Reviving Lesser-Known Potential Fruits for Nutritional security and Community Empowerment

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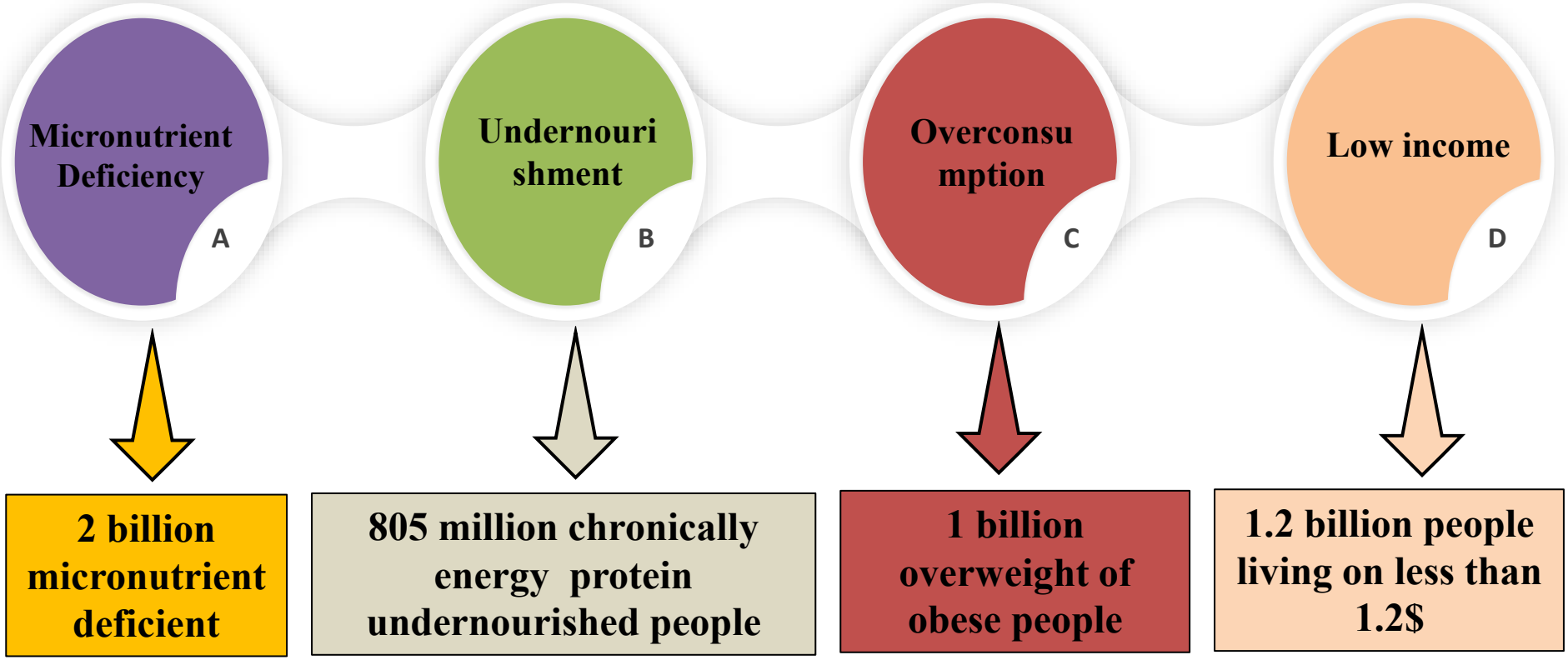
The Global Challenge Today



As of 2021, ~2.3 billion adults in the world are malnourished
That's around 30% of the world's population

India is the largest contributor of undernourished people in the world (Worldometer), with around 194.4 Million people, or 14.37% of its population not receiving enough nutrition

Malnutrition in News

Hindustan Times

News / India News / Over 14 lakh children 'severely malnourished' in India: Govt

Over 14 lakh children 'severely malnourished' in India: Govt

PTI | | Posted by Yagya Sharma

Mar 29, 2023 08:09 PM IST

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The percentage of malnourished children was found to be 7.7 per cent which comes to around 43 lakh, the ministry said.

Children who are severely malnourished have very low weight for their height. (AFP/ Representative image)

There are over 14 lakh severely malnourished children in the country as per the government's Poshan Tracker, the Women and Child Development Ministry said on Wednesday.

The Indian EXPRESS
JOURNALISM OF COURAGE

Tuesday, Nov 07, 2023
EPAPER | TODAY'S PAPER

News / India / Over 33 lakh children in India malnourished, 17.7 lakh of them severely malnourished: Govt data

Over 33 lakh children in India malnourished, 17.7 lakh of them severely malnourished: Govt data

Also, India has slipped to the 101st position in the Global Hunger Index (GHI) 2021 of 116 countries, from its 2020 position of 94th and is behind its neighbours Pakistan, Bangladesh and Nepal.

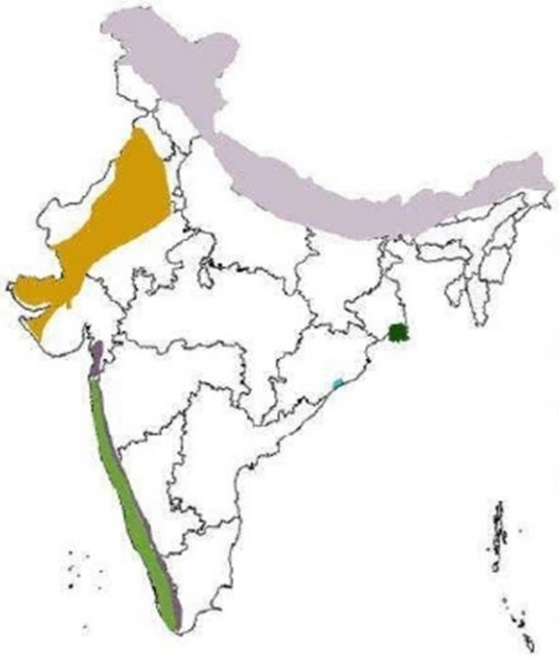
The total 33.23 lakh/3.3 million is a compilation of data from 34 states and union territories

According to the RTI reply quoting the Poshan tracker

Malnourished children:

1. **Maharashtra – 6.16 lakh**
2. **Bihar – 4.75 lakh**
3. **Gujarat – 3.20 lakh**

BIODIVERSITY IN INDIA



Himalayas - This majestic range of mountains is the home of a diverse range of flora and fauna. Eastern Himalayas is one of the two biodiversity hotspots in India.

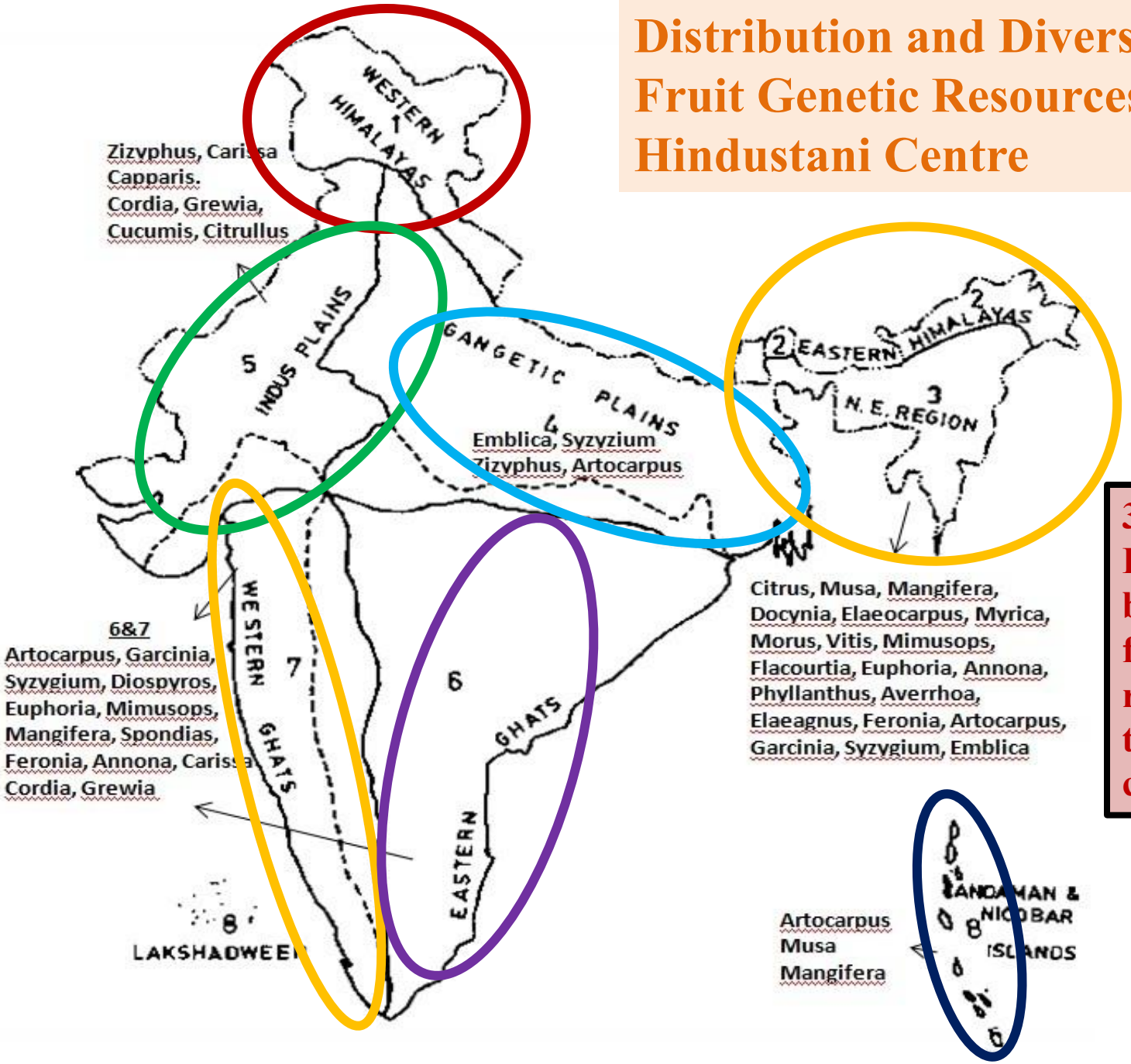
Chilika - This wetland area is protected under the Ramsar convention.

Sunder bans - The largest mangrove forest in India.

Western Ghats - One of the two biodiversity hotspots in India.

Thar desert - The climate and vegetation in this area is a contrast to the Himalayan region.

Distribution and Diversity Map of Fruit Genetic Resources in the Hindustani Centre



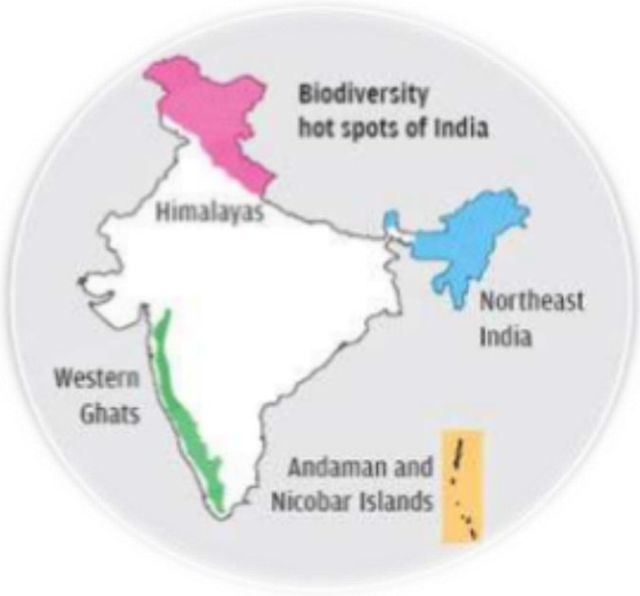
344 species of Fruits belonging to 40 families represented in the 7 agro-climatic zones

The Richest Global Biodiversity

Hot Spot Himalayas → Northeast India → Western Ghats → Andaman & Nicobar Islands

One of the Richest reservoir of genetic variability

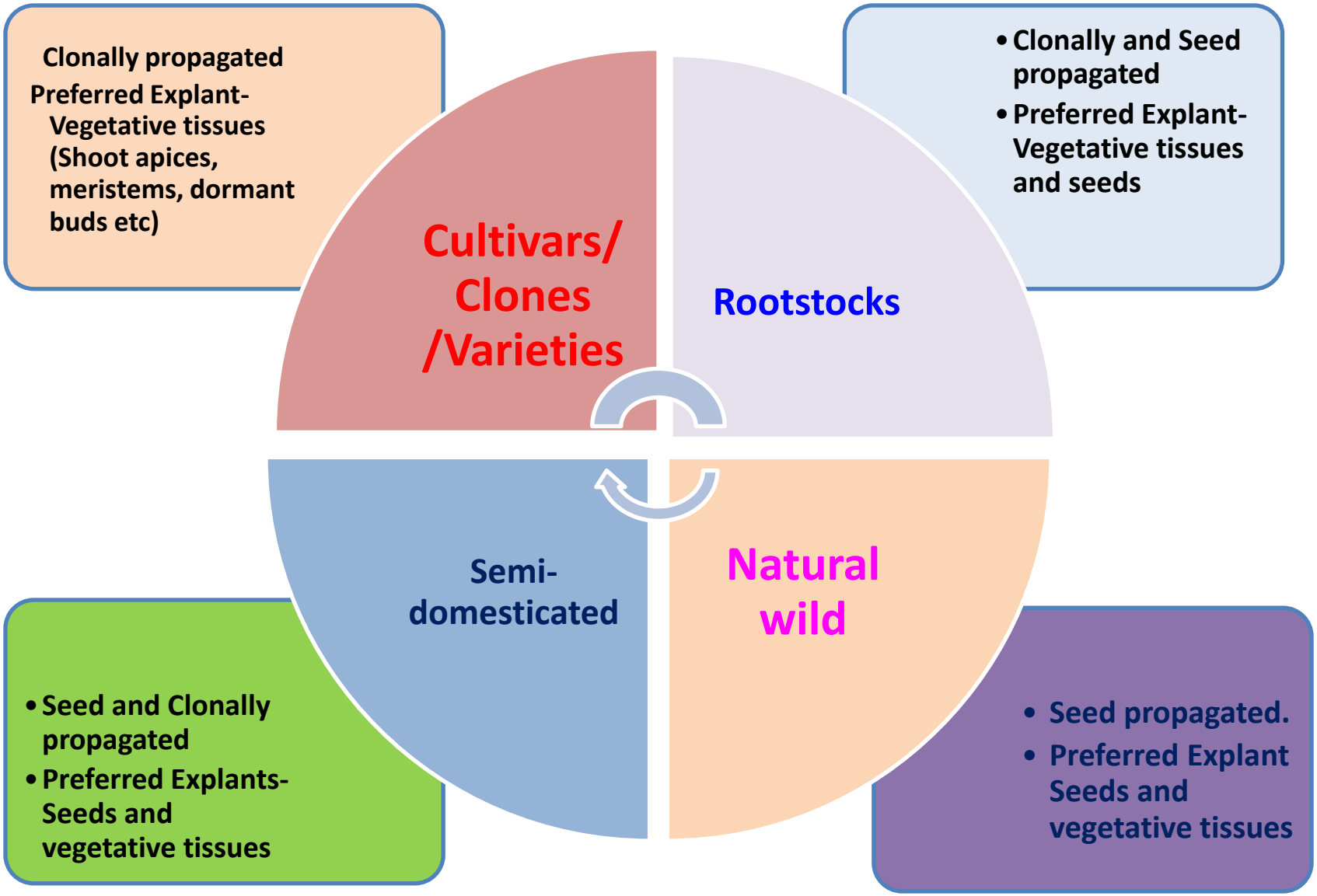
Needs exploration, collection, conservation



THE HINDU

Nature has liberally painted a variety of landscapes in our country. Many of these have been demarcated as Biodiversity Hotspots — areas that have extremely rich and diverse flora and fauna and are under threat of getting endangered. Officially, **four out of the 36 Biodiversity Hotspots in the world are present in India: the Himalayas, the Western Ghats, the Indo-Burma region and the Sundaland.** To these may be added the Sundarbans and the Terrai-Duar Savannah grasslands for their unique foliage and animal species.

Genetic Resources of Fruits species



Lesser known Fruit Crops

- Hold immense potential for economic development, nutrition, and sustainability
- Contributes to food security, health, revenue production and environmental benefits
- An integral part of the rural community
- Have local or regional importance
- Lack national recognition

Many species are indigenous and exhibit wide range of variability in lesser known fruits

- Aonla (*Emblica officinalis)*
- Bael (*Aegle marmelos*)
- Ber (*Ziziphus mauritiana*)
- Chironji (*Buchanania lanzan*)
- Date palm (*Phoenix dactylifera*)
- Jamun (*Syzygium cumini*)
- Karonda (*Carissa carandus*)
- Ker (*Capparis decidua*)
- Fig (*Ficus carica*)
- Khejri (*Prosopis cineraria*)
- Lasoda (*Cordia myxa*)
- Phalsa (*Grewia subinaequalis*)
- Pilu (*Salvadora oleoides*)
- Wood apple (*Feronia limonia*)
- Tamarind (*Tamarindus indica*)

Some of the introduced fruits

- Custard apple,
- Date palm
- Mulberry,
- Pomegranate and
- Tamarind possess good diversity in the country.

Minor fruits contribute 7-8% to the total Fruit production and major contribution is by jackfruit, aonla, custard apple, bael etc.

Tropical Asian countries are the center of origin and diversity of many globally important tropical fruit tree species and their wild relatives.

How underutilized fruit crops can bring an impact on tackling malnutrition?

- Rich in nutrients
- Nutrient dense fruits

- Phytonutrients
- Vit. & minerals
- Trace elements
- Medicinal prop.

High nutritional value

Health benefits

Underutilized fruit crops

Dietary diversity

Sustainable production

- Variety
- Local consumption
- Healthy meal combination

- Diversity
- Seasonality
- Local production
- Less usage of fossil fuel
- Biotic and abiotic stress resistant

Potential Role of Underutilized Fruit Crops

Sources of desirable genes in crop improvement research

- Diversifying diets and improving nutrition
- Enhancing food security through crop resilience
- Supporting sustainable agriculture by reducing monoculture
- Conserving biodiversity and genetic resources
- Mitigating the effects of climate change through adaptability

Bael (*Aegle marmelos*)

❖Sacred trees of the Hindus, leaves are offered in prayers to Shiva and Parvathi.

❖The dry pulp of fruit contains chiefly mucilage pection like substance.

❖The root, stem and leaves have been shown to contain tannins.

❖Alkaloids, sterols, coumarin and aromatic components have been isolated.

❖**Aegelin, marmelosine, marmelin, o-methyl hayordinol, alloimperatorin methyl ester, o-isopentanyl hayordinol and linoleic acid** have been identified.

❖Aegelin, formerly identified as sterol but clarified as a neutral alkaloid, rutacine, y-sitosterol, aegelemine and aegeline were identified from the leaves.

❖Marmin, marmesin, umbelliferine, skimmianine were identified from the bark and roots.

❖**A major constituent of the fruit is the mucilage and marmelosin (0.5%) a coumarin for its potential antioxidant, anti-inflammatory, and anti-diabetic properties.**

Paniala (*Flacourtia jangomas*)

- A native of India
- Fruit an ellipsoid berry, dark red or purple when ripe.
- **Used for making jams, preserves and marmalades.**
- **leaves and bark are useful for bleeding gums and toothache**

Blood Fruit (*Haematocarpus Validus*)

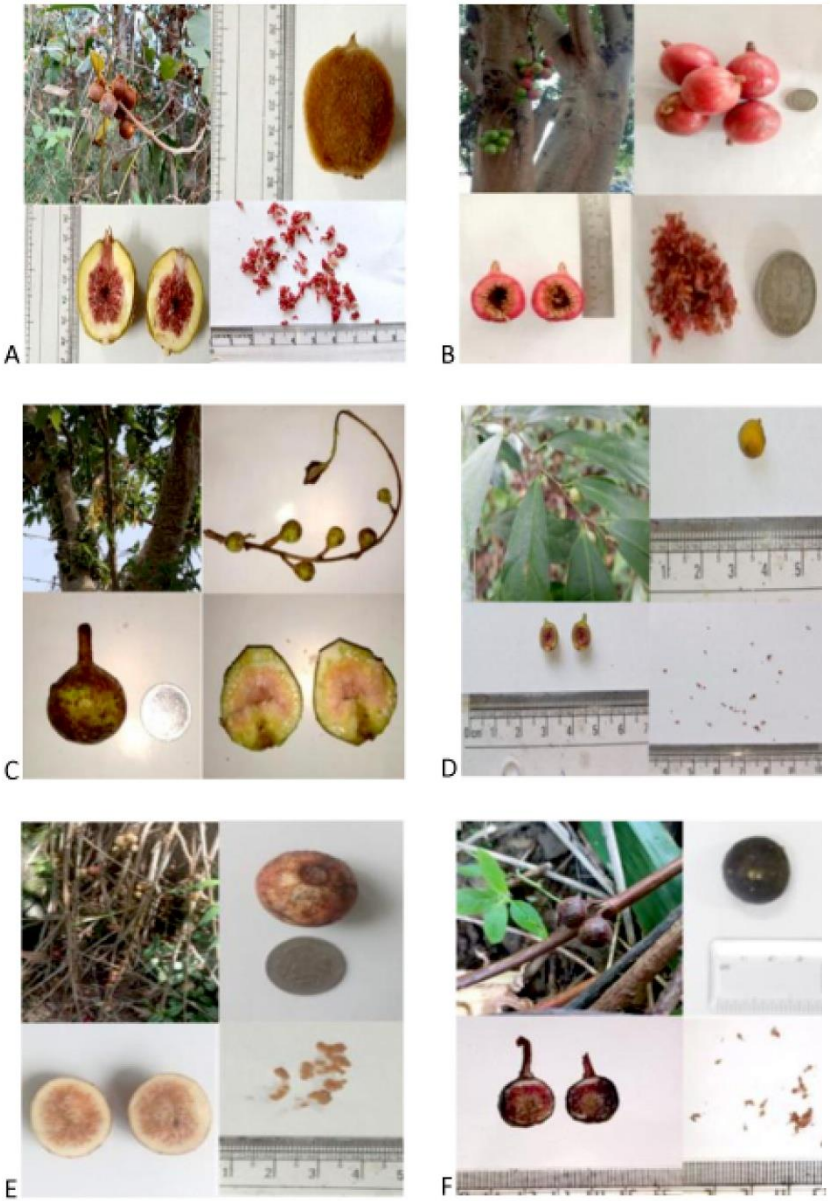
The lesser known promising fruit of Garo Hills with anti-oxidant rich and medicinally important fruit.

- **Dark red, antioxidant-rich fruits,**
- **Used in traditional medicine for a range of ailments, from liver problems to anemia.**
- **The fruit is also a source of vitamin C and iron**

Fig (*Ficus racemosa)*

- Figs have numerous medicinal uses,
- Digestion, promoting cardiovascular health, and treating skin conditions.
- They are used traditionally as a mild laxative, expectorant, and diuretic
- Their sap can be applied externally to treat issues like warts and ulcers.
- Fig leaves are also used in traditional medicine for respiratory issues and bone health.

Fig (*Ficus* spp) diversity



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ORIGINAL ARTICLE

Morphological and molecular insights into the wild *Ficus* species of Mizoram, Northeast India

T. K. Hazarika[1] · Marcy D. Momin[1] · Kalibulla Syed Ibrahim[2] · P. Lalrinzuala[1] · Himjyoti Dutta[3] · Thingnam Surendrakumar Singh[4] · Panthor Debbarma[1] · Jayshree Das[3] · Ajitabh Bora[3]

Received: 14 March 2025 / Accepted: 19 June 2025

Scientific name : ***Myrica esculenta***

Common name : Bay berry/ Box myrtle

Family: : Myricaceae

Distribution : Native to China

Composition **TSS 5.7%; Acidity 4.31 %: Vit C 17.63 mg/100 ml** (Patel and De ,2015)

Uses

- Eaten raw and good for pickling
- Fruits can be dried, canned and made into fermented alcoholic beverages.
- The bark is used as a tan and a source of yellow dye.
- Bark is astringent, antiseptic and its decoction is used in asthma fever, chronic bronchitis, lung infections, and in tooth ache (Jeeva *et al.* 2011). Good source of natural anti oxidant (Rawat *et al* 2011).

Myrica rubra

- It belongs to the family Myricaceae
- The fruits are eaten fresh and made into dried, canned and fermented alcoholic beverages.

Pyrus pashia

- It belongs to family Rosaceae
- Fruit are rich in minerals like P, K, Ca, Mg and Fe.
- Fruits are edible, soft and astringent when ripe and suitable for dehydration
- Fruit juice is used for curing eye disorders (Nautiyal *et al*, 2011)

Elaeocarpus floribundus (Jalpai)

- It belongs to the family Elaeocarpaceae.,
- It is sour in taste.
- It is used to cure ulcers , women's diseases and biliousness and treated as tonic fruit.
- Ripe fruit are edible and also used as pickle.

Antidesma bunius (Bignoy)

- Fruits are rich sources of calcium and iron.
- Use in preparation of jam, jelly. wine and sauce.
- Fruits are astringent, anti-dysenteric, thirst quenching and salivation inducent
- Matured leaves used against snake bite and young leaves are boiled and used in syphilis and skin disorders.

Prunus nepalensis (Steud)

- The fruits are edible and also used to make fruit juice called as Himalayan cherry or khasi cherry or Um Soh-iong in khasi.
- Fruits are astringent, leaf are diuretic and used in dropsy
- Pulp are used for the preparation of squash, jam, RTS and cheery wine.

Passion fruit (*Passiflora edulis)*

- Fruits: round to oval, either yellow or dark purple at maturity, with a soft to firm.
- The fruit is both eaten and juiced;
- fruit juice is often added to other fruit juices to enhance the aroma
- High in beta carotene, potassium, and dietary fibre

Passiflora edulis

Passiflora edulis* var. *flavicarpa

SN : ***Passiflora edulis***
P. edulis* var *flavicarpa

Common name : Passion fruit

Family: : Passifloraceae

Origin : *Brazil*

Uses

- Used in making sauce, gelatin desserts, candy, ice cream, sharbat, cake icing, cake filling
- Anti-inflammatory
- Anti-hypersensitive
- Anti anxiety
- Antioxidant
- Anti-tumour
- Anti-fungal

(Patel,2009)

Composition	Quantity
Acidity (%)	3.4
Reducing Sugar	3.2
Non Reducing sugar	4.6
Total sugars	10
Ascorbic acid (mg/100g)	34.6
Riboflavin ((mg/100g)	0.16
Nicotinic acid(mg/100g)	1.71
Carotene (IU)	1345

(Pruthi and Lal, 1959)

Amra(*Spondias pinnata*)

❖The fruit is a drupe similar to a small mango
❖Fruit possesses antiscorbutic and astringent properties
❖Used in bilious dyspepsia.
❖Unripe fruit is good for rheumatism and sore throat.
❖Ripe fruit is tonic, aphrodisiac and astringent to the bowels; cures burning sensation.

Baccauria sapida

- Family
  - Euphorbiaceae
- Common name
  - Lateku (Ass)

Baccaurea sapida plant

Fruits

Flower

Baccaurea sapida

- It is native to North East India.
- The fruit pulp is white, sometimes deep pink near the seed, acid to sweet in taste.

- Fruits are eaten fresh or used for preparation of juice, squash, chutney etc.
- Fruits are rich in Protein, Vitamin C, Sucrose, Ca, K, P, Mg, and Fe.

Elaegnus latifolia

- It belong to family Elaegnaceae
- Fruits are rich source of vitamins especially, A, C and E, minerals flavonoides and other bioactive compounds.
- It is a good source of fatty acids and has anti carcinogenic effect.
- The species have capacity to fix atmospheric nitrogen into the soil.
- Fruits are eaten as raw with salt and processed into pickles, jam and jelly.

Phyllanthus acidus

scientific reports

OPEN

Genetic diversity analysis of *Phyllanthus acidus* Skeels of north-east India: Insights from multivariate analysis

T. K. Hazarika, Linthoingambi Ningombam, Panthor Debbarma, Marcy D. Momin, P. Lalrinzuala & Lairenjam Saroja Devi

Indian J. Hort. 78(3), September 2021: 244-250

DOI : 10.5958/0974-0112.2021.00035.9

Genetic variability of star gooseberry in North East India

T. K. Hazarika* and Rody Ngurthankhumi
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Jamun (*Syzygium cumini*)

- Bark, leaves, seed and fruits are used as an alternative medicine to treat various diseases.
- Well known traditional medicines to control the blood sugar level in the patients suffering from diabetes.
- Rich in phytochemicals like glycoside jambolin, anthocyanins, tannins, terpenoids, gallic acid and various minerals.
- Used as a nutraceutical. The fruits are purplish black in colour when ripe and have high **anthocyanin** content.
- Fruits processed to make **jam, jellies, squash, vinegar and ice cream** for its beautiful and attractive purple colour.
- The powdered seeds have reputation for being useful in the treatment of **diabetes**.
- One of the most hardy fruit crop and can easily be grown in neglected and marshy areas.

Different phyto-chemicals present in different parts of Jamun tree

(Sahu, *et al.*, 2020)

Plant part	Phyto-chemical compounds	References
Bark	Ellagic acid, Gallic acid, Gallotannin, Ellagi tannin, Myricetin, β-sitosterole, Betulenic acid	Bhargava *et al.* (1974) [3]; Nair *et al.* (1974) [19]; Yogeswari *et al.* (2005) [31]
Leaves	Bornyl acetate, Triancontanol, n-Dotricontanol, Quercetin, Maslinic acid, Betulinic acid, Myrcitin, n-nonacosane, n-dotricontanol	Craveiro *et al.* (1983) [9]
Flowers	Oleanolic acid, Ellagic acid, Iso-quercetin, Kamferol, Myrcetin, Dihydro-myricetin, Quercetin, Arabinoside	Nair *et al.* (1974) [19]; Sagarwat *et al.* (2006) [23]
Fruits	Raffinose, Citric acid, Fructose, Glucosides, Gallic acid, Malic acid, Anthocyanin, tannins, Delphinidin, Petunidin, Malvidin	Srivastava *et al.* (1953) [29] Lewis *et al.* (1956) [15]
Seeds	Fats, Jambosine, Gallic acid, ellagic acid, Quercetin, β-sitosterole other elements like Chromium, Vanadium, Potassium, Sodium, Zinc, tannins	Nadkarni *et al.* (1954) [18] Chopra *et al.* (1956) [8] Bhatia *et al.* (1975) [4]
Roots	Flavonoids, Glycosides and isorhamnetin 3-O-rutinoside	Vaishnava *et al.* (2012) [30]

Bioactive compounds present in Jamun

(Sahu *et al.*, 2020)

Bioactive compound	Compounds present	Uses	Reference
Terpenes	1,8-cineol, Mysterol, Terpinolene, Linalool oxide, β-terpenene, β-pinema, Citronellol, Eugenol	For pleasant flavour, Food additives and Pharmaceutical	Cho *et al*. (2017) [7]
Flavanoids	Iso-quercetin, kampferol, Malvidin, Myricetin, Petunidin, Quercetin, Anthocyanin, Cyanidin diglycoside	Antioxidant and Colouring agent	Shashank *et al*. (2013) [27]
Lipids	Lauric acid, Linoleic acid, N-nanocosane, Strearic acid, N-hentriacontane, myristric acid, Lauric acid	Nematicide, Antioxidant and Anti-acne	
Alkanes	Malic acid, Citric acid	Antioxidant and Antiseptic	
Phenols	Ferulic acid, Caffeic acid	Allelopathic and Antibacterial	

Carambola (*Averrhoa carambola*)

It commonly called star-fruit and locally Soh Pyrshong.
It is cultivated almost in all the states of North Eastern region.
Slow-growing, short-trunked ever green tree with a much branched, bushy canopy that is broad and rounded.

- 25-30 feet in height and 20-25 feet in spread.
- Fruits are ovate to ellipsoid, 6 to 13 cm in length, with 5 (rarely 4 or 6) prominent longitudinal ribs.
- Slices cut in cross-section are star shaped.
- The skin is thin, light to dark yellow and smooth with a waxy cuticle.
- The flesh is light yellow-to-yellow, translucent, crisp and very juicy without fiber. The fruit has a more or less oxalic acid odour and the flavour ranges from very sour to mildly sweet.
- Sometimes fruits contained more than 4% sugar.

Scientific name	:	***Averrhoea carambola***
Common name	:	Star fruit
Family	:	Oxalidaceae
Distribution	:	Tropicl and sub-tropical
Composition	:	contains oxalic acid and mallic acid. Fruits are rich source of vitamins A, B and C with minerals, Fe, K, niacin and P.
Uses	:	The ground leaves and shoots are used as remedy for chicken pox, intenstinal parasites and headaches

CONTENT	QUANTITY
Oxalic acid (%)	0.04-0.7
Acidity (%)	1.9-13.1
pH	2.4-5.0
Brix (%)	5.0-13.0
Total sugar (%)	3.5-11.0
Water content (DW %)	90.0
Juice content (%)	60-70%
Protein (%)	0.75
Crude fibre (%)	0.7
Vitamin A (IU/100 g)	560
Vitamin C (per 100 g)	50

Watson *et al*. (1988)

Dillenia indica

❖The fruit has tonic and laxative properties

❖A wide range of medicinal purposes, including treating diabetes, diarrhea, fever, and cough.

❖Other uses include promoting hair growth, healing wounds and skin issues like scabies, and acting as a laxative.

❖Scientific research supports many of these claims, with studies showing it has antioxidant, anti-inflammatory, and antimicrobial properties

Garcinia pedunculata

- Family Guttiferae
- Common name Bor thekera

Genet Resour Crop Evol (2024) 71:2375–2397
https://doi.org/10.1007/s10722-023-01762-x

RESEARCH ARTICLE

Unravelling the genetic diversity of *Garcinia pedunculata* Roxb. with multivariate analysis

T. K. Hazarika · Lairenjam Saroja Devi · Lintho ingambi Ningombam · Panthor Debbarma · Rody Ngurthankhumi

Garcinia lanceifolia

- Family Guttiferae

Genet Resour Crop Evol (2019) 66:61–69
https://doi.org/10.1007/s10722-018-0695-5

RESEARCH ARTICLE

Exploring genetic diversity of *Garcinia lanceifolia* Roxb. (Clusiaceae), a highly medicinal and endangered fruit of north-east India

T. K. Hazarika · C. Lalnunsangi

Garcinia xanthochymus

- Family Guttiferae
- Common name Tepor tenga (As)

Jackfruit

Artocarpus heterophyllus

Artocarpus lakoocha

scientific reports

OPEN

Morpho-biochemical variability of indigenous jackfruits (*Artocarpus heterophylus* Lam.) for selection of elite types from natural populations of North–East India

Tridip Kumar Hazarika[1], Prakash Thapa[1], Panthor Debbarma[1] & G. Karunakaran[2]

Nutritional value of lesser known fruits

Fruits	Botanical name	Nutritional value
Bael	Aegle marmelos	Vitamin C (8–60mg), Carbohydrates (31.8 g), Fiber (2.9 g), Calcium (85mg), Iron (0.7mg)
Karonda	Carissa carandas	Vitamin C (11mg), Iron (39mg), Fiber (5 g), Antioxidants
Jamun	Jamun Syzygium cumini	Vitamin C (18mg), Iron (1–1.5mg), Fiber (0.9 g), Anthocyanins
Kokum	Garcinia indica	Hydroxycitric acid (HCA) (2–5 g), Vitamin C (12–20mg), Fiber (3.4 g)
Chironji	Buchanania lanzan	Protein (13–18 g), Calcium (279mg), Iron (8.5mg), Fiber (3.8 g)
Wood Apple	Limonia acidissima	Vitamin C (12mg), Fiber (3.5 g), Calcium (96mg), Iron (2.3mg)
Mahua	Madhuca indica	Sugars (9–15 g), Vitamin C (10mg), Calcium (80mg), Iron (2.1mg)
Ber (Indian Jujube)	Ziziphus mauritiana	Vitamin C (69mg), Fiber (0.6 g), Potassium (250mg), Antioxidants

Contents lists available at ScienceDirect

Journal of Agriculture and Food Research

journal homepage: www.sciencedirect.com/journal/journal-of-agriculture-and-food-research

Nutritional composition and anti-nutritional properties of wild edible fruits of northeast India

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Mineral status of few lesser known fruit crops

Species	N (%)	P (%)	K (%)	Ca %)	Fe %)	Zn (%)	Mg (%)	Cu (%)	Na %)
Baccaurea sapida Roxb.	0.78	0.13	0.73	0.16	0.08	600.00	0.51	76.67	0.04
Eleaegnus latifolia L	1.25	0.10	0.91	1.47	0.18	1186.66	0.54	46.66	0.05
Prunus cerasoides D. Don	3.79	0.18	0.47	0.20	0.21	201.66	0.59	11.33	0.04
Spondias axillaris Roxb.	0.35	0.16	0.67	1.58	0.11	831.25	0.68	60.00	-
Zanthozylum rhetuza Wall.	0.87	0.14	0.72	0.88	0.05	1163.33	0.35	116.66	-
Machilus edulis King	-	0.12	0.61	0.15	0.25	-	-	-	0.02
Diploknema butyracea (Roxb.)	-	0.09	0.82	0.82	0.18	-	-	-	0.07

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WILEY

Research Article

Biochemical Profiling and Antioxidant Potential of Fruit Tissues: A Comparative Study of *Citrus* Cultivars Indigenous to Northeast India

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Quality parameters of few lesser known fruit crops

Species	T.S.S. (%)	Acidity (%)	pH	Vit. C (mg/100ml)	Reducing sugar (%)	Total sugar (%)
Elaeagnus latifolia Linn.	9.1	2.16	-	21.15	1.4	6.09
Phyllanthus acidus	4.68	2.27	4.15	21.15	-	-
Baccaurea sapida (Roxb.)	8.2-14.1	1.93	-	-	5.1	13.69
Garcinia cowa						
1. Juice sac	6.8	2.34	3	42.30	1.01	3.4
2. Rind	5.6	2.37	2.8	21.15	-	-
Myrica sp.						
1. Big size fruit green colour	5.7	4.31	-	17.63	0.97	2.48
2. Small size green colour fruit	6.3	4.83	-	28.2	0.83	2.18
3. Small size pink colour fruit	6.2	2.44	-	4.03	3.57	7.68
Passiflora edulis	14.7	4.42	-	-	-	-
Prunus nepalensis	16-23.20	0.13-0.77		8.81-12.34	-	3.53- 10.37
Prunus cerasoides	6.8			44.27		6.28
Dillenia indica	4.8	1.2	-	-	-	
Rubus ellipticus Smith	6.7			18.38		8
Spondias axillaris Roxb.	10.24			35.29		2.58

Antioxidants properties of lesser known fruit crops

Species	Total phenolic content (GAE mg/g of DM) (Mean	Total flavonoid content (mg/g of DM) (Mean ±Sem)	Total flavonol content (mg/g of DM) (Mean ±Sem)	Ascorbic acid equivalent (mg/g of DM) (Mean ±Sem)	Free radical scavenging ability IC50 value (mg/g of DM) (Mean ±Sem)
Eleaegnus latifolia	10.86	9.67	16.58	15.05	0.25
E. pyrifolia	6.45	1.66	3.52	7.09	0.38
Myrica nagi	16.74	3.79	11.17	17.42	0.27
M. esculenta	28.56	2.25	8.87	19.33	0.16

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Phytochemicals constituents, antioxidant activities and cytotoxicity assays of few wild edible fruits of North-East India

Tridip Kumar Hazarika[a], Lalnunpuia Varte[a], Vabeiryureilai Mathipi[b], Lalrinzuali Khawlhring[b], Esther Lalruatsangi[a], Panthor Debbarma[a], and Nachimuthu Senthil Kumar[c]

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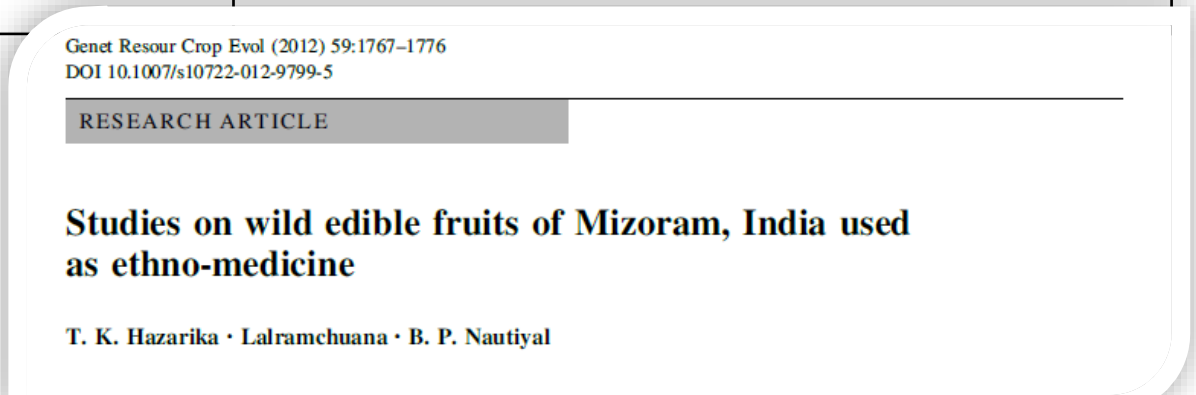
Medicinal properties of lesser known fruit crops

Plant name	Common name	Part Use	Ethno medicinal uses
Aegle marmelos	Beal	Fruit	Mature fruit as against diarrhea and dysentery and ripe fruit as tonic, laxative and good for heart
Annona reticulata	Bullock's heart	Fruit, leaves	Seed powdered paste are applied to the head to kill lice and leaves boil juice to reduce high blood pressure
Aphanamixis polystachya (wall)Parker	Pithraj tree	Fruit	Liver constipation and leucorrhoea
Artocarpus lakoocha Roxb.	Monkey jack	Fruit	Ripe fruit pulp is taken in constipation and in fever and also as anthelmintic
Artocarpus heterophyllus Lam.	Jackfruit	Root, seed, ripe fruit	Treatment of diarrhea from root and seed extract. Ripe fruit as laxative and gum exude from unripe fruit is burnt and the ash powder is applied in skin disease.
Averrhoea carambola	Carambola	Fruit, root	Ripe fruit pulp along with little common salt is eaten against jaundice, bleeding piles and for washing utensil. Besides, the crushed leaves for curing chicken pox, ring worm and scabies and its root extract is used as an antidote for poisoning.

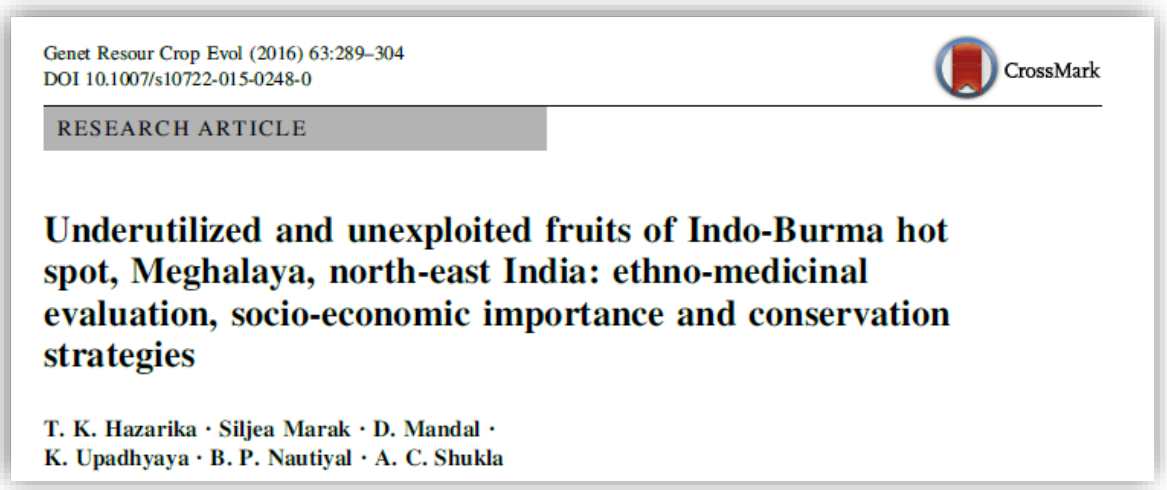

Genet Resour Crop Evol (2012) 59:1767–1776
DOI 10.1007/s10722-012-9799-5

RESEARCH ARTICLE

Studies on wild edible fruits of Mizoram, India used as ethno-medicine

T. K. Hazarika · Lalramchuana · B. P. Nautiyal

Plant name	Common name	Part Use	Ethno medicinal uses
Baccaurea ramiflora Lour.	Burmese grape	Fruit, bark	Fruit as a digestive and bark for skin disease
Calamus tenius	Rattans (Canes)	Fruit	Highly acidic fruit which use as digestive after meal; stem are used for handicraft and furniture
Celtis timorensis	Stinkwood	Leaf	Dysentery and jaundice
Citrus granata	Pommelo	Fruit juice	Fruit juice as febrifuge, seed against dyspepsia and its dry pill to repel the mosquito
Citrus macroptera	Hatkora	Fruit, peel	Fruit juice is used for stomach ailment, fruit pill as spice and in dyspepsia
Dillinia indica Linn.	Chulta/ Elephant apple	Fruit	As a digestive and pickle preparation
Duchesnea indica Focke	Mock strawberry	Whole plant	Against stone formation in urinary tracts and kidney
Elaegnus umbellate Tunb.	Japanese silvery	Fruit, seed	Fruit as a digestive and seed for curing cough



Genet Resour Crop Evol (2016) 63:289–304
DOI 10.1007/s10722-015-0248-0

CrossMark

RESEARCH ARTICLE

Underutilized and unexploited fruits of Indo-Burma hot spot, Meghalaya, north-east India: ethno-medicinal evaluation, socio-economic importance and conservation strategies

T. K. Hazarika · Siljea Marak · D. Mandal · K. Upadhyaya · B. P. Nautiyal · A. C. Shukla

Plant name	Common name	Part Use	Ethno medicinal uses
Euphoria longan Steud.	Longan	Fruit	Relaxation and stomachic from fresh fruit
Ficus auriculata	Elephant ear Fig	Fruit and Bark	Used against dysentery, diabetes and lungs disease
Ficus palmate Linn.	Bedu	Fruit	Prevent oxidative stress
Ficus glometra Roxb.	Cluster fig tree /Gooler	Fruit, root	Fruit are used against dysentery, diabetes and lung disease and bark are used on skin having boil or insect bite
Ficus hispida Linn.	Gobla	Fruit, bark, leaves	Dysentery, ringworm and intestinal worm infection. Leaves are used in preparation of fermented soyabean locally called "hawaizar"
Flacourtia jangomas	Indian plum/ Coffee plum	Fruit	Used for bleeding gum and toothache and diabetes
Gardinia companulata Roxb.	Boilem	Young leaves, fruit	Leave paste are applied on the skin of boil for removing pus and diabetes
Garcinia peduculata Roxb.	Sani	Fruit	Fruit as a digestive and stomach disorder

RESEARCH ARTICLE Indian Journal of Agricultural Research, Volume Issue : ()

Anticancer Screening of Few Wild Edible Fruits in Mizoram, Northeast India using MTT Assay

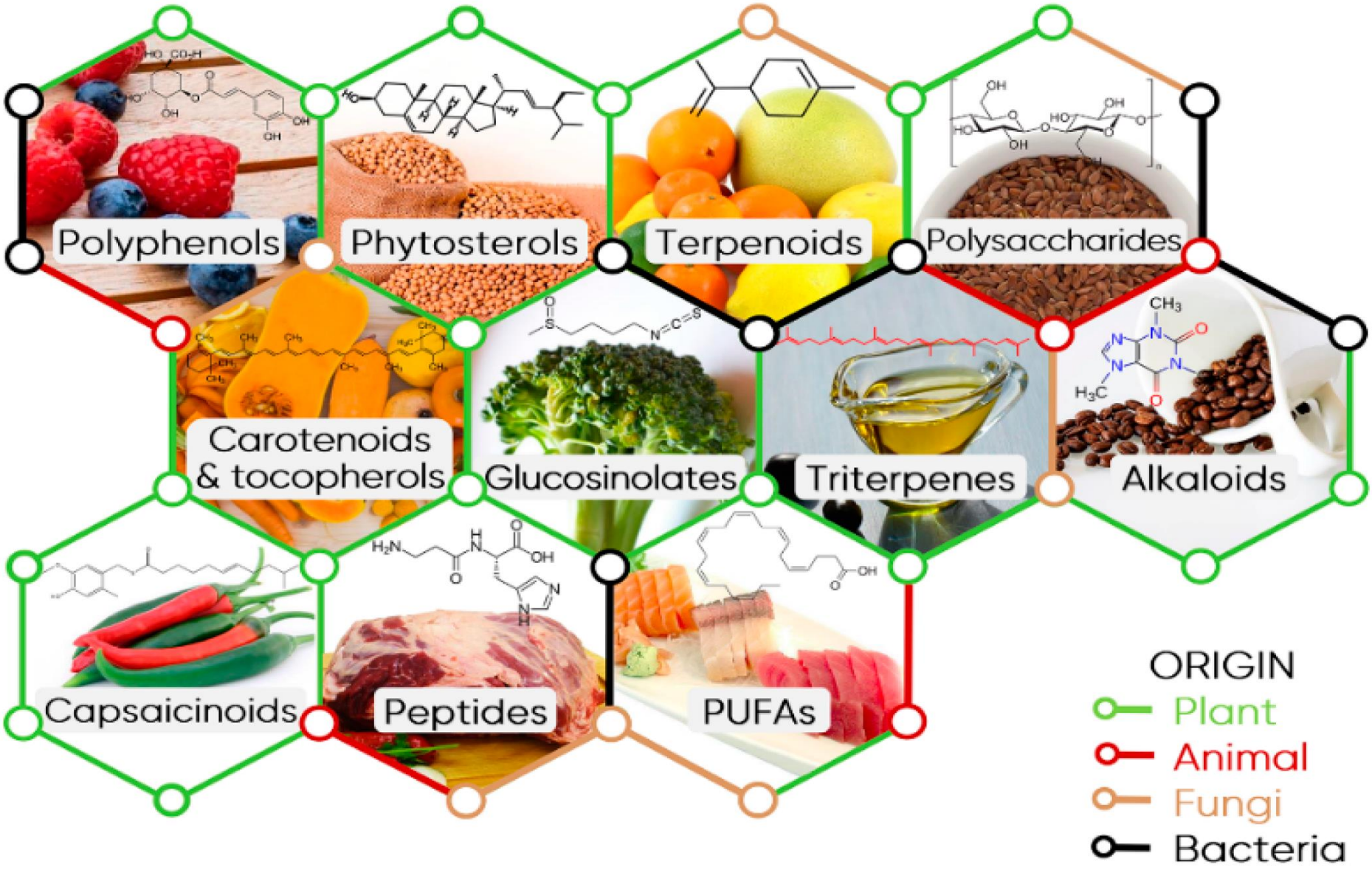
Rody Ngurthankhumi[1], T.K. Hazarika[1], Esther Lalruatsangi[2], H. Lalhmachhuani[1], Panthor Debbarma[1], Zothansiama[3]

10.18805/IJARe.A-6249

Plant name	Common name	Part Use	Ethno medicinal uses
Glycosmis arborea	Chauldhua	Fruit, leaves	Fever liver complaints, jaundice and hair lotion
Juglans regia L.	Walnut	Fruit, leaves	Fruit use for curing heart diseases and leaves are use as traditional medicine to reduce swell on joint, fever and antidairrhoeal
Litsea glutinosa Robins.	Medasaka	Leaves and bark	Cut and injuries for early blood clotting and muscular sprain
Litsea monopetala (Roxb) Pearson	Meda	Leaves, bark, seed	Diarrhea and rheumatism of body pain
Malus bacata Borkh.	Crab apple	Fruit	As a digestive but not recommended to eat during cold fever
Meyna laxiflora Robym.	Moyna	Young leaves, fruit	Intestinal worm and hoarseness
Olea ferruginea	Indian olive	Leaves, fruit	Leaves are used for pile treatment and fruit as a digestive
Phyllanthus acidulous	Star gooseberry	Fruit	Blood enhancer for the lungs and root as a purgative
Phyllanthus fraternus Web	Bhumyamalki	Whole plant	Leucoderma

Plant name	Common name	Part Use	Ethno medicinal uses
Prunus domestica ssp. Syrica	Mirabelles plum	Fruit	Fruit are small, yellow color with excellent flavor, sweet and blue anthocyanin) Laxative property
Prunus domestica ssp. Insititia	Damsons plum	Fruit	Fruit are small, purple color well blended sugar acid ratio and blue anthocyanin, Laxative property
Rhus chinensis	Nutgall tree	Young shoot, fruit	Antiviral, antibacterial, anti-diarrhea, antioxidant activities and as a digestive
Rubus elliptiens Sm.	Yellow Raspberry	Fruit, leaves & root	Fruit against diarrhea and root for dysentery and leaves for abortifacient
Rubus moluccanus Linn.	Ceylon blackberry	Fruit, leaves & root	Fruit against diarrhea and root for dysentery and leaves for abortifacient
Spondias pinnata	Indian hog plum	Fruit, leaves	Leaves are used as an ingredient for making herbal hair lotion "Chinghi", fruit are use against dysentery and dyspepsia
Terminalia chebula Retz.	Yellow myrobalan	Fruit	Anti-inflammatory, cough and colds, pile, ulcer and mild purgative

Major Food Bioactive Compounds (FBCs) Sources



Biological activities of underutilized fruits

Crops	Biological activities
Bael	Anticancer, sedative, hypnotic, analgesic, anticonvulsive, hypothermic, antimalarial, antipyretic, antidiuretic, antitumor, cardioactive, antihyperglycemic, antidislipidemic, antiinflammatory, antiulcer, antiseptic, antiallergic, antidirrhoea, astringent, antibacterial, antihelminthic, antispasmodic, artiemicide, cytotoxic anti-diabetic, antidiabetic
Jamun	Antidiabetic, antihyperglycemic, antifungal, anti-inflammatory, neuropsycho-pharmacological, antimicrobial, antibacterial, radioprotectiv, gastroprotective, antifertility, anorexigenic, antidiarrheal, ulcerogenic and anti-HIV.
Custard apple	Antiviral, antioxidant activity, respiratory stimulant, antimalarial, antihelmintic, antiulcer hepatoprotective, anti-arthritic, antiinflammatory and analgesic, anti-HIV, hypoglycemic
Mulberry	Antidiabetes, hypertension, anaemia, and arthritis antioxidant, antimicrobial, and neuro-protective, anti-inflammatory.
Wood apple	Antimutagenic, hypoglycemic and hyperlipidemic vomiting and hiccups, dysentry, indigestion and induce bowel boils and amoebiosis, diuretic activity, anti-bacterial, antifungal.
Tamarind	Cardioprotective, gastric, jaundice, fever,
Khirni	Aphrodisiac, appetizer, arthritis, jaundice, blood purifier
Mahua	anti-inflammatory, hematoprotective, antitumor, analgesic, rheumatism, ulcer, tonsillitis ulcers, dyspepsia, opcity of the cornea, bronchitis, urethrorrhea, leprosy
Chironji	Antidiarrhoea, intercostals, rheumatic pains and skin diseases
Phalsa	Astringent, stomachic, demulcent, rheumatism, antiinflammation, administered in respiratory, cardiac and blood disorders, antimicrobial, anti-platelet, antiemetic, anti-cancer properties anticancer, antioxidant, radioprotective and antihyperglycemic properties
Karonda	astringent, appetizer, antipyretic, antidiabetic scabies, intestinal worms, diarrhoea antipyretic, appetizer, antiscorbutic, antihelmintic
Manila tamarind	Abortifacient, anodyne, astringent, larvicidal, guamachil is a folk remedy for convulsions, dysentery, dyspepsia, earache, leprosy, peptic ulcers, sores, toothache, and venereal disease eczema, sore throat, acne and pimples
Wild noni	Antibacterial, antiviral, antifungal, antitumor, antihelmin, analgesic, hypotensive, anti inflammatory and immune enhancing effects.
Fig	Metabolic, cardiovascular, respiratory, antispasmodic, anti-inflammatory, antidiarrhoea, respiratory haemorrhage, diuretic, diabetics, anthelmintic tuberculosis, anticancer, antidiarrheal
Timru	Antimicrobial , antiplasmodial, antidiabetic, antimaleria
Gonda	Antihelminthic, diuretic,,demulcent

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Bioactive constituents and health promoting compounds of few wild edible fruits of North-East India

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Original article

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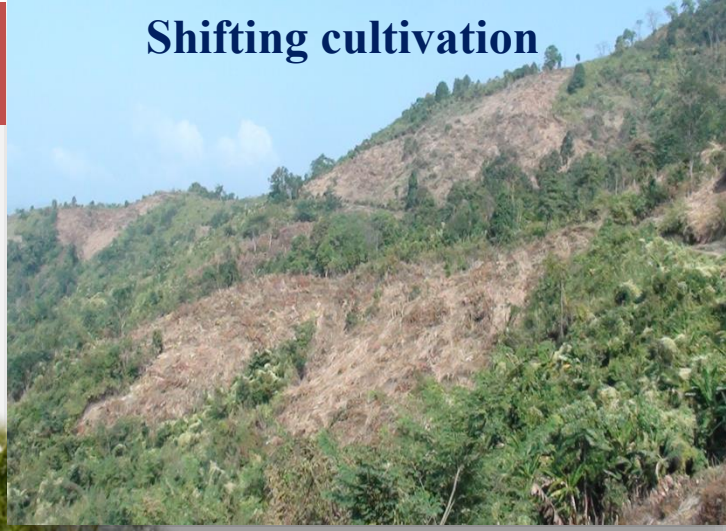
Bioactive compounds and antioxidant activity of an endangered Citrus species '*Hatkora*' (*Citrus macroptera* Mont.) from Mizoram, India

E. Lalruatsangi[1], T.K. Hazarika[1,a], M. Vabeiryureilai[2], N. Senthil Kumar[2], R. Lalnungrenga[3] and Lalnunpuia[1]

[1] Department of Horticulture, Aromatic and Medicinal Plants, Mizoram University, Mizoram, India
[2] Department of Biotechnology, Mizoram University, Mizoram, India
[3] Silviculture and Forest Management Division, Forest Research Institute, Dehradun, India

Loss of GR of Fruit species



Shifting cultivation

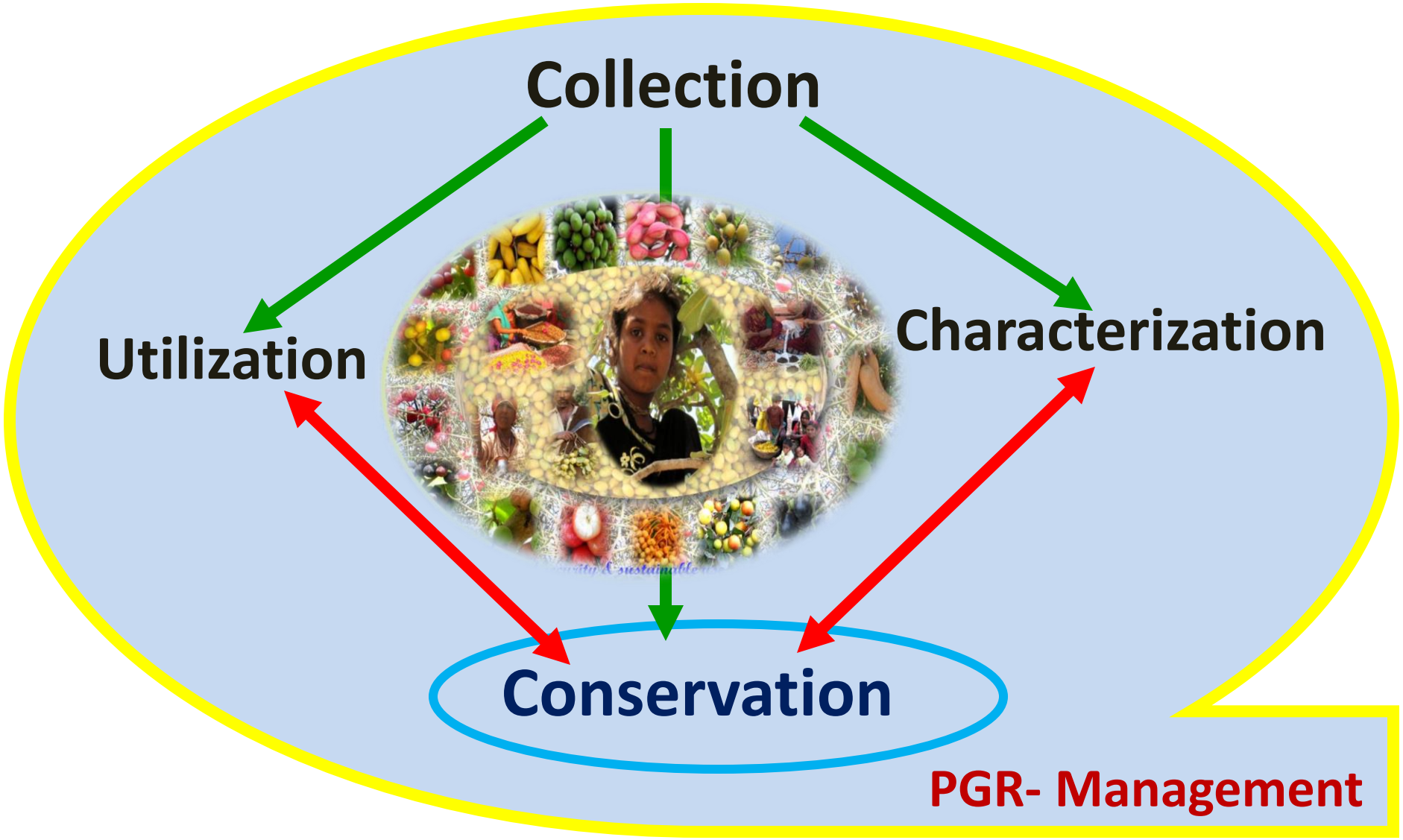
Immense anthropogenic pressure on flora

Land requirement for developmental needs

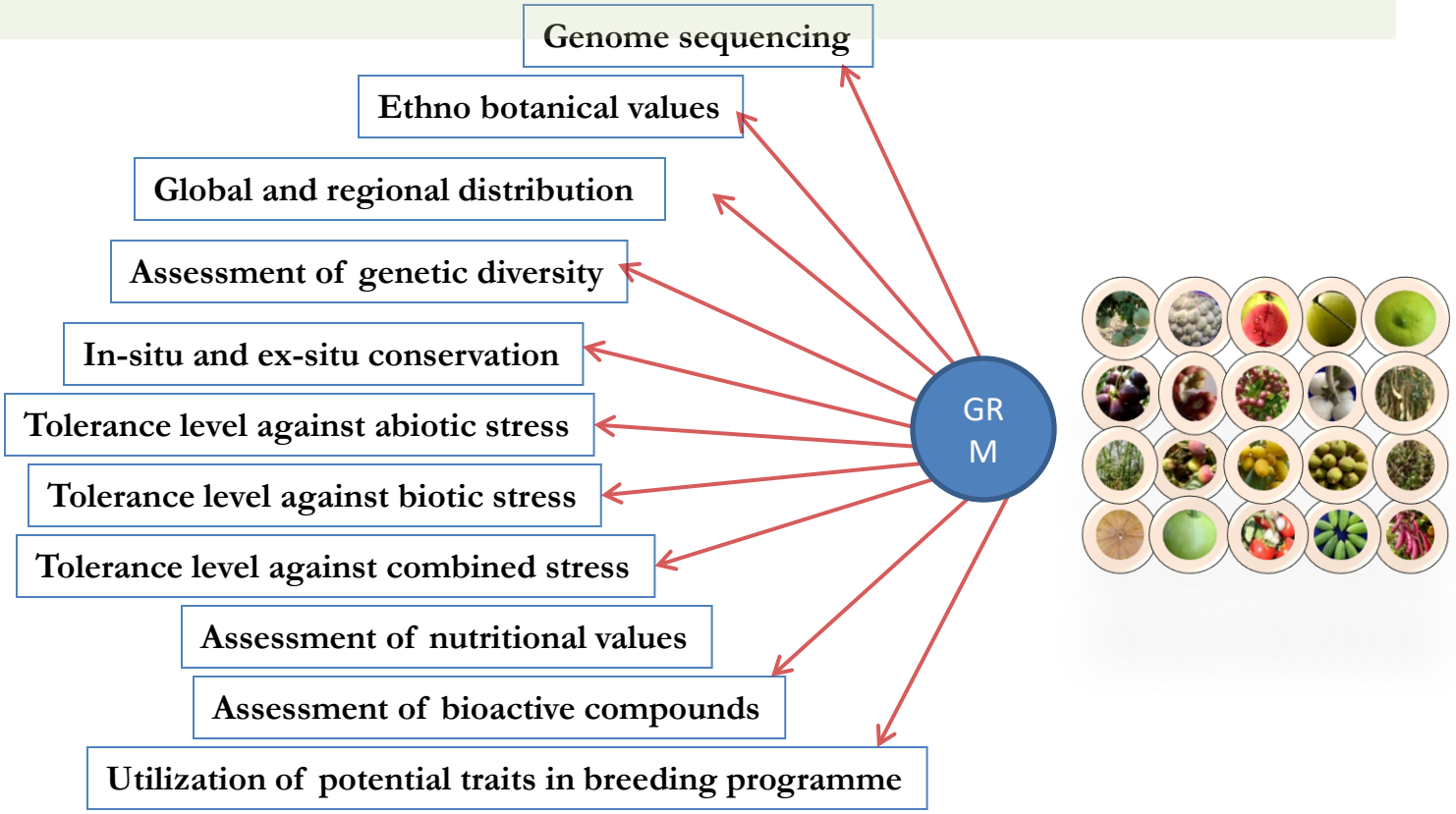
HABITAT DISTRUCTION AND FRAGMENTATION

Commercial agriculture

Management of Fruit Genetic Resources



GENETIC RESOURCES MANAGEMENT OF MINOR FRUITS



STRATEGIES

Germplasm Acquisition and Characterization

Exploration programmes need to be undertaken to collect the existing diversity

Production Technology

In depth, location specific research should be made to determine the package of cultivation practices

Technology Transfer

SAUs and KVKs have to organize FLD, OFT, etc at regular basis on nutritional and medicinal importance of these crops

Collaboration and Linkages

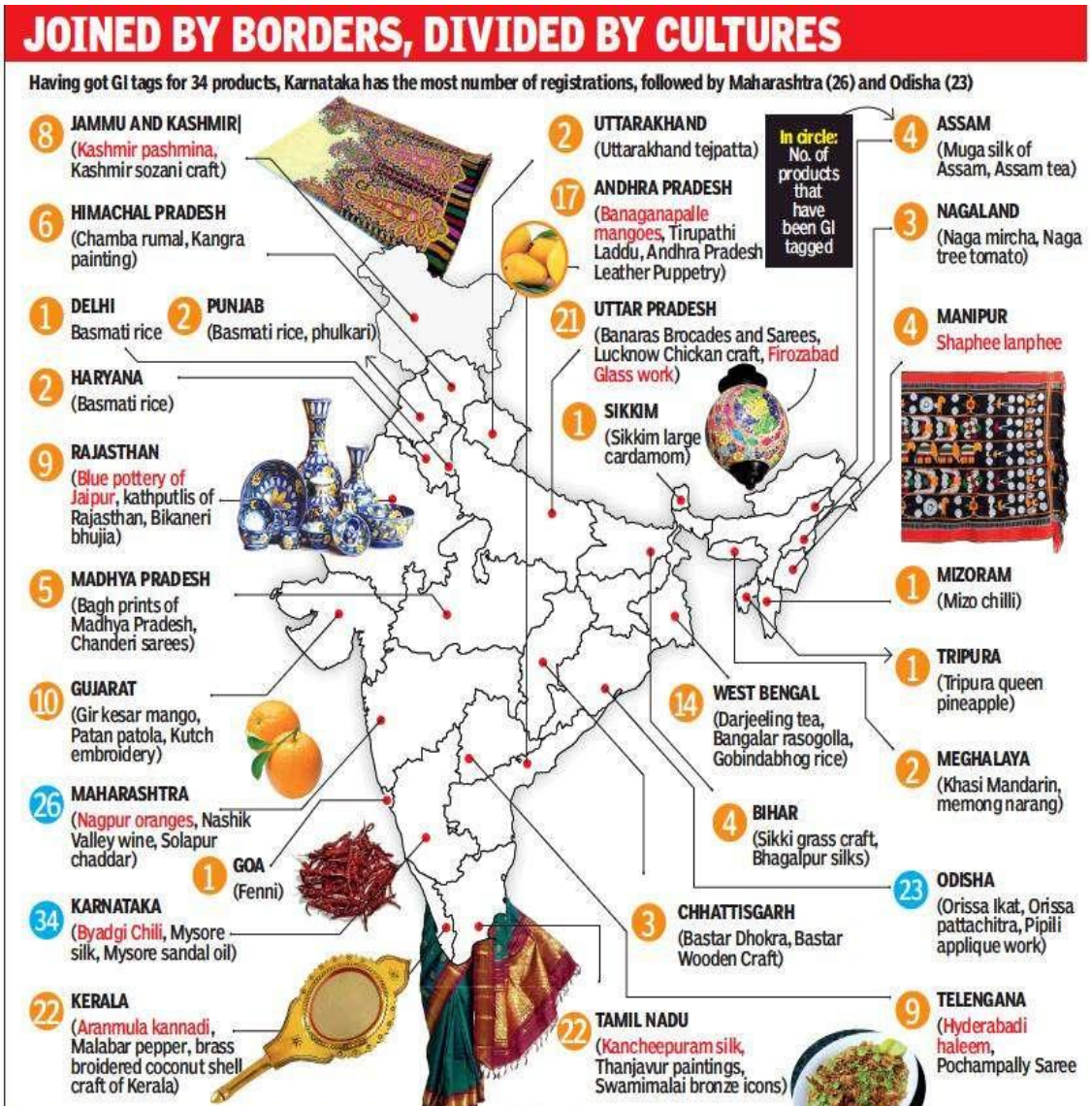
Well connected linkage needs to be established among producers, wholesellers, retailers, processors, and consumers in order to develop effective value chain to promote the use of lesser known fruits

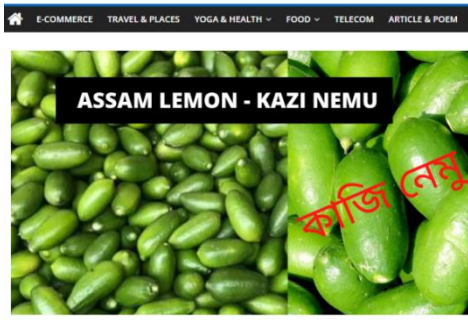
Government Policies

The state government should take initiative to frame out the policies for mainstreaming of lesser known fruit crops.

GI Tags Save Diversity and Indigenous Knowledge, Enhance Farmers Livelihood

Approx. 50 Fruits got GI Tag in India out of that 10 Citrus cultivars





Assam Lemon – KAZI NEMU "Geographical Indication Tag (GI) in 2019"

Community Conservation in Backyards and Farms

- The home gardens or backyard gardens are the well accepted 'Micro-Diversity Areas'
- Wild and semi-domesticated species of fruits such as banana, citrus, mango, jackfruit etc. maintained in backyard gardens of tribal villages in buffer zones of National Parks, Protected Area and Gene Sanctuary.
- The women have been the custodians of these backyard gardens.
- Such a participatory approach with farmers and community involvement needs further impetus.

Future R & D strategies

- E*x situ* and *in situ* conservation of rare and endangered species should urgently be undertaken to ensure safe storage of germplasm
- Thorough assessment of indigenous genetic resources and their employment in strategic breeding programmes involving national/ exotic varieties.

❖ Ensuring household food security and nutrition security through year-round production of indigenous nutritious fruits in *baris*.

❖ There is urgent need to launch global level network programme for conservation and sustainable utilization of all available fruit crops of this region.

Future R & D strategies

- Thorough assessment of indigenous genetic resources and their employment in strategic breeding programmes involving national/ exotic varieties.
- Assessment of nutritive value of indigenous fruits including measurement of ORAC to judge antioxidant capacity.

❖Conversion of homestead garden to nutrition gardens incorporating indigenous fruits having nutritive values.

Way forward

Creating awareness

Abiotic stress tolerant varieties

Ayurvedic formulation

High density planting

Canopy management

Herbal products

Fruit based cropping models

Orchard floor management

Improvement in soil microclimate

Value added products

Quality planting materials

Biotic stress managemen

WILD EDIBLE FRUITS OF MIZORAM, NORTH-EAST INDIA

Wild Edible Fruits of Mizoram, North-east India is an informative collection of 74 fruits growing in the serene wilderness of the state of Mizoram, India. These fruits are important parts of the nutrition and ethno-social livelihood the local tribal population. This book covers all aspects of wild edible fruits of Mizoram, India including scientific name, family, local name, common name, global distribution, Indian distribution, habitat, description, flowering and fruiting time, edible parts and uses, other uses along with references. We believe that the book will be useful for the defence personals, students, teachers, scientists, extension workers and researchers in horticulture and plant science all over the country and will unfurl new vistas for a long-term development of horticulture in the country.

Prof. Tridip Kumar Hazarika is presently working as Professor, Department of Horticulture, Aromatic and Medicinal Plants, Mizoram University, Mizoram, India. Prof. Hazarika did his Post Doctorate from Michigan State University, USA. Prof. Hazarika was served as Head, Department of Horticulture, Aromatic and Medicinal Plants, Mizoram University for two terms, 2016-2019 and 2020-2023.

Dr. Jayshree Das is a retired scientist from DRDO, Defence Research Laboratory, Tezpur, Assam. She obtained her M.Sc. and Ph.D. degrees in Botany from Gauhati University, Guwahati, Assam. She has over 38 years of experience in research related to ethnobotanical plants of Northeast India.

Dr. Ajitabh Bora has been serving as Scientist-E in Defence Research Laboratory, DRDO, Tezpur, Assam. He works in the Field of Bioprospecting of bioresources of NE India for defence application.

Dr. Marcy D. Momin obtained her M.Phil. and Ph.D. degrees from Mizoram University, Mizoram, India. Dr. Marcy has published 6 research papers in reputed national and international journals, 3 book chapters.

Mr. P. Lalrinzuala completed his M.Sc. (Ag.) from the School of Agricultural Sciences and Rural Development (SASRD), Nagaland University in 2019. He served as a Vocational Education in Agriculture Teacher at Govt. Central High School, College Veng, Aizawl in 2022. He then worked as Project Associate I (Mar-Sep 2023) under a DST, Govt. of India project and as Junior Research Fellow (Oct 2023-Nov 2024) under DRDO, Govt. of India.

Dr. Himjyoti Dutta is an Assistant Professor in the Department of Food Technology, Mizoram University, India, and has been an active researcher since 2009, focusing on biological macromolecules in food systems.

WILD EDIBLE FRUITS OF MIZORAM, NORTH-EAST INDIA

Hazarika | Bora | Momin | Lalrinzuala | Dutta

WILD EDIBLE FRUITS OF MIZORAM, NORTH-EAST INDIA

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WILD EDIBLE VEGETABLES OF MIZORAM, NORTH-EAST INDIA

The book Wild Edible Vegetable of Mizoram, North-east India embraces a collection of 75 distinctive vegetables that grow in the serene wilderness of the state of Mizoram, India. They are important parts of the nutrition and ethno-social livelihood the local tribal population. This book covers all aspects of wild edible vegetables of Mizoram including scientific name, family, local name, common name, global distribution, Indian distribution, habitat, description, flowering and fruiting time, edible parts and uses, other uses along with references. We believe that the book will be useful for the defense personals, students, teachers, scientists, extension workers and researchers in horticulture and plant science all over the country and will unfurl new vistas for a long-term development of horticulture in the country.

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THANKS