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KERALA KARSHAKAN

English journal

The First English farm journal from the house of Kerala Karshakan

Star Fruit

Pollination Partners Understanding the Fig and Fig Wasp Relationship

Abiu

Pomegranate

Bilimbi

INSIDE KERALA KARSHAKAN

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The First English farm journal from the house of Kerala Karshakan

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Pomegranate for nutritional and livelihood security

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Spicy remedies for brighter smile

Oral health is an essential aspect of overall well-being, yet it is often overlooked in daily routines. Beyond brushing, flossing, and dental visits (based on need), nature offers an array of spices that can serve as effective adjuncts in maintaining oral hygiene. These natural remedies have been used for centuries, especially in traditional medicine systems like Ayurveda, for their highly effective medicinal properties to prevent and manage

Clove

common dental issues such as tooth decay, gum disease, and bad breath.

The role of major spices in promoting oral and dental health is discussed below, focusing on their antimicrobial, anti-inflammatory, and analgesic properties.

1. Clove *(Syzygiumaromaticum)*

Clove is one of the most well-known and widely used spices in dental care. It contains eugenol, a compound with potent antimicrobial, anti-inflammatory, and anesthetic properties. Historically, clove oil has been used to relieve toothaches and prevent infections. Studies suggest that clove oil can reduce gum inflammation, alleviate pain, and even

Cinnamon

combat bacteria responsible for dental caries and periodontal diseases.

Eugenol's analgesic properties make clove oil effective in numbing the tooth pain. It also exhibits antibacterial activity against microbes like Streptococcus mutans, Candida albicans, and Porphyromonasgingivalis - bacteria involved in tooth decay and gum diseases. Moreover, clove oil's antioxidant properties help to protect against oxidative damage in oral tissues.

How to use: Clove can be chewed whole for immediate relief. Clove oil can also be applied directly to the affected area using a cotton ball or

Nutmeg

Cardamom

diluted with a carrier oil (coconut oil/sesame oil/ mustard oil) to reduce pain and inflammation.

2. Cinnamon *(Cinnamomumverum)*

Cinnamon is not only known for its delightful aroma, but also for its health benefits. Its oil contains cinnamaldehyde, which exhibits strong antibacterial and antifungal properties. Cinnamon is effective against Streptococcus mutans, a major pathogen responsible for tooth decay.

Antimicrobial properties of cinnamon help reduce plaque build-up and prevent the formation of cavities. Its antioxidant content also promotes overall gum health, potentially reducing the risk of gum disease. Additionally, cinnamon's ability to regulate blood sugar levels indirectly contributes to oral health by reducing plaque formation caused by sugary foods.

How to use: Cinnamon oil or ground cinnamon can be added to toothpaste or used as a mouth rinse. Some people incorporate it into their diet to help maintain healthy oral flora.

3. Nutmeg *(Myristicafragrans)*

Nutmeg, like clove, contains eugenol, contributing to its antimicrobial and analgesic properties. Nutmeg can be used to treat tooth pain and inflammation, as well as improve overall oral hygiene.

Nutmeg's antimicrobial activity helps combat the bacteria responsible for plaque buildup and bad breath. It also acts as a natural analgesic for toothache and gum discomfort.

How to use: Nutmeg can be used in the form of oil or powder. Applying a small amount of nutmeg oil to the affected area can relieve pain and reduce inflammation.

4. Cardamom *(Elettariacardamomum)*

Cardamom is widely recognized for its fresh and pleasant flavor, but it also offers several

Turmeric

health benefits for oral care. It has antiseptic and antimicrobial properties, making it effective in fighting oral pathogens.

Oil present in cardamom is particularly effective against Streptococcus mutans and other bacteria that contribute to dental caries and gum infections. It also aids in treating halitosis (bad breath) by neutralizing odour-causing bacteria in the mouth.

How to use: Cardamom can be chewed directly or used as an ingredient in homemade mouthwashes or toothpaste. Its freshening effects

Coriander

help combat bad breath while promoting oral hygiene.

5. Turmeric *(Curcumalonga)*

Turmeric, a staple in both culinary and medicinal traditions, is renowned for its potent anti-inflammatory and antioxidant properties, primarily attributed to curcumin, its active compound. Turmeric has been shown to reduce plaque, bacteria, and inflammation in the gums, making it a natural remedy for gum disease and periodontal health. Curcumin inhibits the inflammatory pathways involved in periodontal disease and gum inflammation. Studies have revealed that turmeric's antimicrobial properties make it effective against Streptococcus mutans, Enterococcus fecalis, and other oral pathogens. also.

How to use: Turmeric powder can be applied directly to the gums or used in homemade toothpaste or mouthwash. While turmeric is being used for whitening the teeth, its primary benefit is in reducing inflammation and promoting oral hygiene.

6. Coriander *(Coriandrumsativum)*

Coriander seeds have been traditionally used to treat oral infections and promote healthy gums. They have antimicrobial properties and can help neutralize acids produced by bacteria in the mouth, which contribute to tooth decay. Coriander seeds raise the pH of saliva, which helps neutralize harmful acids. They are particularly effective against bacteria like Bacillus cereus, which is known to contribute to oral infections.

How to use: Coriander seeds can be chewed directly or boiled in water to create a mouthwash. The solution can be used to rinse the mouth and promote overall oral health.

Conclusion

Use of spices in oral and dental care offers a promising natural alternative to chemical-laden oral hygiene products. Spices such as clove, cinnamon, peppermint, turmeric, nutmeg, coriander, and cardamom have demonstrated various beneficial properties, including antimicrobial, anti-inflammatory, and analgesic effects. Incorporating these spices into daily routines - whether through diet, topical applications, or as ingredients in natural oral care products - can support healthy teeth and gums.

While spices should not replace traditional oral hygiene practices such as brushing and flossing, they serve as valuable adjuncts to enhance oral health. Further research into their long-term effects and efficacy will provide additional insight into their potential as natural remedies for common oral health issues.

Thus, incorporating the above mentioned spices into our daily oral care routine not only offers potential health benefits but also supports a natural, holistic approach to oral and dental hygiene, promoting a brighter and healthier smile.

As always, it is advisable to consult with a healthcare professional or dentist before using these spices as part of a dental care regimen.

Spot the diseases in cassava and save the yield

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Cassava, locally known as *'kappa' or 'maracheeni'* in Kerala, is one of the most important staple food crops in the state, especially in rural households. More than 800 million people worldwide depend on cassava in tropical areas, and in Kerala, it has historically been an affordable and reliable alternative to rice, especially during times of famine. Even though cassava is grown extensively in Asia, Africa, and Latin America, it has a special position in Kerala's culinary traditions and agricultural economy. Although cassava is primarily used for industrial processing or as animal feed in many parts of Asia and Latin America, in Kerala, it is mainly consumed as a staple food, similar to its role in several

African countries.Cassava contributes significantly to food security in various regions of the state, providing a dependable food source for low-income populations. Its ability to grow in marginal soils and under rainfed conditions has made it a dependable crop for small and marginal farmers.One of cassava's greatest advantages in Kerala is its ability to thrive in poor, laterite soils where other major crops may fail. This resilience makes it particularly valuable in the upland and midland regions of the state. Cassava is expected to remain a vital source of carbohydrates for both rural and urban populations in the years ahead, particularly among low-income groups.

Diseases and pests are among the most significant constraints affecting cassava production in Kerala, with the potential to seriously undermine crop yields and overall productivity. Cassava diseases not only reduce the quantity of edible roots, directly impacting farmers' incomes and food security, but also damage stems, leading to shortages of quality planting materials.

Despite these challenges, many cassava farmers in Kerala still pay little attention in managing pests and diseases. A widespread belief persists that cassava will yield reasonably well under any condition, even with minimal care. These misconceptions must be addressed through effective farmer education and awareness programs, highlighting the importance of disease identification, timely intervention, and proper crop management to ensure higher yields and long-term food security.

Important diseases affecting cassava, their causal organisms, spread,symptoms, and management practices are detailed here.

CASSAVA MOSAIC DISEASE

Cassava mosaic disease (CMD) is one of the most economically significant diseases of cassava in Kerala, limiting its productivity, particularly in districts like Thiruvananthapuram, Kollam, Pathanamthitta, and parts of Idukki, where cassava is widely cultivated.

Causal organism

Indian cassava mosaic virus (ICMV) and *Sri Lankan cassava mosaic virus* (SLCMV). Of the two major viruses responsible

Symptoms of cassava mosaic disease

for cassava mosaic disease, the latter is predominant in most cassava-growing areas and is associated with more severe symptoms.

Spread

Infected plants serve as the primary source of the virus, and the whitefly *(Bemisia tabaci)* acts as the vector, transmitting the virus from plant to plant as it feeds on cassava leaves. The disease spreads mainly through the use of infected stem cuttings as planting material, making the selection of healthy cuttings crucial for disease prevention.

Symptoms

Cassava plants infected with cassava mosaic virus exhibit a wide range of symptoms, depending on the virus species or strain involved, prevailing environmental conditions, and the susceptibility of the cassava variety.

The most recognizable symptom is the appearance of mosaic patterns on the leaves, characterized by irregular patches of normal green interspersed with varying shades of yellow or pale green.These chlorotic areas indicate a reduction in chlorophyll content, which directly impairs photosynthesis and, consequently, lowers crop yields.The disease can cause significant leaf deformation, with leaf blades becoming twisted, curled and distorted to give a shoestring appearance. When infection occurs during the early growth stage,stunted growth is observed, resulting in weak, thin stems that are unsuitable for propagation.Additionally, such plants tend to produce fewer and smaller storage roots, significantly reducing overall yield(Fig.1)

Management

- Use of disease-free planting material obtained from healthy plants
- Growing of resistant varieties released from CTCRI,Sreekariyam, viz.Sree Kaveri, Sree Reksha, Sree Sakthi and Sree Suvarna
- Regular inspection, removal and destruction of infected plants (roguing) and strict field sanitation by removing previous season left over plants around the field and weeds
- Vector control- spraying of Imidacloprid 17.8 SL (0.3 ml L-1) or Thiamethoxam 25 WG (0.3-0.4 g L-1) at 14-dayintervals

CASSAVA STEM AND ROOT ROT

This disease,first observed in 2019 after the heavy flood,has become a threat to the farmers of Kerala, particularly in wetland regions and yield loss of up to 100% was reported.

Causal organism:

Major pathogens: Species belong to Fusarium solani species complex (FSSC)

Symptoms of cassava stem and root rot

Spread

The soil-borne pathogen infects the collar region and subsequently spreads to the stem and roots. Symptoms appear rapidly, within 7 to 10 days, following the onset of rain.Infection is favoured by high soil acidity (pH 3.5–5.0) and imbalanced nutrient levels, particularly excess nitrogen and deficiencies in micronutrients like calcium, magnesium, boron, and zinc.

Symptoms

Cassava can be affected by the disease at any stage, from planting to harvest.The primary symptom is stem blackening with fungal mycelia and pustules near the collar region, where the infection usually begins and spreads both upward and downward.It eventually spreads to the tubers, leading to their decay. In advanced stages, lower leaves exhibit yellowing, drooping, and wilting.(Fig.2).

Management

- Prevent waterlogging by maintaining proper drainage in the plot
- Crop rotation with non-host crops
- Follow balanced application of primary, secondary and micronutrients
- Apply 150 g phosphogypsum or lime per plant 10–15 days before planting in soils with pH 4–5, ensuring adequate moisture
- Apply 20 g of neem cake and 1 kg of Trichoderma asperellum-enriched FYM per plant
- Sett treatment with Carbendazim (0.05%) for 10 minutes and soil drenching with the same fungicide, three times at 15-day intervals starting from planting

CASSAVA BROWN LEAF SPOT

Brown leaf spot is a major fungal disease commonly found in regions with heavy rainfall. It causes substantial defoliation and more than 30% yield loss in susceptible varieties such as Malayan-4 (M-4). Older leaves are more susceptible than younger ones and are mostly observed in crops that are more than five months old.

Causal organism: *Cercospora henningsii*

Spread

The disease thrives under warm and humid conditions, with rainfall and high moisture levels

Symptoms of cassava brown leaf spot

accelerating its progression. Consequently, its severity is greatest during the monsoon season. Excessive application of nitrogen and phosphorus fertilizers aggravates the infection. The pathogen spreads to healthy plants primarily through rain splash and wind. During the dry season, the fungus survives mainly on fallen, infected leaves.

Symptoms

Appearance of a few to several characteristic brown spots(3-12 mm in diameter) develops on both sides of lower, mature leaves. The spots are uniformly brown with a distinct dark brown margin on the upper surface and less distinct and grayishon the lower surface. The spots expand and become irregular and angular in shape as they are limited by leaf margins and veins. A light yellow halo appears around the spots in certain susceptible varieties. The middle portion of brown spots may break, giving rise to shot holes. As the disease advances, the infected leaves turn yellow, become dry, and fall off (Fig.3).

Management

- Wider spacing lowers humidity levels within the cassava crop canopy, thereby decreasing disease incidence
- Clean cultivation and balanced fertilizer application help in restricting the development and spread of the disease
- Adjusting the planting schedule to ensure that the most susceptible growth stage of the crop does not coincide with the wet season
- Cultivation of resistant varieties like Sree Prakash or Sree Visakham

Cassava anthracnose disease

CASSAVA ANTHRACNOSE DISEASE OR DIEBACK

This disease is found in most of the cassava-growing regions, usually after prolonged rains. Under favourable conditions, the disease can result in an

estimated yield loss of up to 30% in susceptible cultivars. The disease affects both the leaf and stem portions. Severe anthracnose attacks can cause death of stems, which affects the availability of planting materials and can lead to reduced yield.

Causal organism: Colletotrichum *gloeosporioides f.sp.* manihotis

Spread

The disease usually begins with the onset of rains and intensifies as the wet season advances. The pathogen spreads through wind or by using infected stem cuttings for planting. Dead cassava stems and leaves containing the fungus can act as reservoirs for the disease if not properly disposed of.

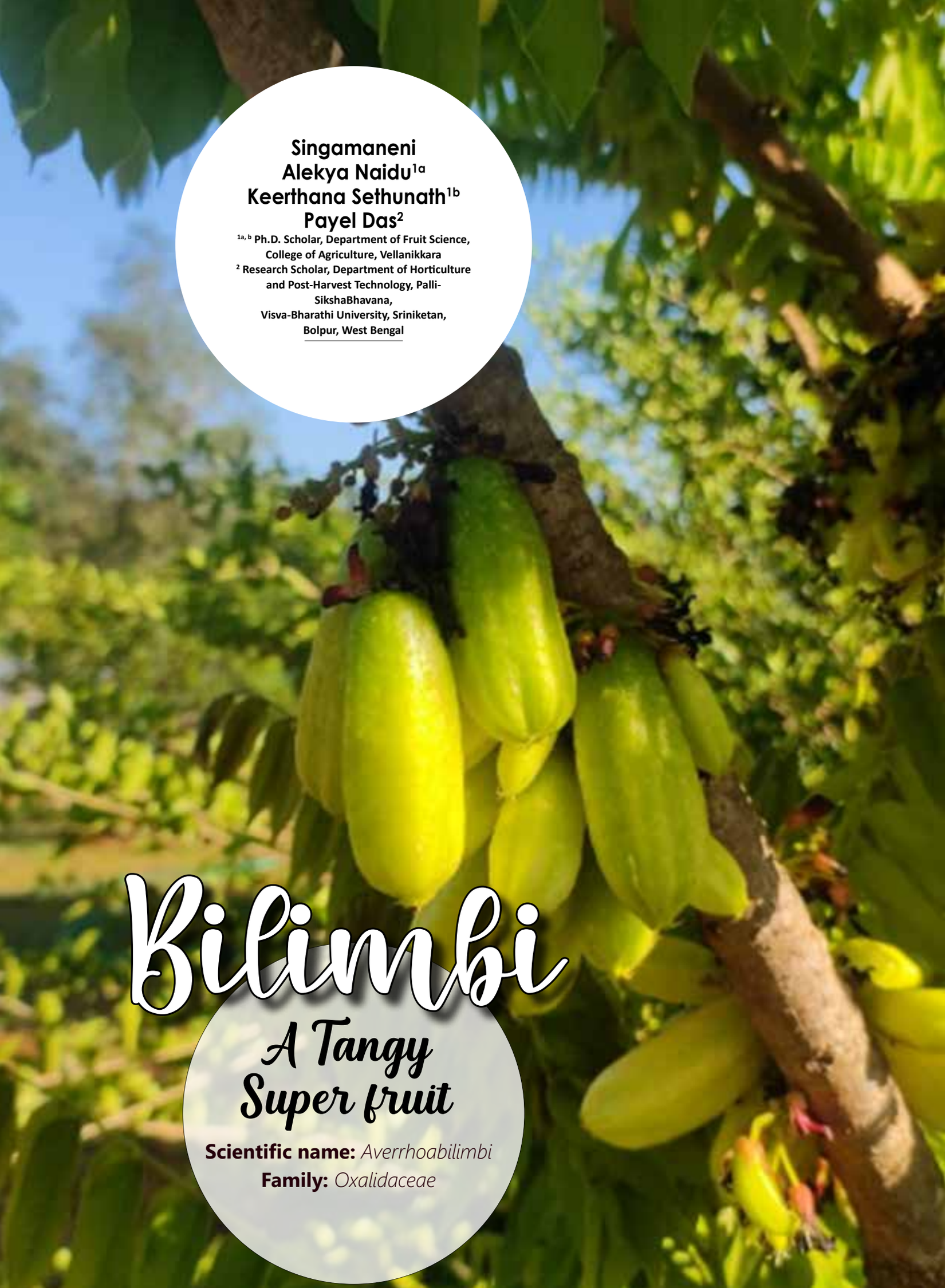
Symptoms

Sunken leaf spots (about 10mm diameter) are produced on the lower leaves and cause leaf drying in advanced stages. Such lesions or cankers are noticed on the stem, especially on the young shoots and growing tips. The cankers may be formed at the nodes bearing petioles or along any part of the stem.The size of cankers varies depending on the variety and environmental conditions.These cankers may crack open, exposing the inner stem tissues to external elements. As the cankers develop, they can cause deformities in the shape of the infected stems. Dieback of stems is an important symptom of the disease and the entire infected stems may die back and break off. Infected plants often exhibit wilting, which is commonly accompanied by defoliation. New twigs often sprout from the axillary buds located below the necrotic region, giving a characteristic bunchy appearance.(Fig.4).

Management

- Only healthy stems, free from cankers and dieback tissues,should be selected to prepare cuttings for planting.
- Removal of crop debris and destruction after harvest from the infected fields
- Removal of dead plant parts and spraying of mancozeb 0.3% or carbendazim (0.05%) three times at fortnightly interval starting from the first appearance of the symptom

To unlock the full potential of cassava cultivation in the state, it is essential to adopt improved management practices, particularly those aimed at controlling these threats to crop productivity. Strengthening disease surveillance systems and promoting the use of disease-resistant varieties are essential steps in addressing these challenges. Along with disease management, enhancing productivity through efficient farming techniques, pest control, and better agronomic practices will help maximize yield per unit area and ensure a reliable supply for both food security and industrial needs.The future of cassava depends on farmers, scientists, and communities working together. By staying informed and adapting to new solutions, farmers can protect their crops and their livelihoods for generations to come. This document will help farmers and other stake holders to identify the disease and follow appropriate management practices.



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Bilimbi

A Tangy Super fruit

Scientific name: *Averrhoabilimbi*
Family: *Oxalidaceae*

Averrhoabilimbi, commonly known as bilimbi or cucumber tree, is a tropical fruit native to Southeast Asia with a distinct sour flavor. Although it is not as widely known as other fruits, it's gaining attention for its unique flavor and versatile uses. Often mistaken for its close relative, the starfruit (*Averhoacarambola*), bilimbi has its own distinct characteristics, making it a valuable addition to our culinary and health repertoire.

What Is *AverhoaBilimbi*?

Bilimbi tree is a small, fast-growing plant that can reach up to 10 meters in height. The fruit itself is elongated, typically green, and looks like a miniature cucumber, which is why it's called the cucumber tree. Once ripe, it can turn yellowish or pale green. Tree is cauliflorous with 18–68 flowers in panicles that form on the trunk and other branches. Flowers are heterotristylous, yellowish green to reddish purple. The flavor is intensely sour and tangy, which makes it both a culinary delight and a medicinal treasure.Fruits are packed with vitamin C and offers numerous health benefits, from

boosting immunity to supporting skin health. In Southeast Asian cuisine, it's prized for its tangy taste, often added to savory dishes and drinks. With growing global interest, Averhoabilimbi is quickly becoming recognized for both its versatility and nutritional value.

Culinary Importance:

Bilimbi is highly valued in Southeast Asian cuisine for its distinctively sour flavor, which is used to add tartness to a wide range of dishes. It's often incorporated into soups, pickles, sauces, and curries, especially in countries like the Philippines, Malaysia, and Indonesia. Its intense sourness makes it a key ingredient in traditional dishes such as sinigang (a sour soup) and various chutneys and relishes. Bilimbi is also used to flavor beverages, jams, and preserves, adding versatility to both sweet and savory recipes.

Medicinal and Health Benefits

Beyond its culinary potential, Averhoabilimbi has several health benefits. Rich in vitamin C, it's an excellent immune booster and can help fight off infections. The fruit is also known for its anti-inflammatory properties, making it beneficial for those suffering from joint pain or other inflammatory conditions. In traditional medicine, bilimbi has been used to treat a variety of ailments, including high blood pressure, diabetes, and digestive issues.

Additionally, some studies suggest that bilimbi extracts may have antibacterial and antifungal properties, which can support overall skin health. People have used it as a natural remedy for minor skin infections and to promote healthy, glowing skin.

Propagation

It can be propagated through two main methods: seeds and cuttings. Both methods are effective, though each has its own set of requirements and benefits.

1. Seed Propagation:

Seed Preparation: Fresh seeds

are preferred for propagation, as they have higher germination rates. The seeds should be cleaned and allowed to dry for a short period before planting.

Germination: Seeds are typically planted in a well-drained seedbed or nursery pots. The seeds are placed about 2 cm deep in the soil. It's important to keep the soil moist and maintain a warm environment for better germination. Germination usually takes about 2-3 weeks.

Transplanting: Once the seedlings have grown strong enough (typically after 6-8 months), they can be transplanted into the field or garden. Bilimbi trees need to be spaced around 3-4 meters apart to allow for proper growth.

2. Cutting Propagation:

Selecting Cuttings: Semi-hardwood cuttings, around 15-20 cm long, are taken from healthy, mature bilimbi trees. The cuttings should be from the current year's growth and have at least one or two nodes.

Rooting Hormone: To increase the chances of successful rooting, the cut end of the cutting can be dipped in rooting hormone before planting.

Planting Cuttings: The cuttings are planted in a well-draining potting mix or directly in the soil, ensuring the nodes are buried sufficiently. Keep the cuttings in a shaded, humid environment to prevent dehydration.

Root Development: After 4-6 weeks, the cuttings should begin to develop roots, at which point they can be transferred into larger pots or planted in the ground.

3. Care after Propagation:

Watering and Fertilizing: Whether grown from seed or cutting, bilimbi seedlings require consistent watering, especially in the early stages. Fertilizers, both organic and chemical, can be applied to encourage healthy growth.

Sunlight: Bilimbi trees require full sunlight for optimal growth, so it's important to plant them in areas that receive plenty of direct light

Sustainability and Environmental Impact

The bilimbi tree is not only beneficial for human health but also for the environment. As a fast-growing plant, it is easy to cultivate and doesn't require much maintenance.

The tree thrives in tropical climates, where it helps promote biodiversity. Given its versatility and ability to grow in various regions, bilimbi could be a valuable crop for sustainable farming, particularly in tropical areas where other crops may struggle.

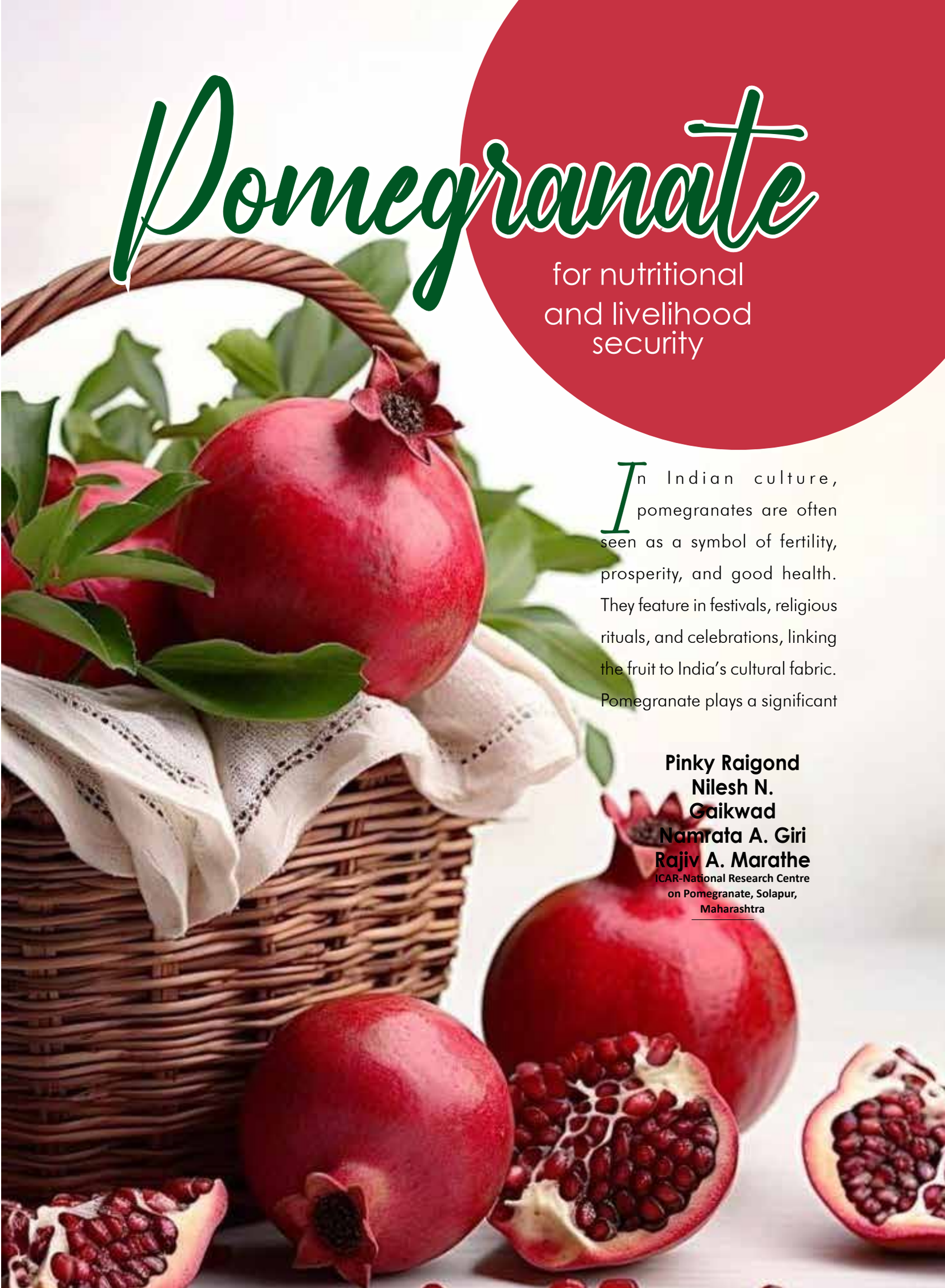
A Growing Global Interest

While Averhoabilimbihas long been a staple in Southeast Asian kitchens, the fruit is slowly gaining popularity world wide. With an increasing interest in exotic fruits, it's no surprise that more people are starting to explore the culinary and health benefits of bilimbi. Whether you're looking to spice up your cooking, boost your vitamin C intake, or discover a new natural remedy, this unique fruit offers a lot to be excited about.

In conclusion, Averhoabilimbi is a powerhouse of flavor and nutrition that deserves a place in your kitchen and health routine. From its tangy taste to its impressive health benefits, bilimbi is a tropical fruit that is definitely worth discovering. Whether you're a food enthusiast, a health-conscious individual, or someone simply looking for something new to try, bilimbi is sure to surprise and delight.

Pomegranate

for nutritional and livelihood security



In Indian culture, pomegranates are often seen as a symbol of fertility, prosperity, and good health. They feature in festivals, religious rituals, and celebrations, linking the fruit to India's cultural fabric. Pomegranate plays a significant

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Table Important constituents and bioactive compounds in pomegranate plant

Juice	Ellagic acid, quinic acid, flavonols, catechin, quercetin, rutin, caffeic acid, amino acids, minerals (K, Ca, P, Mg and Na), ascorbic acid, simple sugars (fructose, glucose), organic acids (citric, malic, oxalic, acetic)
Seeds	Punicic acid, palmitic acid, stearic acid, oleic acid and linoleic acid, eleostearic acid, catalpic acid, sterols, tocopherols, fiber
Peel	Punicalin, ellagic acid, punicalagin, caffeic acid, ellagitannins, pelletierine alkaloids, luteolin, kaempferol, pedunculagin, gallic acid, quercetin
Flower	Polyphenols, gallic acid, triterpenoids, fatty acids, punicalagin, ursolic acid, punicalin, ellagic acid
Leaves	Carbohydrates, reducing sugars, sterols, saponins, flavanoids, tannins, piperidine, alkaloids, flavone, glycoside, ellagitannins.
Root and Bark	Ellagitannins, piperidine alkaloids, pyrrolidine alkaloid, pelletierine alkaloids

pomegranate Juice

role in India's vision of "Viksit Bharat" in various ways, primarily in agriculture, economy, health, and sustainable development. Pomegranate holds potential to contribute to India's growth and development. India is one of the largest producers of pomegranates globally, particularly in states like Maharashtra, Gujarat, and Andhra Pradesh. The crop is well-suited to arid and semi-arid climates, and its cultivation can help improve the economic status of farmers in these regions.Pomegranate farming supports a large workforce, providing employment not just in cultivation but also in processing, packaging, and transportation. It boosts rural economies and helps in reducing migration to urban areas for work.India exports a substantial quantity of pomegranates to international markets, including the Middle East, Europe, and the United States. This trade brings in foreign exchange and strengthens India's position in global agriculture market. Pomegranates are processed for utilization in the food,

pomegranate RTS

pharmaceutical and cosmetic products. The growth of the agro-processing industry creates opportunities for value-added products, enhancing the income for producers and contributing to India's manufacturing sector. Indian pomegranateindustry is increasingly using technology to enhance the productivity and quality of crops. Innovations like drip irrigation, advanced farming techniques, and pest management are being implemented to improve yield and quality, contributing to sustainable agriculture.

Nutritional quality of Pomegranate

The pomegranate fruit is composed of approximately 50% edible part constituting of arils and 50 % non-edible portion peel on a fresh weight basis. Within the arils, seeds are found and represent between 4-10 % of the total fruit weight. The pomegranate juice made from arils contain 85 % water, 10 % total sugars (mainly fructose and glucose), and 1.5 % pectin, organic acids (ascorbic, citric and malic) and bioactive compounds such as phenolic compounds and flavonoids mainly anthocyanins. Arils also provide 12 % of the daily value

Pome blended RTS

Probiotic Pome Juice

(DV) for vitamin C and 16 % for vitamin-K per 100 g serving. The red color of arils and juice can be attributed to anthocyanins, such as delphinidin, cyanidin, and pelargonidin glycosides. Pomegranate peel contains higher bioactive compounds than arils and seeds. Therefore, the peel is an important source of phenolics, ellagitannins (ETs), and proanthocyanidins, flavonoids and minerals mainly K, Ca, P, Mg, Na, and complex polysaccharides. Pomegranate seeds are important co-product of the pomegranate juice processing industry. Seeds

contain a significant amount of lipid, protein, sugars, dietary fiber and essential minerals. In addition to this, the pomegranate seeds contain nutraceuticals, such as sterols, γ-tocopherol, hydroxyl benzoic, punicic acid, and phenyl aliphatic glycosides such as phenethylrutinoside; besides the contents of most minerals excluding K are higher in seeds than in arils. The soft seeded varieties of pomegranate contain seed oil up to 25-26 % (V/W), which is mainly rich in conjugated linolenic acid (70 %). Seeds contain punicic, palmitic, stearic, oleic, and linoleic acids. Seed oil is also a rich source of a steroidal estrogen, estrone, and contains γ-tocopherol, a rare and potent form of vitamin E and the phytosterols: β-sitosterol, stigmasterol, and campesterol. Pomegranate flowers contain a variety of secondary metabolites such as polyphenols with strong antioxidant activity. It contains mainly ellagic acid, anthocyanins, triterpenes, oleanolic acid, ursolic acid, and gallic acid.

Low Caloric Drink

Pomegranate products

The pomegranate arils, seeds, peel may be processed into different value added and functional foods as mentioned below.

Pomegranate Juice: Pomegranate juice is nutritionally an important beverage. It is consumed frequently for its phenolic compounds and high antioxidant activity. It is good source of vitamin C, K and has good mineral balance. The pomegranate juice will have shelf life of 6 months in refrigerated storage or 10 weeks in ambient condition.

Pomegranate Ready To Serve (RTS) beverage: RTS beverage is prepared by using minimum 10% of pomegranate juice and addition of sugar and citric acid for adjusting TSS and acidity respectively of the ready to serve beverage. This RTS beverage is sweet in taste, dense in energy and appealing taste as compared to pure pomegranate juice.

Carbonated RTS beverage

Probiotic Pomegranate Drink: The probiotic pomegranate juice was developed with co-encapsulation of prebiotics inulin and GOS (*Galacto oligosaccharides*) along with probiotic microorganisms *L.Casei and L. acidophilus*. The per cent yield of cell count

varied in the range of 26.98% to 68.94%.

Pome-Lime-Ginger RTS drink: The product has the combination of 60-85% pomegranate juice, 10-20% lime juice and 05-10% ginger juice. This blending resulted to improve in the taste, flavour and nutritional profile of the RTS drink as compared to pomegranate RTS beverage. The 40% increase in antioxidant activity, 20% increase in ascorbic acid, 5% decrease in calorific value is observed.

Low calorie pomegranate fruit drink: Low calorie pomegranate drink was prepared using natural (steviol glycoside) and artificial sweeteners (sucralose and aspartame) by substituting sucrose (refined white sugar). Low-calorie drinks are promoted as healthy alternatives to sugar-sweetened beverages. The developed beverage is suitable for the consumers on low calorie diet and also for patient with type-II diabetics.

Pomegranate Wine: The pomegranate wine is prepared by pressing cut fruits without crushing or extraction of juice from arils which gives yield of 76-85 %. Sugar is added to juice to bring TSS to 22-23 °B. Potassium meta-bisulphite is added to restrict the growth of undesirable microorganisms. The juice is fermented with starter wine yeast and the wine is aged and wine is flash pasteurized at 60 ^{0}C, bottled hot and sealed.

Pomegranate seed oil (PSO): Pomegranate seeds are by-product from juice processing industry which contains 22-25% oil rich in punicic acid known as essential fatty acids. The process of extraction of PSO is standardized and patented by NRCP. This oil has medicinal properties and application in cosmetics, food and pharmaceutics.

Carbonated RTS beverage: Carbonated RTS beverage can be prepared with 15 % juice and 12 % sugar and 0.3 % acidity with carbonation at 80 psi of CO_2 pressure.

Pomegranate- Karonda Mix Fruit Jam: The highly underutilized karonda fruit (rich in iron content) along with pomegranate (rich in phenols and antioxidant) can be used for jam preparation. The best quality of jam with good spreadability and sensory properties was obtained by blending of karonda fruit pulp with pomegranate juice, sugar and pectin. Ready to eat confectionery product with real taste of fruit. Fruit jam with natural taste of pomegranate and karonda fruit.

Pomegranate dried arils: The osmotic pre-treatment followed by the convective tray drying

seed oil

of pomegranate arils resulted into a reduction of drying time by 9 hours. The nutritious and convenient dried arils with higher shelf life can either be consumed directly or used as ingredient in the snacks, energy bars, ice cream, yoghurts, milkshakes,

Pome Karonda mix fruit jam

Pome Dried Arils

salad dressings etc.

Pomegranate juice powder: Pomegranate juice powders is economically viable over juice because of improved shelf life, low volume/weight, easy handling and transportation. The process of pomegranate juice powder development as been standardized using foam mat drying technique with optimum nutrition and least drying time. Pomegranate juice powder can be utilized for reconstituted juice and juice based beverage, preparatory foods etc.

Pomegranate seed-based Mouth Freshener: Pomegranate seeds are by-product of juice processing industry and can also be extracted from unmarketable fruits. Pomegranate seeds are rich in conjugated linolenic acid, protein, fiber etc. A crunchy mouth freshener has been developed from the pomegranate seeds.For the preparation of mouth freshener, Pomegranate seeds extracted by cleaning marc (leftover portion of arils after juice extraction) are dried, blended with mix of sugar syrup and spices followed by heat treatment in microwave oven, cooling and vacuum packaging.

Pomegranate Juice Fortified Aonla Candy: It is ready to eat confectionary product. It is nutritious and healthy confectionary product for children. Because it is rich in ascorbic acid and bioactive compounds due to fortification of pomegranate juice.

Deoiled Pomegranate Seed Cake Based Cookies: Pomegranate seed cake (PSC) is the byproduct of the pomegranate seed oil extraction process. PSC is a good source of proteins, fats and fiber. The pomegranate seed cake recovery in seed oil production is around 80%. The technology has been standardized for development of pomegranate de-oiled seed cake-based cookies.

Pomegranate peel powder fortified fiber rich muffins: It is ready to eat snack fortified with pomegranate peel powder. It is nutritious, rich in fiber content. Also rich in bioactive compounds due to addition of pomegranate peel powder.It is having high oxidative and microbial stability.

Pomegranate-muskmelon squash: It is prepared by blending of pomegranate juice and muskmelon pulp. This drink is having improved flavour and sensory properties. It is refreshing, nutritious, rich in

Pome Juice Powder

antioxidant, high ascorbic acid content with no preservatives. The squash needs dilution in the ratio of 1:3 proportion.

Anardana: Arils of sour type pomegranate are dried to prepare *anardana*. Anardana is also used in the ayurvedic medicine as digestive and stomachic. It is used as acidulent and condiment in Indian culinary or traditional system of medicine. The cabinet drying at 55^{0}C for 7 hours of the arils is best for getting quality *anardana*. New varieties / hybrids with high acidity for production of good quality *anardana* have been identified by NRCP and testing is in progress.

Minimally processed pomegranate arils: Commercialization of minimally processed and "ready-to-eat" fresh arils is the good alternative. The minimal processing consists of washing with sanitizing agents to reduce the primary inoculum load, pH modification, use of antioxidant agents, temperature control and others, to control partially the high perishability of the fruits. Minimally processed arils can be stored under refrigerated conditions for 15 days.

Waste to Wealth

The pomegranate processing industry, while contributing to the production of delicious and nutritious juice, generates a significant amount of waste in the form of by-products and residues. This waste, if not managed effectively, can pose environmental challenges. The waste generated from the pomegranate juice processing industry typically includes pomegranate peel, outer cover of the juice arils and seeds. Pomegranate peel and seed are valuable sources of bioactive phytochemicals, the vast majority of which hold a great potential through appropriate processes to be converted into value added products. So, pomegranate by-products could be used as substrate for the production of nutritionally valuable and

Pome mouth freshner

Juice Fortified alona candy

biologically active components that could find several applications as functional food ingredients, food additives, nutraceuticals and supplements and in phenolic-rich diets. Throughout the juice production process two main solid by-product streams are generated after extraction of juice from fruit and separation of seeds from juice are pomegranate peel and pomegranate seed.

Pomegranate peel, accounting about 50% of the whole fruit, is the non-edible fraction comprised mainly of several bioactive compounds such as hydrolysable tannins (pedunculagin, punicalin, punicalagin and ellagic and gallic acids), flavonoids (catechins, anthocyanins, and other complex flavonoids), complex polysaccharides and minerals (phosphorus, magnesium, calcium, potassium and nitrogen). The primary polyphenols in peel are gallic acid (14.14 %), proto catechuic acid (14.51 %), chlorogenic acid (2.35 %), vanillic acid (3,851 %), coumarin (3.53 %), caffeic acid (2.74 %), oleuropein (0.59 %),

Pom-musmelon squash

ferulic acid (1.85 %), quercetin (0.94 %), and caffeine (6.42 %). Pomegranate peel is known for high antioxidant activity and anti-microbial properties.

Numerous studies are currently focused on using natural ingredients to enhance the food quality and shelf life and to meet consumer demands for safer foods to avoid the use of synthetic preservatives. In particular, modern consumers are increasingly looking for healthy and sustainable products. Therefore, the idea of replacing the practice of synthetic preservatives with plant-based compounds is of high

Deoiled seed cake cookies

Peel powder fortified mjuffins

interest, especially if extracted from cheap, abundant and sustainable agricultural sources, as by-products. Generally, fruit and vegetable by-products are the most abundant materials among food by-products, accounting for about 10–35% of the raw mass. These by-products have enormous potential to be recycled, being rich in polyphenols and flavonoids and, thus, playing an important role as both antioxidant and antimicrobial agents. Several studies have also shown that higher bioactive compounds are concentrated in the peel rather than in other parts of the fruit. In particular, pomegranate peel is rich source of tannins and other phenolic and flavonoid compounds, thus having a higher antioxidant capacity than seeds and pulp.

Pomegranate seed, accounts about 10% of the edible part of pomegranate; the edible part is known as aril comprising 50% of the fruit. Pomegranate seeds ranging from 40 to 100 g/Kg of fruit, are rich sources of total lipids (12-20% w/w of total seed), containing high concentrations of polyunsaturated (n-3) fatty acids. More specifically, the oil consists up to 80% of conjugated octadecatrienoic fatty acids with a high percentage of cis, trans, cis-Δ-9, 11,13 acid (for instance punicic acid).

Valorization of pomegranate juice by-products stream rich in valuable bioactive compounds could led to the production of several products such as:

1) Additives used in industrial food sector to increase shelf-life of products

2) Functional ingredients to enhance food quality and promote human health,

3) Single cell protein and industrial enzymes by using a proper pomegranate by-product streams based on fermentation media. In that way would not only reform the existing structure in pomegranate's juice production sector, but also give rise to the development of new products with diversified market outlets, handling simultaneously waste management related issues.

Pomegranate processing by-products and its applications

Pomegranate juice processing industries generate various by-products that can be utilized in different ways, contributing to sustainability and economic efficiency. Some common by-products from pomegranate juice processing and its application may include:

1.Pomegranate Peel: Pomegranate peel is rich in antioxidants, polyphenols, and dietary fiber. It can be used to make pomegranate peel extracts for dietary supplements, natural food colorings, or as an ingredient in functional foods.

2. Pomegranate Pomace: Pomace is the residual solid material obtained after extracting juice from the seeds and arils. It can be used as animal feed, organic fertilizer, or as a source of bioactive compounds for the pharmaceutical and cosmetic industries.

3. Pomegranate Seed Oil: Pomegranate seeds contain oil with high levels of punicic acid, a polyunsaturated fatty acid. The oil is used in cosmetics, skincare products, and as a dietary supplement due to its potential health benefits.

4. Pomegranate Seed Meal: After extracting oil from seeds, the remaining seed meal can be used as a protein-rich ingredient in food and feed.

Pomegranate Export status and Future Scope

In the fiscal period 2022-23, India's agricultural exports reached USD 53.1 billion. Some major exports include fresh fruits and processed vegetables, both registering more than 20% growth than last year. India is leading pomegranate producer in the world with 0.276 million ha area under pomegranate cultivation and production of 3.184 MMT in year 2022-23 (DoA & FW, MoA&FW, GOI). In 2023-24, 71,625 metric tonne of pomegranate worth 56.7 million rupees was exported. Only 2.27 % of the total Indian

Waste to Wealth

Export of Pomegranate (08109010) from India

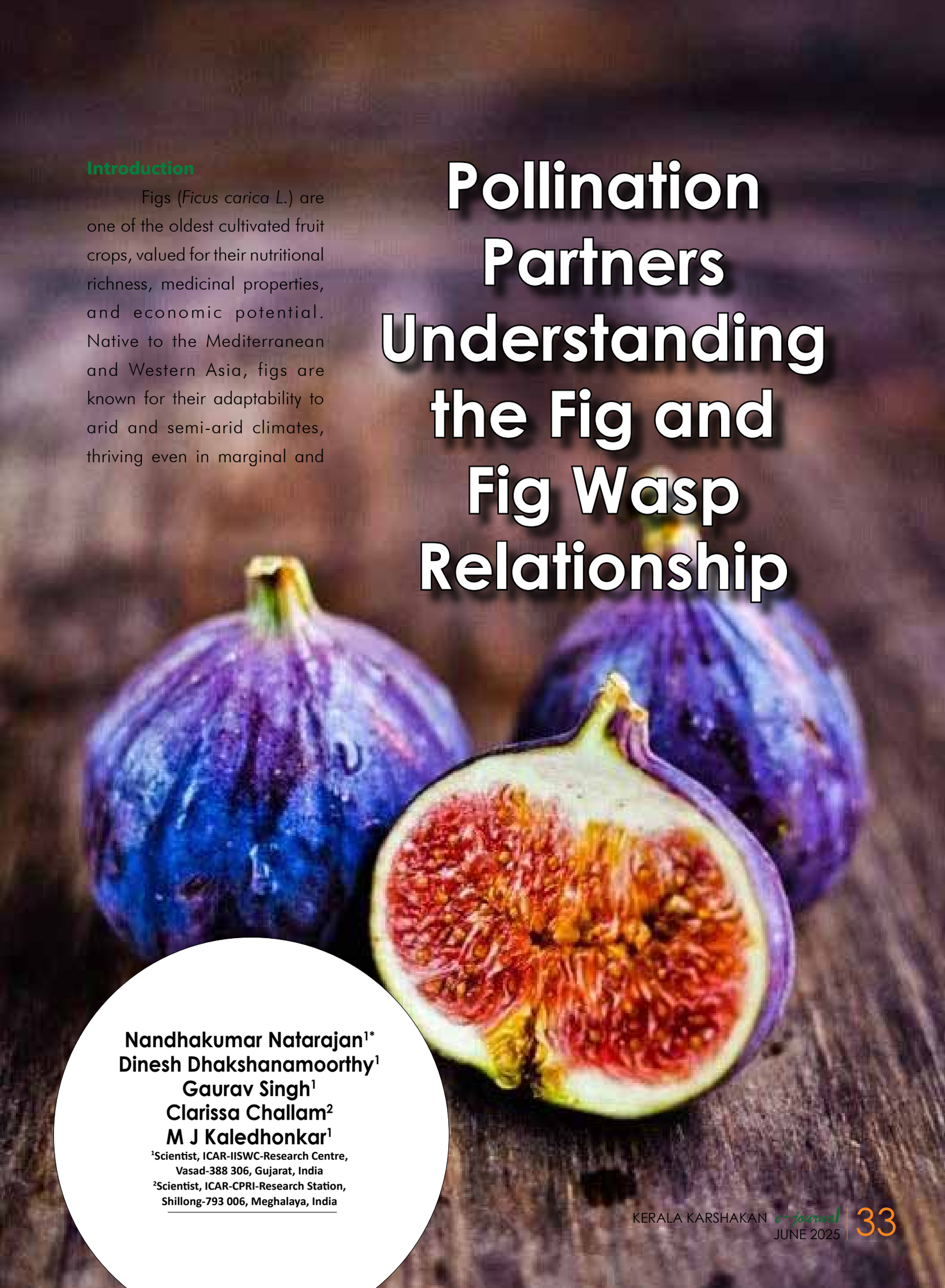
Country	2019-20		2020-21			2021-22			2022-23		
	Qty (Tonnes)	Value Rs. Crore	Qty (Tonnes)	Value Rs. (Crore)	Rates (Rs/Kg)	Qty (Tonnes)	Value Rs. (Crore)	Rates (Rs/Kg)	Qty (Tonnes)	Value Rs. (Crore)	Rates (Rs/Kg)
U Arab Emts	15,898	185	12,509	162	129	15,773	192	122	15,227	199	131
Bangladesh Pr	15,898	139	36,526	159	44	63,371	280	44	34,323	96	28
Qatar	2,634	30	2,350	30	127	2,174	29	133	959	15	160
Nepal	8,776	37	6,788	27	40	10,448	46	44	6,585	31	47
Netherland	3,032	64	759	26	338	1,302	37	286	917	31	333
Saudi Arab	5,083	57	1,964	24	123	1,234	16	131	786	13	170
Oman	2,539	26	3,175	20	62	493	7	132	522	8	161
Sri Lanka Dsr	1,190	18	568	10	180	753	14	191	233	4	190
Egypt A Rp	794	9	734	10	138	714	10	141	99	2	191
Baharain Is	795	9	571	8	147	403	6	142	327	5	162
Kuwait	1,262	15	557	8	139	498	7	137	287	5	165
Switzerland	162	9	121	8	643	180	11	596	199	13	673
Malaysia	659	10	285	5	192	228	4	190	411	9	208
Hong Kong	29	1	197	3	136	223	3	132	119	2	152
Indonesia	237	4	105	2	225	146	3	218	187	4	236
France	4	0	70	2	334	183	6	299	197	6	293
Thailand	1,145	19	105	2	223	147	5	314	206	6	289
Canada	189	3	100	2	191	5	0	306	8	0	228
U K	464	15	78	2	242	98	4	410	46	2	348
Singapore	245	3	158	1	92	94	1	133	122	2	159
Ireland	49	3	17	1	575	27	1	494	27	2	543
New Zealand	45	2	13	1	560	17	1	445	24	1	569
Total	80,548	688	67,977	517		99,043	689	70	62,280	470	75

Source: APEDA Website
DGCIS Annual Export

pomegranate production has been exported in year 2022-23. Thus, there is huge scope for increasing export of Indian pomegranate. India has favourable climatic conditions for the pomegranate production and capable of its export throughout the year. The major export destinations for Indian pomegranate were United Arab Emirates (UAE), Bangladesh, Nepal, Netherlands, Saudi Arabia, Sri Lanka, Thailand, Bahrain, Oman. However, an export to premium markets like Europe and USA which is meagre at present but fetches higher forex earning. This shows that besides traditional export destinations there is huge scope for the pomegranate export to newer and premium markets. The USA is the premium market for the Indian pomegranates.

The pomegranate can be processed into high value nutritious food products. The by-products from pomegranate processing industry may be utilized as functional ingredients which can acts as a bio-preservative and will also enhance the nutritional value of the food products. Besides, processing and value addition export of the pomegranate to the traditional and export markets will certainly has promising future. Enhanced export will bring foreign exchange, increased profitability for the farmers and improve the sustainability of the pomegranate industry.In conclusion, the pomegranate has all the potential to contribute in "Viksit Bharat" by improving agriculture, boosting economic growth, promoting health and nutrition, sustainable livelihood, and supporting rural development. Through strategic focus and innovation, the cultivation and processing of pomegranates can play a key role in India's journey toward becoming a developed nation.

Pollination Partners Understanding the Fig and Fig Wasp Relationship



Introduction

Figs (*Ficus carica L.*) are one of the oldest cultivated fruit crops, valued for their nutritional richness, medicinal properties, and economic potential. Native to the Mediterranean and Western Asia, figs are known for their adaptability to arid and semi-arid climates, thriving even in marginal and

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Fig. 1. A well-established fig tree growing in marginal land in Gujarat

degraded lands—making them ideal for regions like Gujarat. Consumed both fresh and dried, figs are a rich source of dietary fibre, minerals, and antioxidants, contributing to their growing popularity in health-conscious markets. Beyond their agricultural significance, figs are unique in the plant kingdom for their specialized pollination system, which involves a mutualistic relationship with fig wasps. This intricate biological process, where the fig fruit is pollinated internally by tiny wasps, has sparked debate among vegetarians and vegans regarding the classification of figs as vegetarian. Understanding the fig–fig wasp interaction not only adds to our biological knowledge but also informs dietary and ethical considerations, making the fig a fascinating subject of both scientific and socio-cultural interest.

What is a Fig?

A fig is not a fruit in the traditional sense but a syconium, an enclosed inflorescence containing hundreds of tiny flowers. These flowers are inverted and develop inside the fleshy structure we recognize as the fig. Each seed within a fig corresponds to one of these tiny

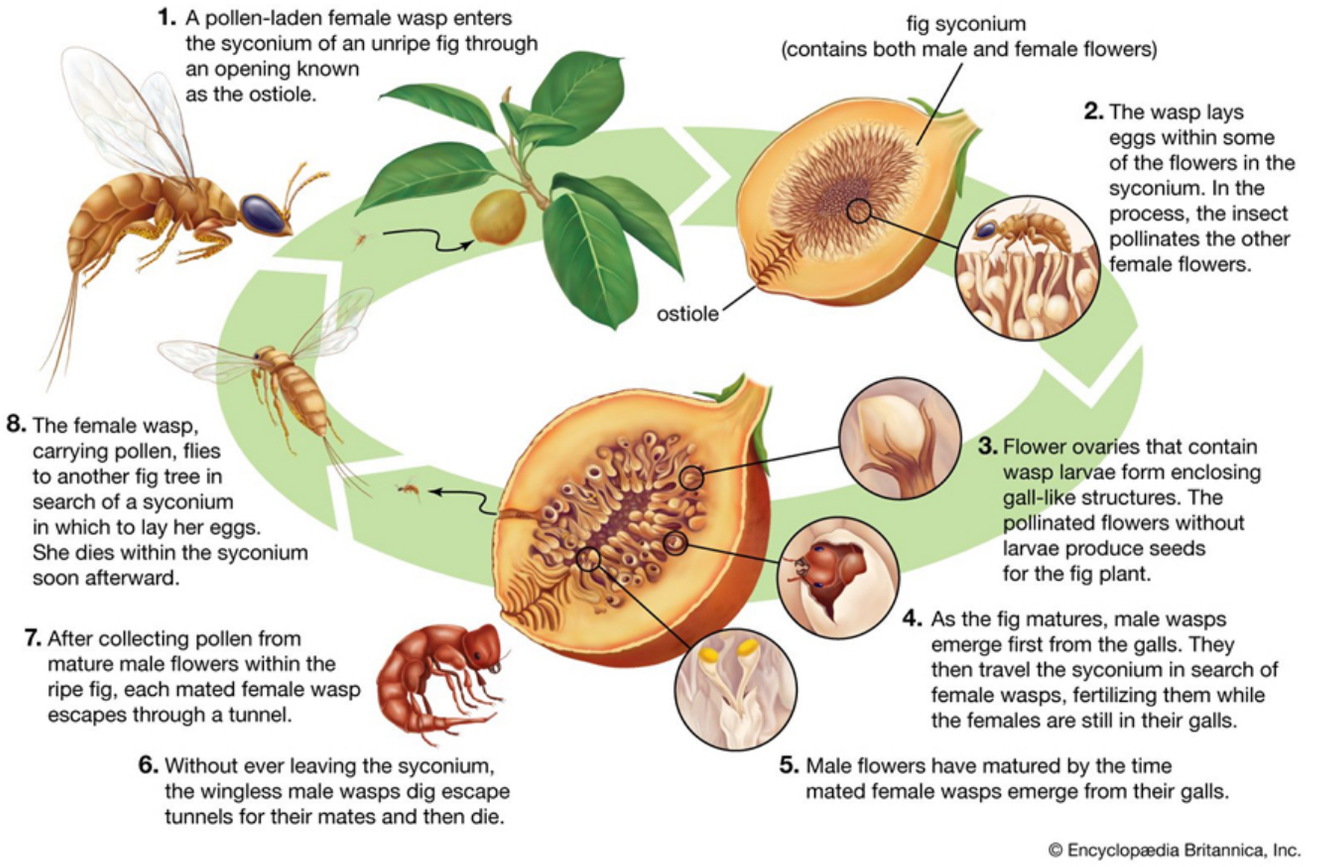

Fig. 2. Life Cycle of the Fig Wasp

(Image sourced from Google Images for illustrative purposes)

flowers. Figs belong to the genus Ficus, which includes around 750 species, such as the banyan tree and the peepul tree. These trees are found in tropical and subtropical regions and play a vital role in their ecosystems (Fig 1).

What is a Fig Wasp?

Fig wasps are small insects belonging to the family Agaonidae. These wasps are typically less than 2 millimeters in length and are highly specialized pollinators of fig trees. Each species of fig tree is usually pollinated by its own specific species of fig wasp, although there are some exceptions where multiple species of wasps can pollinate a single fig tree species or a single wasp species can pollinate multiple fig tree species. Fig wasps are so well-adapted to their role that they can navigate through the tiny opening of the fig, known as the ostiole, to reach the flowers inside.

The Pollination Process (Fig 2)

1.Attraction and Entry: When the female flowers inside the immature fig are ready for pollination, the fig releases a specific chemical signal in the form of an enticing aroma. This scent attracts only the female wasps of the specific species that pollinate that particular fig tree. The female wasp, guided by her antennae, locates the fig and enters through the tiny ostiole at the fig's apex. This passage is so narrow that the wasp often loses her wings and parts of her antennae in the process, but this

Fig 3. Flowering stage of Fig and harvesting stage

is not a problem as she will not need them again.

2.Pollination and Oviposition: Once inside the fig, the wasp moves around the interior, visiting many flowers. She lays her eggs inside some of the flowers, which will develop into seeds that will nourish her offspring. As she moves from flower to flower, she also spreads pollen that she collected from the fig where she was born. This pollen fertilizes the flowers, allowing seeds to develop in all the flowers, not just those where she has laid her eggs. Some flowers have ovaries that are out of reach of the wasp, ensuring that these seeds can mature without being consumed by the wasp larvae.

3.Development and Emergence: The eggs laid by the female wasp hatch into larvae, which feed on the endosperm tissue of the seeds. After a few weeks of development, the larvae metamorphose into adult wasps. The males, which are smaller and wingless, emerge first and mate with the females. After mating, the males die inside the fig. The females, now fertilized, emerge from the fig carrying pollen from the male flowers, which have ripened by this time.

4.Continuation of the Cycle: The fertilized female wasps leave

the fig in search of another receptive fig to lay their eggs. They are attracted to the same chemical signals that attracted their mothers, ensuring that the cycle continues. The fig, having been pollinated, ripens and changes colour and smell, becoming attractive to frugivorous animals such as birds, bats, and monkeys, which help disperse the seeds.

Enzyme Breakdown

One of the key points often overlooked in the debate about figs being vegetarian is the role of enzymes within the fig. When the female wasp dies inside the fig, enzymes present in the fig break down the wasp's body, converting it into nutrients that are absorbed by the fig. This process ensures that no remnants of the wasp remain in the mature fig. Therefore, the fig does not contain any parts of the wasp by the time it is consumed.

Commercial Fig Production

In commercial fig production (Fig 3), many farmers use plant hormones to pollinate figs artificially, bypassing the need for wasps altogether. This method is particularly common in the cultivation of fig varieties intended for human consumption. As a result, the figs found in stores are unlikely to have been pollinated by wasps, further supporting the argument that figs are indeed vegetarian-friendly.

Fun Facts

Wasp Breakdown: When female fig wasps enter the fig to lay their eggs, their wings and antennae often break off due to the tight squeeze through the ostiole. However, this doesn't hinder them, as they never leave the fig again after entering.

Short Lifespan: The entire lifespan of a fig wasp is incredibly brief, lasting only one to three days. This means that fig trees must constantly produce figs year-round to ensure that there are always receptive figs available for the wasps to lay their eggs in.

Natural Recycling: After the male and female wasps die inside the fig, the fig uses an enzyme to break down the wasp bodies into protein. This process not only helps the fig to decompose the wasps but also provides additional nutrients for the developing seeds.

Tiny but Mighty: Despite their small size, with a total body length of just 1-2mm, fig wasps play a crucial role in the pollination process. Their tiny size allows them to navigate through the narrow ostiole and reach the flowers inside the fig.

Year-Round Production: Fig trees produce figs continuously throughout the year, providing a constant supply of food for frugivorous animals. This year-round production is essential for the survival of both the fig tree and the fig wasp, as it ensures that there are always receptive figs available for the wasps to continue their life cycle.

The Fig Controversy in Gujarat: Understanding the Vegetarian Perspective

In Gujarat, a state known for its predominantly vegetarian population, the unique pollination process of figs involving wasps has led to some misunderstandings about whether figs can be considered vegetarian. Despite scientific evidence showing that figs do not contain wasp remnants by the time they are consumed, some individuals, particularly those following strict Jain or vegan diets, may still choose to avoid figs. This decision is often based on ethical considerations and the desire to avoid any form of animal exploitation, even if the wasps are not directly consumed. For Jains, the principle of

ahimsa (non-violence) extends to all living beings, and the involvement of wasps in the pollination process may be seen as a form of exploitation or harm. Similarly, ethical vegans may choose to avoid figs as part of their broader commitment to minimizing harm to all living beings. It is important to note that commercial fig production often uses artificial pollination methods, bypassing the need for wasps altogether. This means that many figs available in stores are not pollinated by wasps and are, therefore, free from any involvement of wasps. Understanding these perspectives and the scientific processes involved can help individuals in Gujarat and elsewhere make informed decisions that align with their ethical values.

Future Prospects

Fig cultivation holds significant future potential in Gujarat due to its adaptability to dry and warm climates, making it ideal for semi-arid and degraded lands. The crop's low input requirements, early bearing nature, and long productive lifespan make it economically viable, especially for small and marginal farmers. With growing consumer awareness of its health benefits, figs enjoy steady demand in urban markets like Ahmedabad, Surat, and Mumbai, as well as increasing export potential to Gulf and European countries. Government schemes and research support from institutions like Navsari Agricultural University further enhance its prospects through subsidies, improved varieties, and production technologies. The formation of Farmer Producer Organizations, adoption of organic and residue-free practices, and investment in value addition and e-commerce marketing can further strengthen its market potential. Branding Gujarat figs as premium or region-specific products and creating strong market linkages can help farmers realize better returns and establish fig as a profitable horticultural enterprise in the state.

Conclusion

In conclusion, the fig *(Ficus carica L.)* is not only a nutritionally valuable and economically promising fruit crop, particularly well-suited to arid and semi-arid regions like Gujarat, but also a remarkable example of ecological interdependence through its unique pollination relationship with the fig wasp. This mutualistic interaction, often misunderstood, has led to the myth that figs are non-vegetarian. However, scientific evidence shows that the wasps involved in pollination are broken down by natural enzymes within the fig, leaving no trace by the time the fruit is consumed. Furthermore, many commercial fig varieties are produced using artificial or parthenocarpic methods, eliminating the need for pollinating wasps altogether. Understanding this process dispels misconceptions and highlights the fig's ecological significance, dietary compatibility, and potential for sustainable cultivation and market expansion. Thus, fig remains a fascinating crop—botanically, ethically, and economically.

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Star Fruit

A Natural Immunity Booster

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Star fruit, commonly referred to as *Averrhoa carambola*, is a tropical and subtropical fruit renowned for its peculiar star-shaped cross-section when sliced, hence the name "star fruit." It is native to Southeast Asia, mainly Malaysia, Indonesia, and the Philippines,

but has gained popularity worldwide due to its unique perceive, refreshing taste, and numerous health benefits.

The tree is Small, evergreen tree, 5–12 meters tall, with a rounded crown and drooping branches. Leaves are

Leaf

Flower

seeds

Composition of Star Fruit (per 100g)

Calories and Macronutrients

Nutrient	Amount per 100g	Benefit
Calories	31 kcal	Low in calories, great for weight management
Carbohydrates	6.7g	Provides energy, but low in sugar
Sugars	3.98g	Naturally sweet without excess sugar
Dietary Fiber	2.8g	Promotes digestion and gut health
Protein	1.0g	Small amounts of plant-based protein
Fat	0.3g	Almost negligible fat content

Vitamins

Vitamin	Amount per 100g	Benefit
Vitamin C	34.4 mg (38% DV)	Boosts immunity, fights free radicals, and promotes skin health
Vitamin A	3 µg	Supports eye health and skin regeneration
Vitamin B9 (Folate)	12 µg	Essential for cell growth and DNA formation
Vitamin B5 (Pantothenic Acid)	0.39 mg	Helps convert food into energy
Vitamin B2 (Riboflavin)	0.016 mg	Supports metabolism and red blood cell production

Essential Minerals

Mineral	Amount per 100g	Benefit
Potassium	133 mg	Helps regulate blood pressure and heart function
Magnesium	10 mg	Supports nerve and muscle function
Calcium	3 mg	Contributes to bone health (though not a major source)
Phosphorus	12 mg	Aids in bone and energy metabolism
Iron	0.08 mg	Supports oxygen transport in the blood

Cultivation Practices

Climate & Soil	**:**	Prefers warm, humid climates (20°C–35°C), full sun, and well-drained loamy soil (pH 5.5–6.5).Avoid frost and waterlogging
Propagation & Planting	:	Grown from seeds, grafting, or air layering (grafting preferred for early fruiting). Spacing: 6–8 meters apart; best planted at the start of the rainy season.
Irrigation & Fertilization	:	Regular watering, especially for young trees; drip irrigation recommended. Use organic manure and balanced NPK fertilizers (10:10:10) with micronutrients.
Pruning & Pollination	:	Prune after harvest for better sunlight and airflow. Mostly self-pollinating; bees improve fruit set.
Pest & Disease Control	:	Common issues: fruit flies, aphids, anthracnose, root rot. Use organic pesticides and maintain orchard hygiene.
Harvesting & Yield	:	Fruits mature in 60–75 days; turn yellow when ripe. Mature trees yield 200–400 fruits per year.
Post-Harvest Handling	:	Short shelf life (7–14 days); store in cool conditions. Used fresh or processed into juices, jams, and dried products

Compound, pinnate, 15–25 cm long, with 5–11 light green leaflets. Flowers have Small, pink to purple, in clusters along branches and trunks. Pollinated by insects. Fruits are Star-shaped, 5–15 cm long, green when unripe and yellow when ripe. Crisp, juicy flesh with a sweet-tart flavor and small brown seeds inside.The tree thrives in tropical climates, grows quickly, and bears fruit multiple times a year.

Nutritional Profile

Star fruit is composed of over 90% water, making it a refreshing and hydrating fruit.It helps keep the body cool and replenished,

especially in hot weather. It is low in calories and has a lot of vitamins and other nutrients, like Fiber, Protein, Vitamin C, Vitamin B5, Folate, Copper, Potassium and Magnesium.

Benefits

Boosts Immunity: Prevents infections, speeds up wound healing, and strengthens overall immunity)

Supports Digestive Health: Improves gut health, prevents constipation, and promotes regular digestion.

Promotes Heart Health: Supports heart health, reduces high blood pressure, and lowers cholesterol.

Aids in Weight Loss: Helps with weight control by keeping you full and promoting a healthy metabolism.

Improves Skin and Hair Health: Promotes glowing skin, slows aging, and strengthens hair.

Regulates Blood Sugar Levels: Helps in diabetes management by regulating blood sugar.

Enhances Hydration & Electrolyte Balance: Keeps the body hydrated, supports electrolyte balance, and prevents dehydration.

Reduces Inflammation & Has Antioxidant Properties: Reduces inflammation and protects against chronic diseases.

Supports Eye Health: Supports healthy vision and prevents age-related eye diseases.

Detoxifies the Body & Supports Liver Health: Naturally detoxifies the body and supports liver health

Precautions

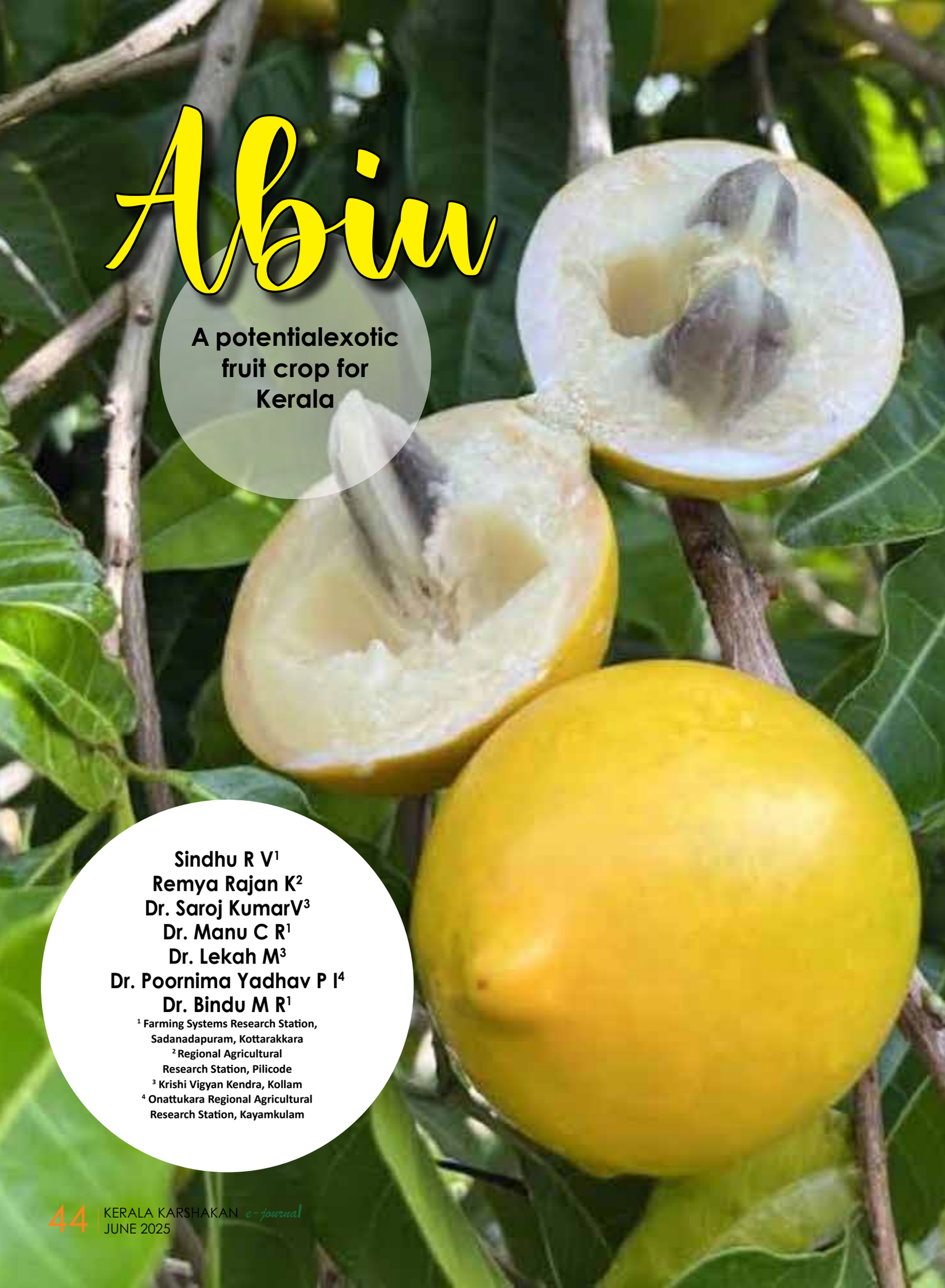
- People with kidney problems should avoid star fruit due to the presence of oxalates and caramboxin, which can be harmful.
- People with renal failure or uremic patient should completely avoid it.

Star fruit is a nutrient-rich fruit that offers numerous health benefits, particularly in boosting the immune system. Packed with vitamins A and C, antioxidants, and dietary fiber, star fruit can help enhance the body's natural defense mechanisms, fight off infections, and improve overall health. Its low-calorie content makes it an ideal addition to a balanced diet.

Embracing star fruit as a regular part of your diet can contribute to a healthier, more resilient immune system.

Abiu

A potentialexotic fruit crop for Kerala



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Climatic conditions of India show significant variations from sub-tropical to tropical conditions. This helps the farmers of India to explore large number of new generation fruit crops like rambutan, mangosteen, durian, avocado, dragon fruit, abiu, pulasan, longan,etc., which has high potential in markets. When the profitability to farmers is considered in the era of climate change the new generation fruits appear to be the crops for the future. Most of the fruits are rich in antioxidants, vitamins andnutrients. It is very well suited for sustainable agriculture that facilitates livelihood for the farmers by growing different types of fruits in different regions. More over, commercial production and value-addition enhances the income of small and marginal farmers. Recently, cultivation of exotic fruits has gained substantial momentum due to steadily increasing market demand as common people are more attracted towards exotic fruits. Many of these new generation fruits are introduced into India especially from the South East Asian countries. Now it is becoming popular in the homesteads of Kerala. The avocado, mangosteen, rambutan and dragon fruit are now knownto the people and are being grown commercially through out India. Though it is beginning phase for some of the fruits like abiu, longan, mattova and other exotic high value fruit

crops, some are already in fruit market and consumer bowl. Abiu is one among them which is an emerging exotic fruit capturing the attention of fruit growers and health conscious consumers.

Abiu [Pouteria caimito (Ruiz & Pavon.) Radlk.] is an excellent tropical evergreen fruit of Sapotaceae family. It is also known as ' Emperor's Golden Fruit', 'Golden Star Apple', 'Yellow Star Apple', 'Yellow Sapotae', 'Abi', 'Caimo' etc. The tree is originated in the Amazonian region of South America and was known to be cultivated in Indian by tribes about 10,000years ago. Now, Abiu trees are cultivated in tropical regions of South and Central America in countries like Brazil, Columbia, Peru, Venezuela etc., Southeast Asian countries like Indonesia and Philippines, and in India. In India, abiu is distributed in southern parts covering Kerala, Karnataka and Tamil Nadu as a backyard crop and also in small plantations.

The tree is medium to large size which grows to a height of 5 to 15 m with a pyramidal or oval canopy

that flowers within three years after planting. The flowers are produced singly or in clusters of 2–8 flowers in leaf axils of new growth or on leaf scars. Flowers are small, hermaphrodite, 4 to 5 lobed, cylindrical and white to greenish. Abiu is allogamous but sometimes can be autogamous also. The petals start to wither and turn brown with in thirty to forty hours after flower opening. In case of successful pollination ovary develops into fruit. Fruit is botanically a berry which is smooth, leathery and green when immature and turns to bright yellow when ripened. It contains irritant latex that coagulates when exposed to air. Fruits have a length of 6.3 to 17.7 cms. The shape of the fruit varies from ellipsoidal to spherical and some may have a pointed end. The edible pulp is soft, gelatinous, translucent and white in colour. Each fruit have 1 to 4 large ellipsoidal dark brown seeds with distinct hilum. The seeds germinate readily and germination occurs in 2 to 10 days. The seeds have the capacity to germinate still within the fruit itself. Seeds can retain its capacity to be viable for 1 or two days in dry conditions indicating that it may be difficult to store this for long periods without losing their viability.

This exotic fruit is delicious and highly nutritious not only because of its attractive bright golden yellow colour but also because of its nutritional value and health benefits. The fruit contains many nutrients and antioxidants that are beneficial for the human body, such as an inhibitor of acetylcholinesterase activity and is anti-microbial. This is a rich source of Vitamin C, Vitamin A, Niacin, Carbohydrates and contains a fair amount of dietary fibres also. It has a soluble solid content of 10–13 °Brix, and titratable acidity of 0.04–0.08%. Abiu fruit has several benefits as they are rich source of potassium, nitrogen, magnesium, calcium and traces of phosphorus.

For planting material production cultivars with the following characters has to be selected

a) Early regular bearers with high yield

b) Round or rotund fruits with or without small nipple

c) Mean fruit weight greater than 180g

d) Absence of watersoaked areas in pericarp when undamaged

e) Few seeds or seedless

f) Low rind latex

g) Rind thickness of more than 4 mm

h) Firm, sweet, translucent but not glassy pulp

i) Little or no physiological browning

j) Good shelf life of 10-12 days

The area under abiu fruit is yet to expand as many of the fruit growers are unaware of its cultivation practices and potentials of this crop. The studies on abiu fruit are still limited, especially regarding physiological changes and fruit quality. Thepresent market demands exotic taste, health benefits and consumers preference. This indicates that new generation fruits have good scope for commercial exploitation in future. Farmers of our country are almost unknown about the fruit. As demand continues to grow, Abiu is expected to open several opportunities to the farmers, fruit importers and dealers. An increase in area and production of new generation fruit crops like abiu will not only provide nutritional security but also boost the economy of the country.

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