. Varietal improvement typically depends on crossing genetically diverse, elite heterozygous parents to produce segregating populations, from which superior recombinants can be selected. Hence, understanding the segregation patterns of important traits is essential for effective targeted breeding. The study assessed full-sib progenies produced from the cross between Allahabad Safeda and Arka Kiran. Hybridity testing of 60 progenies using 60 SSR markers ascertained 50 as full-sibs based on three informative SSRs (FHTGSSR-3.4, 7.5, and 3.6). These progenies were then evaluated for various morphological and biochemical parameters. Substantial variation was observed in tree, leaf, fruit, and seed characteristics, exhibiting both intermediate and transgressive segregation patterns. Fruit traits varied widely (length: 5.59–10.13cm; weight: 79.33–406.33g), also seed number (134–520), and hardness (6.55–14.45kg·cm^{-2}) showed broad segregation. Qualitative variation was also recorded for leaf and fruit shape, peel, and pulp colour. Biochemical profiling revealed significant differences in TSS (10.30–14.80°Brix), ascorbic acid (65.00–302.00mg/100g), carotenoids (0.78–9.55mg/100g), and lycopene (0.53–9.03mg/100g). Antioxidant activity also varied considerably (DPPH: 86–95%; FRAP: 8.9–22.0µmol Trolox/g). Multivariate analyses indicated positive correlations among fruit weight, size, and biochemical parameters and titratable acidity was negatively correlated with TSS/acid ratio, while cluster analysis grouped progenies into three distinct clusters indicating genetic diversity. PCA separated fruit size from biochemical quality attributes, revealing contrasting cluster smaller fruits tended to accumulate higher carotenoids and lycopene, while larger fruits grouped with thicker pulp and higher weight. The results revealed extensive genetic and biochemical variability among the progenies, with several combining superior yield,

nutritional, and antioxidant attributes. The study demonstrates that hybridization between heterozygous guava parents effectively generated diverse progenies, facilitating the identification of superior recombinants exhibiting enhanced fruit quality and nutraceutical potential. Furthermore, the SSR markers (FHTGSSR-3.4, 7.5, and 3.6) successfully confirmed hybridity, underscoring their reliability and practical utility in guava breeding programs aimed at improving both yield and fruit quality.

Keywords: *Guava; full-sib; SSR; morpho-biochemical; lycopene*

A-3

Documentation of Ethnobotanical, Nutritional and Economic Significance of *Moringa concanensis*: A threatened tree species of Rajasthan

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Moringa concanensis Nimmo, locally known as "Jungali Sehjan" in Rajasthan and "Kattumurungal" by tribal communities in the Nilgiris (Tamil Nadu), has recently gained attention for its nutritional, medicinal, and economic potential, comparable to that of the well-known *M. oleifera*. Phytochemical analysis reveals that *M. concanensis* contains terpenoids, steroids, cardiac glycosides, alkaloids, tannins, phenols, carbohydrates and proteins. Its nutritional profile indicates high levels of vitamins (C, E, K) and essential minerals such as calcium, sodium, potassium, and iron. Furthermore, the presence of ascorbic acid, myristic acid, palmitic acid, oleic acid, stearic acid, arachidic acid, and linoleic acid has been reported from its fruits and seeds. Traditionally, various parts of the plant are utilized in indigenous

healthcare systems. The unripe fruits are consumed as vegetables, while leaf juice taken on an empty stomach helps reduce cholesterol and body weight. Cooked leaves have a cooling effect and are believed to prevent eye soreness. The flower juice, taken twice daily for 30 days, is used as a female tonic, while leaf decoctions are used as aphrodisiacs, in the management of diabetes, menstrual disorders, jaundice, and constipation. Seed powder is used as an anthelmintic, and root decoctions are taken for spinal cord pain. The gum mixed with milk is traditionally applied on the forehead to relieve headaches.The increasing market demand for *Moringa*-based products, particularly leaf powder, seed oil, and nutraceutical supplements, has encouraged community-based collection and value addition initiatives.

A reconnaissance survey was conducted in Barmer, Churu and Jodhpur District of Rajasthan to document the occurrence of *M. concanensis* for multiplication through seeds and ethanobotanical significance as this tree is categorised under threatened species in Rajasthan. Trees were identified from different sites and recorded the morphological parameters like tree height, girth, flowering and fruiting percentage. Seeds were collected from the marked trees and raised under nursery conditions and recorded an overall germination of 62%. Physical parameters of pods like pod length, pod width, seeds per pod were also recorded. Findings reveal that average pod length varies from 10.3cm to 24.0cm with an average of 17.03 cm. Pod width varies from 1.1-2.6cm with an average of 1.63cm. No. of seeds per pod varied from 5.0-14.0 with an average of 8.73. Marketing data reveals that *Moringa* leaves and seeds from Rajasthan fetch ₹80–150/kg and ₹250–500/kg, respectively, depending on quality and drying methods. Processed products like *Moringa* leaf powder capsules and seed oil have growing domestic and export markets, particularly in Ayurvedic nutraceuticals and natural cosmetics. Local entrepreneurs and women's self-help groups (SHGs) in southern Rajasthan are increasingly adopting small-scale *Moringa* processing units, contributing to livelihood diversification and income generation. The potential for sustainable cultivation and commercial exploitation of *M. concanensis* is thus substantial, aligning with state-level initiatives for promoting underutilized and climate-resilient species.

Keywords: Documentation, Germination, *Moringa*, Medicinal plant, Phytochemical analysis

A-4

Container fruit culture: An approach for health and income generation

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Problem of malnutrition among the city dwellers pose the serious health issues further pollution in city posing great threat to our health. As the increased population resulted unemployment not only in rural areas and urban too. The aforementioned problem can be addressed by containerized fruit culture up to some extent. Growing fruits (perennial plants) in the container always been a challenging task, accordingly ICAR-CISH, Lucknow, initiated research on standardization of container fruit growing which can be used in the city not only for nutrition but increasing green cover which act as carbon sequestration also.

For successful container fruit culture it is required to know the type and composition of media, container size, and type of fruit plant and their variety. It can be helpful for fruits growing on the roof top. The results obtained from the experiment conducted at ICAR-CISH, revealed that canopy spread (60-75 cm) recorded in different containerized fruit plants with canopy height (70-125 cm). In guava 0.14-0.52 m^3, pomegranate 0.15-0.51 m^3 and in citrus 0.21-0.42m^3 canopy volumes recorded after 3 years. Higher canopy growth recorded in larger containers; however, yield and quality attributes did not vary in different container sizes. Fig, karonda, Citrus, 'Kagazilime' variety 'Sriganganagar Lime-1', Jaffa (Sweet orange) and Navel Orange (Sweet orange), pomegranate and 'Kinnow' performed best in container. Maximum

canopy spread (79.30 cm) was noted in Sriganganagar Lime-1 grown in 30x45 cm container which was on par to 45x60 cm, 45x45 cm container size. Pomegranate variety Mridula was found most suitable for growing in the container. In case of guava 'Shweta', 'Lalit' cultivars were found most suitable for container farming. Phenological parameters showed that different fruits grown in container have 4-7 days' advance in flowering and fruit maturity than field condition. In guava, 4-5 kg fruits, pomegranate 2-3 kg and in citrus group fruit 3-4 kg fruits per containerized plants were harvested in 3rd years. Water requirements vary according to season, containers size and type of fruit plants. Maximum ET and water requirement was recorded in guava. During summer approximately 1.80-4.50 liter water/ container/day needed in different fruit crops, in winter 01.0- 2.0 Liter /container/day water required in guava, citrus and pomegranate. The B: C ratio for production of fruited containerized plants is 4:1.

Keywords: Container fruit cultivation, urban horticulture, nutritional security

A-5

Rapid and Precise Detection of Male and Female Plants in Papaya Using Molecular Markers at Nursery Level for Enhancing Resource Efficiency and Productivity

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For commercial papaya cultivation, a higher proportion of female and hermaphrodite plants is necessary, as male plants do not yield fruit and females generally produce lower quality produce. Conventional methods are unable to determine plant sex at the seedling stage. In this study, a RAPD-SCAR molecular marker (T12) was used to identify sex in 100 seedlings each of the CO 7 gynodioecious and CO 8 dioecious varieties developed by this university. Presence of the T12 marker reliably indicated male lines, while its absence identified female or hermaphrodite plants. To ensure accuracy, an OPA 04 oligomer primer served as a control across samples. The T12 marker predicted plant sex with 97% accuracy in CO 7 and 98% in CO 8, validated by field observation of flower types. Sequence analysis of the T12-amplified product confirmed its alignment with male-specific regions of the papaya Y chromosome. Adopting these molecularly certified seedlings allows growers to save up to 55% on seedling and labor costs by eliminating non-productive male plants at the outset. These findings equip breeders and farmers with an efficient tool for early sex identification, enhancing both crop profitability and production efficiency.

Keywords: RAPD-SCAR, dioecious varieties, hermaphrodite, crop efficiency

A-6

Identification of Brown Spot Disease in Dragon (Kamalam) fruit caused by *Exserohilum rostratum* and in vitro assessment of antifungal chemicals

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Dragon fruits, particularly *Selenicereus undatus* and *Selenicereus polyrhizus* (previously *Hylocereus undatus* and *Hylocereus polyrhizus*), are members of the cactus family. These fruits are valued for their edibility and high market worth in India. Dragon fruit production can suffer significant yield losses due to various fungal diseases, making the precise identification of causal pathogens crucial for developing cost-effective and sustainable disease management strategies. The stems of Kamalam fruit at IIHR (CHES-Hirehalli), Karnataka, showed distinctive reddish-brown lesions with a slight pink tint, with a disease incidence of about 3–5%. In this study, *Exserohilum rostratum* DF57 was isolated from stems of *Hylocereus monacanthus* exhibiting brown spot symptoms. DNA sequencing of the internal transcribed spacer (ITS-rDNA) regions of isolate DF57 showed high similarity to known *Exserohilum rostratum* strains. Pathogenicity tests confirmed that *E. rostratum* DF57 could infect two cultivated dragon fruit species (*H. undatus* and *H. monacanthus*), with large brown lesions appearing on 3-week-old inoculated stem cuttings six days post-inoculation (dpi) in repeated laboratory and glasshouse trials. Morphological and cultural characteristics of the isolate were consistent with those of *Exserohilum* species. PCR amplification using ITS1/ITS4 primers, followed by sequence analysis of the ITS region of DF57 (PV701132) and two additional isolates (PV697033, PV701028), showed 100% similarity to *Exserohilum rostratum* sequences (PQ373011, PQ373015) in BLAST searches. Since no control measures have been previously reported for diseases caused by *E. rostratum*, the study evaluated the antifungal activity of seven fungicides at concentrations ranging from 50 to 2000 ppm using the poisoned food technique. Seven fungicides were screened against DF57 using the poisoned food technique (50–2000 ppm). Carbendazim and Tebuconazole 50% + Trifloxystrobin 25% WG achieved complete inhibition at all concentrations, while Carbendazim + Mancozeb and Metalaxyl + Mancozeb were fully effective at 250 ppm and 500 ppm, respectively. Thiophanate methyl showed moderate inhibition (20–65%), whereas Sulphur and Copper oxychloride were less effective (12.5–85%). Systemic fungicides were

generally more effective than contact fungicides. These findings confirm *Exserohilum rostratum* as an emerging pathogen causing brown stem spot disease in dragon fruit in India, marking the first report of this association. The tested fungicides demonstrated strong potential for early disease management; however, further validation under field conditions is recommended.

Keywords: *Exserohilum rostratum,* brown stem spot, disease management, fungicide screening

A-7

Nutrient-Rich Underutilized Fruit Trees: Prospects for Climate-Resilient Agriculture

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Underutilized fruit tree species represent an invaluable but often overlooked resource for achieving nutritional security, ecological sustainability, and climate resilience. Many of these species—such as *Ziziphus mauritiana* (ber), *Aegle marmelos* (bael), *Syzygium cumini* (jamun), *Carissa carandas* (karonda), and *Tamarindus indica* (imli)—are naturally adapted to harsh climatic conditions and marginal soils where conventional crops fail to thrive. Rich in essential vitamins, minerals, antioxidants, and dietary fiber,

these fruits play a significant role in improving rural diets and combating malnutrition. Despite their high nutritional and adaptive potential, most remain neglected in mainstream horticultural research, extension, and market systems. The promotion of underutilized fruit trees can contribute to diversified farming systems, enhance soil fertility, prevent erosion and ensure sustainable livelihoods in dryland and semi-arid regions. Integrating these resilient species into agroforestry and climate-smart agricultural practices can reduce the vulnerability of smallholder farmers to drought and other climate stresses. Furthermore, value addition, processing, and market linkage development can transform these neglected species into profitable commodities, fostering local enterprise and rural development. Harnessing their potential requires focused research on propagation techniques, genetic improvement, post-harvest management and policy support for conservation and utilization. Encouraging community-based cultivation and awareness about their nutritional benefits can also enhance acceptance and demand. Thus, nutrient-rich underutilized fruit trees hold tremendous promise not only for enhancing food and nutrition security but also for building climate-resilient agricultural systems and sustainable rural economies.

Keywords: Underutilized fruit trees, nutrition security, climate resilience, sustainable agriculture, indigenous species and livelihood diversification.

A-8

Participatory domestication of underutilized fruits in north east india for enhanced livelihood and nutritional security

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Throughout the tropics there are many underutilized fruit species that are consumed and traded for livelihood by rural people. In the North East region of India, a number of such species have been identified which are a source of food, nutrition, medicine, income and security during unfavorable times. Evidences from many reports showcase the diversity of these wild edible fruit resources within the region with many ongoing efforts to characterize the morphological, nutritional and medicinal properties of these resources. Concurrently growing evidence reveals the potential of these resources have to alleviate rural household economy. Hence there is large scope of integrating the species as novel crops within existing farming systems. However due to the lack of holistic scientific interventions for domestication of such species farmers are reluctant to adopt them. Participatory domestication refers to the means by which rural communities select, propagate and manage species according to their own needs, in partnership with scientists, civic authorities and commercial companies. It is usually oriented towards specific local markets and encompasses the use of both indigenous knowledge and genetic selection based on scientific principles. In this paper, I share my experiences on the domestication of two wild edible fruit trees- *Phoebe cooperiana* and *Parkia timoriana* involving characterization of the variation, understanding consumer preferences and selection of superior phenotypes. Efforts to standardize vegetative propagation methods are underway to ensure cheaper and faster method of seedling generation for planting purpose. The future of underutilized fruit domestication to resolve the nutritional and economic challenges faced in the region is discussed.

Keywords: NUS species, participatory domestication, rural livelihood, genetic variation

Enriching Guava Genetic Resources through Phylogenetic and Population Structure Analysis using genome-wide microsatellite markers

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Guava (*Psidium* spp.) is a fruit crop of significant economic and nutritional value, playing an increasingly vital role in food and nutritional security. Currently, the majority of Indian guava cultivars originate from the open pollinated selections of the Allahabad Safeda or cross-bred from a few guava genotypes, resulting in a narrow genetic base. Therefore, the Indian guava industry fixed guava ideotype develop to the varieties having the key traits like tenet branching, thick firm pulp, small soft seed core, extended shelf life, and resistance to biotic and abiotic stresses. To address this, augmentation of the genetic resources inform of cultivars, selections, hybrids, exotic/USDA introductions and wild species were made and maintained in the field gene bank of guava. Genetic characterization is a crucial step for effective germplasm management and its optimal utilization in guava breeding. In addition, microsatellite or simple sequence repeat markers are considered robust marker system in genetic characterization and population structure studies in guava. In the present investigation a collection of 78 guava genotypes (cultivars, selections, exotic/USDA introductions, and wild species) maintained at ICAR-IARI, New Delhi was characterized using 44 polymorphic genome-wide SSR (g-SSR) markers. These, 44 FHTGSSR loci amplified 187 alleles (mean 4.25 alleles per locus), indicating substantial genetic variation among the guava genotypes. The mean PIC was 0.52, mean gene diversity (He) was 0.58, and mean observed heterozygosity (Ho) was 0.148, reflecting moderate to high marker informativeness. The Neighbour-Joining tree clustered the 78 guava

genotypes into three major groups, however, the wild species, exotic and USDA introduction genotypes are grouped separately from the Indian genotypes, while STRUCTURE and PCoA consistently resolved genetic groups and admixture patterns; allelic frequency divergence between the two STRUCTURE populations was 0.0966. The AMOVA attributed most variation to differences among individuals within populations 72%, with 7% among populations and 21% within individuals ($P \leq 0.001$). Thus, these markers were efficient and informative for guava diversity analysis; the evaluated germplasm displayed significant diversity, providing reliable genetic resources for selecting superior genotypes and developing novel guava cultivars.

Keywords: Guava, Genome-wide SSRs, Genetic Resources, Population structure.

A-10

Biodiversity of minor fruit in Bundelkhand region conservation and utilization strategies

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The Bundelkhand region of central India, spanning parts of Uttar Pradesh and Madhya Pradesh, is endowed with a rich diversity of minor and underutilized fruit species that play a crucial role in local food security,

nutrition, and ecological balance. Despite their potential, these species remain neglected in research, conservation and commercial utilization. This study documents the biodiversity of minor fruits in Bundelkhand, highlighting species such as *Ziziphus mauritiana* (ber), *Carissa carandas* (karonda), *Aegle marmelos* (bael), *Syzygium cumini* (jamun), *Annona squamosa* (custard apple), *Buchanania lanzan* (chironji) and *Tamarindus indica* (imli). Field surveys, ethnobotanical studies, and interviews with local communities were conducted to assess species distribution, traditional uses, and conservation practices. Results reveal that these fruits are integral to the rural diet and livelihood, offering high nutritional value and resilience to drought and marginal soils. However, genetic erosion, habitat degradation, and lack of organized market linkages threaten their sustainability. The paper emphasizes the need for in-situ and ex- situ conservation approaches, community based germplasm preservation, and the development of value-added products to enhance economic potential. Integrating minor fruit cultivation into agroforestry systems and promoting awareness through participatory conservation programs can strengthen rural resilience and biodiversity conservation. This study underscores that systematic documentation, sustainable utilization and policy support are essential to conserve Bundelkhand's minor fruit heritage while improving local livelihoods and ecological stability.

Keywords: Minor fruits, biodiversity conservation, underutilized species, agroforestry, genetic resources, traditional knowledge, sustainable utilization

A-11

Passiflora Diversity in Northeast India: Morpho biochemical-molecular insights for tribal nutrition and livelihoods

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The global food system is increasingly challenged by population pressure, climate variability, and declining soil health, necessitating a paradigm shift toward sustainable and resilient production systems. The North-Eastern region of India represents a megadiversity center for fruit crops; however, passion fruit, comprising the purple (*Passiflora edulis* f. *edulis*) and yellow (*P. edulis* f. *flavicarpa*) forms, remains an underutilized yet promising genetic resource. The present study aimed to elucidate the morphological, phytochemical, and molecular diversity among passion fruit genotypes collected from this region. Morphological characterization revealed considerable variability among genotypes. CHF/PF/02 exhibited the greatest fruit length (68.40 mm) and diameter (65.28 mm), while CHF/PF/14 recorded the maximum fruit weight. The purple genotype CHF/PF/04 demonstrated the highest antioxidant capacity (96.49%), and CHF/PF/12 exhibited the maximum total phenolic content (842.01 mg 100 g^{-1}) and flavonoid concentration (321.11 mg 100 g^{-1}), highlighting its strong nutraceutical potential. Molecular characterization using 19 SSR markers revealed 91% intra-population variation, with polymorphic information content (PIC) values ranging from 0.32 to 0.97, and identified 72 private alleles, underscoring the extensive genetic variability and selection potential within *Passiflora* germplasm from Northeast India. Beyond its genetic and phytochemical richness, passion fruit holds immense promise as a high-value crop for low-income and smallholder farmers due to its adaptability to marginal lands, short gestation period, high market demand, and suitability for processing industries. Promoting its systematic cultivation can strengthen regional food systems, enhance nutritional security, generate rural employment, and improve livelihood resilience in economically vulnerable communities of Northeast India.

Keywords: *Passiflora edulis*, Northeast India, genetic diversity, phytochemicals, SSR markers, nutritional security, livelihood improvement

A-12

Enhancing Tribal Livelihood through Collection, Value Addition and Marketing of Lesser-Known NTFPs in Sirohi and Pali Districts of Rajasthan

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Reconnaissance survey carried out in 24 tribal-dominated villages of Abu Road block, Sirohi district and 70 villages of Pali district, Rajasthan to assess the livelihood dependence of tribal communities on agriculture, wage labour, and Non-Timber Forest Products (NTFPs). The predominant tribal groups—Garasia, Gameti and Meena—reside in interior forest regions with limited livelihood options. Findings revealed Agriculture as primary income source followed by NTFP collection and wage labour. In Sirohi district, the average annual household income was Rs. 13,806 from agriculture, Rs. 6,982 from NTFPs, and Rs. 4,500 from wages, with livestock contributing minimally (Rs. 1,000). NTFPs accounted for 26.56% of total household income and generated 16.78% employment. In Pali district, average income from agriculture, NTFPs and wage labour was Rs. 22,842, Rs. 11,796 and Rs. 5,000 respectively, while livestock income remained negligible. NTFPs contributed 29.03% to total income and 24.83% to employment generation. The major

NTFPs collected in Sirohi were *Feronia limonia*, *Tamarindus indica*, *Butea monosperma* and *Diospyros melanoxylon*, while *Momordica dioica*, *Cordia gharaf*, and *Leptadenia reticulata* dominated in Pali. Based on index ranking (quantity × price), *L. reticulata* ranked highest in Pali and *F. limonia* in Sirohi. Average family participation in NTFP collection ranged from 2.5 to 4.87 members, generating 37.5 to 103.05 mandays annually per family, with *M. dioica* offering the highest employment. Among 13 value-added products developed, *M. dioica* (pickle), *L. reticulata* (dehydrated pods), and *B. monosperma* (herbal gulal) exhibited one-year shelf life. Product acceptability using 9-point Hedonic scale showed maximum preference for *M. dioica* pickle, *T. indica* chutney, jam, and squash, *F. limonia* pickle and jam (without sugar syrup) and *B. monosperma* herbal gulal. Fourteen training-cum-demonstration programs received positive responses from SHGs and local stakeholders emphasizing the potential of NTFP-based value addition for sustainable livelihood enhancement in tribal regions. *Momordica dioica* pickle has obtained FSSAI certificate. SHG women of Shivaji Rajivika Krishi utpadak Samooh, Pindwada (Sirohi) are selling this product in Various District Administration Camps, Trade Fairs, Tree Grower Melas etc.

The study identified several issues through structured market surveys. NTFP collection at the village level was largely unorganized and barter system still prevalent. Most NTFPs were sold at low prices to local agents or grocery shop owners. Family labour remained the key input in collection and processing with NTFPs contributing only around 26.56% in Sirohi and 29.03% (Pali) to total household income due to poor market access, lack of price information, inadequate transportation and limited financial capital. Key policy recommendations include granting collection permits to tribals, linking them with government cooperatives, fixing minimum support prices for non-nationalized NTFPs, improving collection and harvesting practices through VFPCs/SHGs and promoting collective marketing approaches.

Key words: NTFP collection, value addition, marketing, tribal livelihoods, Sirohi and Pali districts.

A-13

Indigenous ethnomedicinal practices of Gujarat tribes in managing major chronic ailments

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A reconnaissance survey was conducted using semi-structured questionnaire in Dang, Navsari, Aravalli, Valsad, Banaskantha, Narmada, Sabarkantha, Gandhinagar, Ahmedabad, Nadiad and Kheda talukas of Gujarat to document indigenous formulations employed by tribal communities for the management of bronchial disorders, diabetes, arthritis and cardiovascular diseases. The survey highlights the traditional knowledge of dosage, preparation and administration methods, reflecting the rich ethnobotanical heritage of tribes such as Barda, Bhil, Bawcha, Dhodiya, Patelia, Garasia, Rabari, Kathodiya and Warli etc. Findings revealed that 69 medicinal plant species belonging to 42 families and 59 genera are used by these ethnic groups to treat respiratory disorders, diabetes, arthritis and related ailments. District-wise analysis of plant use indicated the following order: Dang > Dahod > Aravalli > Narmada > Valsad > Navsari > Sabarkantha > Gandhinagar > Kheda > Banaskantha > Nadiad > Ahmedabad. The Use Value (UV) or relative importance of medicinal plants within the local communities ranked as follows: *Curcuma longa* (10.36) > *Abrus precatorius* (9.45) > *Tinospora cordifolia* (7.28) > *Syzygium cumini* (7.08) > *Allium schoenoprasum* (6.50). The descending order of plant parts used in various ethnomedicinal preparations was observed as: Leaves > Roots and Tubers > Stem, Bark and Rhizomes > Seeds > Fruits.

The Informant Consensus Factor (ICF)—reflecting the homogeneity of traditional knowledge within a community—ranked as: *Ficus racemosa* and *Adhatoda vasica* (0.93) > *Withania somnifera*, *Tinospora cordifolia*, *Aegle*

marmelos, *Azadirachta indica* (0.92) > *Ricinus communis* (0.91) > *Moringa oleifera*, *Sorghum bicolor* (0.90) > *Calotropis procera* (0.89). Based on the Fidelity Level (FL%) indicating the degree of cultural importance for a specific ailment, the species ranked as: *Terminalia arjuna* (99.6) > *Alangium salviflorum* (99.1) > *Commiphora wightii* (97.7) > *Acalypha indica* (96.2) > *Vetiveria zizanioides* (95.5). The Family Use Value (FUV) revealed the ranking: *Curcuma longa* (10.66) > *Abrus precatorius* (9.90) > *Tinospora cordifolia* (7.67) > *Syzygium cumini* (7.54) > *Allium schoenoprasum* (6.71). Based on the Composite Ethnobotanical Score (CES), medicinal plants were ranked as: *Syzygium cumini* (1.00) > *Curcuma longa* (0.91) > *Abrus precatorius* (0.86) > *Commiphora wightii* and *Millettia pinnata* (0.80) > *Annona squamosa* (0.79). Among the disease categories studied, the maximum number of medicinal plant species were reported for bronchial diseases, followed by diabetes, arthritis and cardiovascular disorders respectively. Among various families use to cure aforesaid diseases maximum plants belonged to Fabaceae family followed by Solanaceae. Contribution of leaves, roots, stem, seeds and fruits were recorded as 30%, 20.9%, 14.54%, 11.81 % and 7.27% respectively. The study emphasizes the need for the active participation of ethnic communities in the evaluation, planning and monitoring of traditional medicinal resources to ensure their sustainable utilization and long-term conservation.

Keywords: Ethnic Groups, ethnomedicinal practices, Gujarat tribes, Chronic ailments, Medicinal plants, Traditional knowledge.

A-14

Custard apple- a potential crop for entrepreneurship and value addition through secondary agriculture

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Custard apple is grown wildly in different part of hill regions in India. In Rajasthan, Mewar region have diversity of germplasm. All part of fruit has great significance. Custard apple rich source of carbohydrate it includes fructose (3.5%), sucrose (3.4%), glucose (5.1%) and oligosaccharides (1.2-2.5%). It is available for short period of time (October-December). The fruit is climacteric in nature and have immense potential for processing industry, but it is commonly susceptible to enzymatic browning. Therefore, keeping in view of above facts two experiment was conducted one to increase shelf life and other preserve pulp by use of different antioxidant. Data revealed climacteric fruit stored Hexanal filter paper dip (0.05%) effectively reduced respiration, ethylene evolution and maintained firmness upto 14 days of storage. Moreover, fruit pulp stored with ascorbic acid (0.5%) at cold storage (0+1°C) maintained better qualitative characteristics viz TSS, acidity and colour during 120 days of storage. The stored pulp can be used for various value-added product such as ice-cream, rabdi, squash, RTS.

Keywords: Shelf life, Antioxidant treatment, Fruit pulp preservation

A-15

Role of insect pollinators in fruit setting of *Capparis decidua* in Rajasthan

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Capparis decidua (Forssk.) Edgew., commonly known as Ker, is a drought-tolerant shrub of the Thar Desert, valued for its edible fruits, medicinal properties and ecological significance in arid landscapes of Rajasthan. *C. decidua* holds a unique place in the traditional food culture of Rajasthan. Its immature green fruits are pickled or cooked as a vegetable and are an essential ingredient in the famous Rajasthani delicacy “Ker Sangri”. The dish

is not only a culinary staple but also a symbol of the desert people's adaptation to harsh arid conditions, as *C. decidua* thrives naturally in sandy, drought-prone soils where few other plants survive. The fruits are rich in antioxidants, vitamins and minerals, contributing to their nutritional and medicinal value. Beyond food, the plant supports rural livelihoods through local trade of dried fruits and pickles, forming an important part of the desert economy. The species exhibits entomophilous pollination, relying largely on insect visitors for effective pollen transfer and subsequent fruit set. The present study aimed to evaluate the diversity and activity of insect pollinators and their role in fruit setting of *C. decidua* under natural field conditions of Rajasthan. Field observations revealed that *Apis dorsata*, *A. florea*, *Xylocopa* spp. and various other hymenopterans were the dominant floral visitors, showing peak foraging activity during early morning hours. Controlled pollination trials revealed complete fruit failure in bagged (self-pollinated) flowers, while open-pollinated flowers exhibited a high fruit set, confirming that *C. decidua* is strongly dependent on cross-pollination mediated by insects. The absence of fruit set under pollinator exclusion emphasizes the essential role of native pollinator guilds in ensuring reproductive success and fruit yield. Conservation of pollinator habitats and floral diversity is therefore vital for the sustainability of *C. decidua* populations and desert ecosystem productivity.

Keywords: *Capparis decidua*, pollination, insect visitors, fruit set, Rajasthan, arid ecosystem

A-16

Leaf gall formation by *Aceria pongamiae* on *Pongamia pinnata* in Rajasthan: Morphology, incidence, and host response

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Pongamia pinnata (L.) Pierre, commonly known as Karanja, is an ecologically and economically important leguminous tree widely distributed across Rajasthan, valued for biodiesel production, nitrogen fixation, and medicinal uses. During field surveys across different agro-climatic zones of Rajasthan, characteristic leaf galls were frequently observed. Morphological examination of gall tissues and associated mites identified *Aceria pongamiae* (Channabasavanna, 1966) (Eriophyidae) as the causal agent. Infestations were characterized by finger-like or pouch-shaped galls on the upper leaf surface, often resulting in deformation, curling, and chlorosis. Individual galls frequently coalesced into complex, irregular structures covering the laminar surface, midrib, veins, and veinlets. Incidence and severity varied regionally, with higher occurrence in semi-arid zones, particularly after the monsoon in September–October. Severe galling led to early leaf senescence, twig dieback, and reduced plant vigor.

Biochemical analysis revealed elevated levels of total sugars and phenolic compounds in gall tissues compared to normal leaves, indicating enhanced nutrient accumulation and activation of host defense responses. The results demonstrate the gall's sink-like nature, attracting assimilates to sustain mite colonies, while phenolics contribute to biochemical resistance. This study provides baseline data on the seasonal incidence, host–mite interaction and metabolic responses of *P. pinnata* to *A. pongamiae*, offering insights for integrated management strategies, including early detection, pruning of affected shoots and conservation of natural enemies.

Keywords: *Pongamia pinnata*, *Aceria pongamiae*, Eriophyidae, leaf gall, Rajasthan, incidence, host–mite interaction.

A-17

Survey, collection and characterization of chironji (*Buchanania lanzan* Spreng.) germplasm as revealed by phenotypic traits and molecular markers

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The present study carried out during years 2022 - 2023 and 2023- 2024 at Banda University of Agriculture and Technology, Banda-210001. The survey conducted in the years 2022-23 at different geographical locations of Uttar Pradesh, Madhya Pradesh, Bihar and Gujarat particularly in the districts of Chitrakoot, Lalitpur, Satna, Katni, Burhanpur, West Champaran, Rohtas, Dahod and Panchmahal to select promising chironji genotypes. Morphological and molecular characterization carried out as per standard procedure developed by NBPGR and PPV & FRA, New Delhi. Marked variation observed in between different genotypes but the range of variability in fruit/ kernel size and fruit quality parameters are less. Variations were recorded for growth habit (spreading, semi spreading and upright), bearing habit (regular and irregular), fruit shape (bold and flat), leaf shape recorded uniformly oblong type; leaf base (acute, obtuse and rounded, leaf apex (acute, obtuse and rounded) and flower colour (creamy white with pink tinge and creamy white). Variability recorded for tree height (5.00–11.20m), tree spread E-W (3.30-6.20m), tree spread N-S (3.19-6.16m), tree girth (43.25–80.90cm), average no. of flower/inflorescence (1954.06-3650.10), average fruit yield kg/tree (12.76-30.50kg/tree), average fruit weight (0.89-1.20g.), average pulp weight (494-821mg), average kernel weight (46-95mg), kernel percent (12.45-25.07%), TSS (19.00-25.250B), total sugars % (13.02-15.48), Vitamin C (45.34-63.31mg/100g.), fat % (52.56-68.31), kernel protein % (22.00-30.81) and kernel antioxidant % (47.42-60.96). Molecular studies indicated that the maximum number of alleles in SCoT-7 (18.0) and the highest allele frequency was found SCoT-21 (0.912). The highest PIC (Polymorphism Information Content) value was observed to be SCoT-9 (0.365). The SCoT-9, SCoT-1, SCoT-22 and SCoT-18 were found to be informative and able to detect polymorphism among the studied

genotypes due to its high PIC value. On the basis of growth habit, bearing habit, fruit/ kernel size and weight, fruit yield and fruit/kernel quality attributes, the genotypes BUAT-C-35, BUAT-C-45, BUAT-C-46, BUAT-C-54, BUAT-C-56 were found most promising and may be promoted for in situ / ex situ conservation, multiplication and plantation at commercial level. Further, as the range of variability is narrow, the early bearing genotypes (with less gestation period i.e. 7-8 years), good fruit and kernel quality and high yielding genotypes may be promoted in dry tropical forests for in situ seedling plantation.

Keywords: Survey, Chironji germplasm, seed weight

A-18

Phytochemical and antioxidant potential of Bael (*Aegle marmelos* L.): A bioprospecting approach

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Bael (*Aegle marmelos* L) is an indigenous and underutilized fruit tree native to the Indian subcontinent, making it a promising option for nutraceutical and pharmaceutical development. It has traditionally been recognized in Ayurveda, Siddha, and folk medicine, with various parts of the plant such as fruit, leaves, bark, roots, and seeds used to treat digestive disorders, infections, and metabolic diseases. The bioprospecting of bael emphasises the identification and characterization of its diverse phytochemicals, while also validating their therapeutic efficacy through modern scientific methods. Phytochemical investigations show that bael is a rich source of

alkaloids, phenolics, flavonoids, tannins, coumarins, and terpenoids. These compounds contribute to a variety of biological activities, including antimicrobial, anti-inflammatory, hepatoprotective, and cardioprotective effects. Notably, antioxidant properties have gained significant attention, as oxidative stress is closely associated with chronic disorders such as diabetes, cardiovascular diseases, and cancer. Both the fruit pulp and leaf extracts of bael have demonstrated considerable abilities to scavenge free radicals, reduce oxidative stress, and inhibit lipid peroxidation, which can be attributed to their high content of phenolics and flavonoids. The antioxidant properties of bael phytochemicals not only aid in disease prevention but also increase their value in functional food and nutraceutical products. Regular consumption of bael-based items can help reduce oxidative damage, boost the immune system, and delay the onset of degenerative diseases. By-products such as bael seeds and peels, which are often discarded as waste, are now being studied for their antioxidant-rich extracts. This presents opportunities for waste valorisation and sustainable use. The bioprospecting of bael combines traditional knowledge with modern science, emphasising its phytochemicals and antioxidant properties, which contribute significantly to its therapeutic potential. Future research focused on isolating compounds, understanding mechanistic pathways, and validating clinical applications will facilitate the development of innovative nutraceuticals, herbal medicines, and functional foods. This will establish bael as a valuable resource for global health and wellness.

Keywords: Antioxidant; Bael; Health perspective; Phytochemical; Nutraceuticals.

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