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The First English farm journal from the house of Kerala Karshakan



Bees

OUR
PRECIOUS
POLLINATORS

The First English farm journal from the house of Kerala Karshakan

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04 **Bees: Our Precious Pollinators**

Sourabh maheshwari¹, Shakuntala gupta²

10 **How much thirsty we are? Measure in terms of water footprint !**

Ajay P Kumar¹, Sunitha S²

14 **"Green Serenity: Elevate the space with stunning Moss Wall"**

Dr.Amreen Taj¹, Nagajyothi G N^{1*}

40

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35



Chief Editor
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- 21 Hanging in the Shade: Perfect Low Light Hanging Plants for Every Home**
*Akhilraj B.C., *Adarsh S., *Lilia Baby, *Priya G Nair
- 35 Saffron cultivation in india: Challenges and opportunities**
A. Anjaneyulu¹, A.Laxman Kumar², Mohammed Abdul Waseem³, Bathula Jagadeesh Kumar⁴
- 40 SORGHUM: A POTENTIAL CROP FOR KERALA IN THE CONTEXT OF CLIMATE CHANGE AND NUTRITIONAL SECURITY**
Sowmiya S.¹, Usha C. Thomas ²
- 46 SKYBLUE CLUSTERVINE – A LIGHT AND PRETTY PERENNIAL TWINER**
Prathibha B T¹, Munikrishnappa P M²

Articles/ Features appearing in this e-journal are either commissioned or assigned nevertheless, other articles of farm relevance are also welcome. A maximum of 750 wordage is appreciated. Such items should be addressed to The Editor, Kerala Karshakan e-journal, Farm Information Bureau, Kowdiar PO, Thiruvananthapuram, Pin: 695003 These may also be mailed to editorejournalkkfib@gmail.com in word format. Responses can be also sent to this mail. Authors are requested to provide the following details along with the articles, for quick processing of the remuneration, after the articles are published: Account Number, Name of Bank, Branch (Place), IFSC Code.

Pollination is an essential ecological service which supports life on Earth. About 70% of the world's crops depend on animals for pollination. It is estimated that 87% of the world's flowering plants depend on animal pollinators. Diverse species of animals participate in pollination of flowering plants such as Bees (Melittophily), Flies (Mycophily), Bat (Chiropterophily), Beetle (Cantharophily), Butterflies (Psychophily), Snails (Malacophily), Birds (Ornithophily) and Wasps etc. Nearly 80% of the insect pollinators are bees. Majority of flowering plants depends upon bees for pollination. There are more than 20,000 species of bees in the world. Great physicist Albert Einstein, once stated that if all bees disappeared from the earth's surface, humanity would

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Bees

OUR
PRECIOUS
POLLINATORS



Stingless bees (*Tetragonula* spp.,
Lisotrigona spp. and *Lepidotrigona* spp.)



Honey Bees (*Apis* spp.)

have only four years of life left, because food crops would have no one to pollinate them. Without bees food we love, will be lost. Bee's visit flowers to collect useful resources like Pollen, Nectar, Oils, and Scents etc for their own uses as well as for their young ones. They intentionally do not visit



Large carpenter bees (*Xylocopa* spp.)

flowers too specifically to effect pollination, but flower exploit them for that purpose.

Plants produce pollen for their reproduction and attract insects by variety of signals to facilitate pollination. Mainly there are two types of pollinators which are classified as: Generalists which pollinate wide array of



Small carpenter bee *Ceratina* spp.-

Small carpenter bees
(*Ceratina* spp.)



Leaf cutter bees
(*Megachile* spp.)

flowering plants and specialists who pollinate particular family of flowering plant or plants of the same genus. Majority of pollinators provides generalist type of pollination services. Some flowering plants also exhibit self-pollination, if they are not self incompatible. Thus, Pollination is one of the several crucial ecological services which sustain biodiversity and Humanity. Some common pollinators are discussed here-

1.Honey Bees (*Apis* spp.)

Honeybees are best known bees, not only for the honey they produce, but also because they play very important role in pollinating various agricultural and horticultural crops. They are a component of

our biodiversity on which we all rely for survival. They produce premier source of natural and high-quality food products like Honey, beeswax, venom, propolis, pollen, and royal jelly. They depend exclusively for pollen and nectar on flowering plants, not only for their own survival, but also for rearing their young ones. They are excellent pollinators of many of our food crops. They pollinate millions of rupees worth of commercial agricultural crops in India.

2. Stingless bees (*Tetragonula* spp., *Lisotrigona* spp. and *Lepidotrigona* spp.)

Stingless bees are important pollinators of various food crops. They are called stingless because

of their relatively softer stings by which they are not capable of stinging. These bees are also known as dammar bees. They have been domesticated in many parts of India, mainly in Kerala. Compared to honeybees, the honey yield per hive per year is very low, approximately 100 to 750 g per hive per year, however the honey fetches a very high price due to its medicinal value.

3.Large carpenter bees (*Xylocopa* spp.)

These Bees shows solitary behaviour. They are wood-nesting and generalist pollinators. It has been found foraging on a number of different species of flowering plants. They perform Buzz Pollination with the help of powerful thoracic



muscles. They are excellent pollinators and most valuable pollinator for Beans, Sunhemp and Peas.

4. Small carpenter bees (*Ceratina spp.*)

Small carpenter bees are small sized with black or bluish green or blue colour body. This bee prefers to visit plant species

with small and whitish coloured flowers. They are generalist pollinator and pollinate many plant species belonging to 28 families which include vegetables, fruits, ornamental and wild flowers. These bees are most valuable pollinators for crops such as beans, cowpeas, sesame, cashew, apples and

coffee.

5. Blue banded bees (*Amegilla bees*)

These bees are medium-sized with characteristic golden brown head with striped abdomen. They show solitary behaviour. These bees also able to perform buzz pollination. They regarded as ideal pollinator

for greenhouse especially for solanaceous crops such as Brinjal, tomatoes, chillies whose pollens are attached firmly with anthers. *Amegilla* sp. Also visits Maize, Red gram, Green gram, Sesamum, Sunflower, Guava, Passion fruit, Drumstick, Pumpkin, Cucumber, Bitter gourd etc for pollination. It also pollinate large number of Weeds like Indian borage, Big sage, Coat buttons, Purple bush bean, Indian mallow, Jimson weed, Fever root, Wild mustard, *Leucas aspera* etc.

6. Leaf cutter bees (*Megachile* spp.)

Leaf cutter bees estimated to have 260 species in India. They are medium to small sized solitary bees and have black and orange colouration with pale bands of hair across the abdomen. They exhibit 'tripping mechanism' (a special ability for tripping the blossoms to get at the pollen hidden deep inside flowers), which other bees including honeybees can't perform or avoid such flowers. Most species of *Megachile* spp. exhibit specialists to generalists' type of pollination services. For example, *M. bicolor* specialized for plants of Fabaceae family while *M. lanata* forages on plants of Fabaceae, Asteraceae and Lamiaceae families. Leafcutter bees are utilized commercially to



Blue banded bees
(*Amegilla* bees)

pollinate alfalfa, onions, carrots in America and Canada.

7. Indian Bumble bees (*Bombus* spp.)

Bumblebees are large insects possessing ability to survive in the cold climate. They have a dense covering of hairs on their body and produces high buzzing sound in flight. They pollinate diverse range of cultivated plants and also wild flowering plants of the higher elevations. They prefer sunny meadows to pollinate small flowers at high altitude. They are effective pollinators to increase the yield of cash crops like peas, clover, mustard and alfalfa and

also the fruits like pear, apricot, peach, cherry, and almond grown at high altitudes.

Conclusion

Since majority of the world crops are dependent on animal pollinators and Bees are most popular and most significant pollinating group. There is need to create awareness and to promote actions to conserve pollinators and their habitat to ensure food security, maintaining biodiversity and sustaining livelihood. Knowledge about science of pollinators is one of the most urgent need for benefiting life on the earth.

Have you ever imagined the quantity of water required for our day-to-day life? Do you know that about 140 litres of water is required to make a cup of coffee we have every day morning? We may be aware of how much water we use for drinking, showering, and doing laundry, but the water used to

produce the food we eat, the clothes we wear and the lives we lead may be less obvious. As per FAO (UN), that cup of coffee, for example, requires 140 litres of water to grow, process and transport enough beans for a single cup. The water that we consume in our everyday life is not just the water we use from tap to flush, but the water that

is used to produce our food, clothes, and everyday items and is mostly invisible. This is known as virtual water and it accounts for most of our water use.

The effects of human activity on the ecosystem have increased more and more quickly than anticipated. For example, human activity uses up more land and water than

How much thirsty we are ? Measure in terms of water foot print !

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the planet can replenish. Freshwater is a finite resource that is becoming increasingly valuable globally due to overuse and scarcity, which are proven to cause social, environmental, and economic concerns. To be more specific, freshwater is a resource that is required for human health and well-being as

well as for industrial operations and production. Freshwater consumption is expected to expand twice as fast as the human population and by 2050 consumption is predicted to be tremendously higher than it is today, with over 40 per cent of the world's population experiencing water scarcity. Various indicators,

including Carbon Footprint, Ecological Footprint, and Water Footprint, have been created to address comparable assessments related to certain environmental concerns. A methodology was created in this context to study and measure the amount of water used, as well as to gain a deeper understanding of the connections

Table 1: Water footprints reported for different nations

Nation	Annual water footprint (m ³)
India	1089
China	1071
United States	2842
United Kingdom	1695
Finland	1733

Source: Water Footprint Network (www.waterfootprint.org)

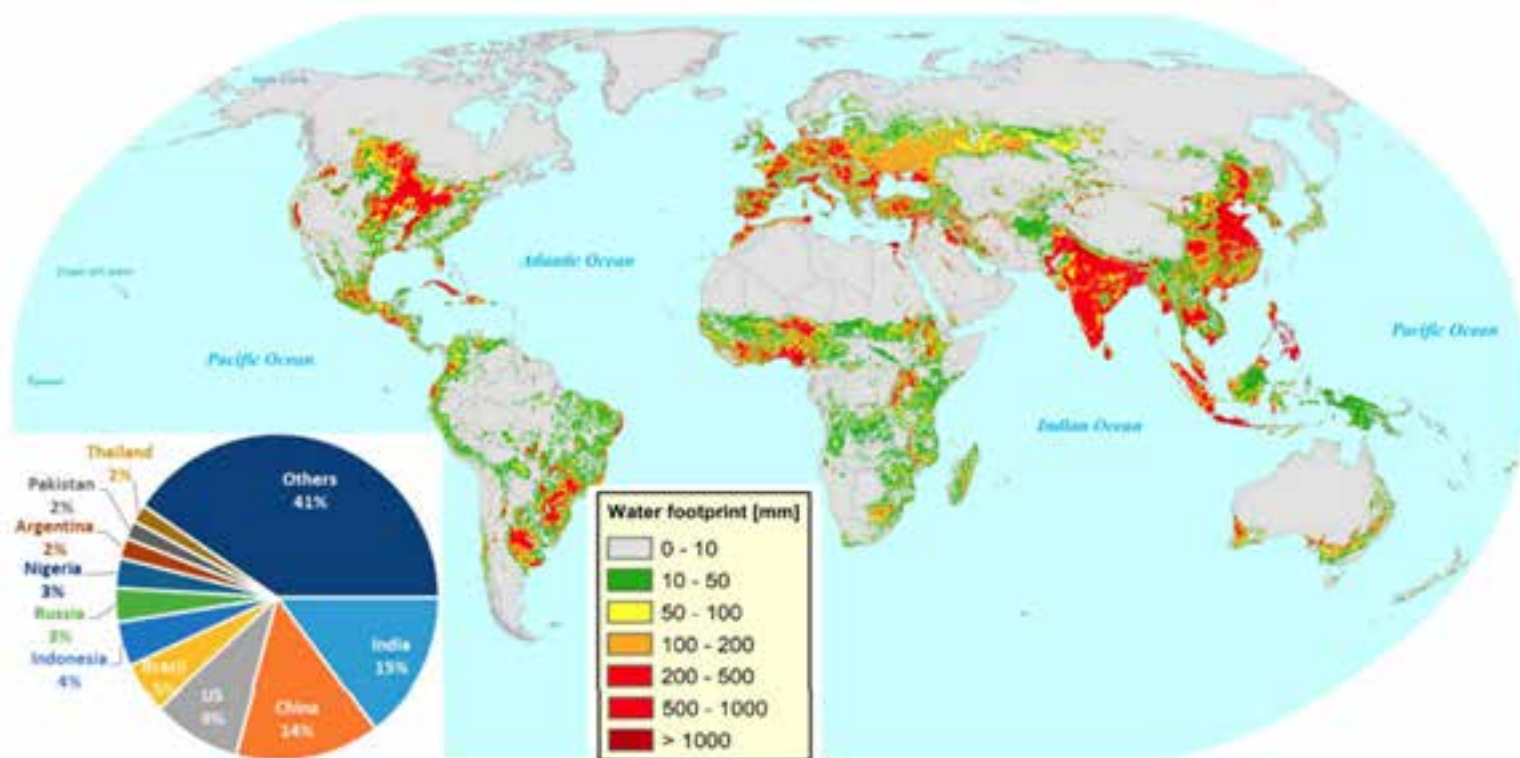


Fig. 1: The total (green, blue, and grey) WF of food crops production. The pie chart shows the contribution of countries to total WF (Source: Mekonnen and Leenes, 2020)

between humankind’s creative endeavours and the increasing demand on water, both directly and indirectly through the usage of products and services.

What is a water footprint?

A water footprint is a measure of the quantity of water used in our day-to-day activities. Much like a carbon footprint, the measurement includes our daily consumption as well as the water required to produce goods and services in society.

The concept of a water footprint was coined in 2002, by Arjen Hoekstra, Professor in water management at the University of Twente, Netherlands, and co-founder and scientific director of the Water Footprint Network. The water footprint of a person is defined as the total volume of freshwater that is used to produce the commodities, goods and services consumed by that person. Every product produced

has a water footprint and often consumers are unaware of the large volumes of water required for fresh water appropriation of a product or process over its entire lifetime that looks not only at the direct water use of a consumer or producer but also at indirect water use. The water footprint is a comprehensive and multidisciplinary indicator and is commonly expressed as the water volume used to produce a unit of product (m³/t) or the water volume per year of a delineated area (e.g., nation, province, catchment as m³/ha/yr), individual or community (m³/yr). The water footprint measures the amount of water used to produce each of the goods and services we use. It can be measured for a single process, such as growing rice, for a product, such as a pair of jeans, for the fuel we put in our car, or for an entire multi-

national company. The water footprint can also tell us how much water is being consumed by a particular country – or globally – in a specific river basin or from an aquifer.

The water footprint is divided into three components i.e., Green water footprint, Blue water footprint, and Grey water footprint. The green water footprint is the water from precipitation that is stored in the root zone of the soil and evaporated, transpired, or assimilated by plants. The blue water footprint is water from surface or groundwater resources and is either evaporated, integrated into a product, and is associated with irrigated agriculture. The grey water footprint is an indicator of freshwater pollution and it is the amount of water required to assimilate pollutants to meet given natural background

Table 1: The water footprints of some common food items

Item	Water footprint (L/kg)	Item	Water footprint (L/kg)
Apple	822	Beef	15415
Bread	1608	Chocolate	17196
Butter	5553	Milk	1020
Rice	1673	Egg	3265
Wheat	1827	Chicken meat	4325
Maize	1222	Pork	5988
Potato	287		
Tapioca	564		
Banana	790		

Source: Water Footprint Network (www.waterfootprint.org)

concentrations and existing ambient water quality standards. Together, these components provide a comprehensive picture of water use by delineating the source of water consumed, either as rainfall/soil moisture or surface/groundwater, and the volume of fresh water required for assimilation of pollutants.

Global water footprint

As per reports, the average global water footprint of an individual is 1,385 m³ per year. Water footprint of crop production grown for consumption across the world is shown in Fig.1. Most parts of India has a larger footprint. The pie chart shows major countries with a larger share of total water footprints.

The figures of some of the nation's water footprint values reported are as follows:

Water footprint of Agriculture

Agriculture is a major contributor to water use, currently it accounts for 70% of water use worldwide. The water footprint of growing a crop, the volume of water consumed per unit of a harvested crop—is a common metric for evaluating agricultural freshwater appropriation. The consumptive WF includes appropriated green water from precipitation and blue water from irrigation or capillary rise.

We may not think that water, the valuable resource is the key ingredient in most of the food in our shopping baskets, when we visit the grocery store.

Meat and poultry products are the most water-intensive food products, the vast majority of it is used to grow the animal feed. Fruit, by comparison, is less water intensive. Agriculture isn't the only industry that is heavily reliant on water. The water used to produce our food and clothing represents a drop in the ocean compared to industrial water use.

Water Footprint Network (WFN)

The Water Footprint Network is an international learning community (a non-profit foundation under Dutch law) which serves as a platform for sharing knowledge, tools and innovations among governments, businesses and communities concerned about growing water scarcity and increasing water pollution levels, and their impacts on people and nature. The network consists of around 100 partners from all sectors – producers, investors, suppliers and regulators – as well as non-governmental organisations and academics.

Conclusion

The World Economic Forum ranks water crisis as the

risk with the fourth largest impact. Exploitation of existing water supplies, a growing population and the impact of climate change are setting the world for a future where demand for water will exceed supply. Such a future could bring conflict and hardship as agriculture, energy, industry, and households compete for water. As the planet does not have an endless supply of water, the volume currently used by industry, manufacturers and consumers is not sustainable, particularly as the global population is increasing. It is reported that there will be 9.8 billion people on earth by 2050, drastically increasing pressure on existing resources.

The water footprint provides a detailed understanding of the water impact of products, companies, and nations, enabling informed decision-making to conserve this vital resource. Also the values need to be revised with changes in scenario in agricultural production, climate change, industrial expansion and population growth etc.

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Mekonnen, M.M. and Leenes, W.G. 2020. The Water Footprint of Global Food Production, *Water* 2020, 12(10), 2696; <https://doi.org/10.3390/w12102696>



Thuidium sp.

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Brachythecium Rivulare

Mosses are a group of ancient non-vascular plants that have been identified 330

Green Serenity

Elevate the space with
stunning Moss Wall



million years ago. These are the first land forming plants, which helped to turn earth into the complex community of organisms that it is today. Moss belongs to division "Bryophyta", instead of having specialized system for transporting water and nutrients, moss absorbs nutrients directly through their leaves



Bryum Argenteum

Hypnum Cupressiforme



or small anchor-like structures called rhizoids. There are about 15,000 species of moss around the world.

A moss wall is a vertical surface or panel covered with live or preserved moss, often used as a decorative feature in interior spaces of walls. These walls

Syntrichia Ruralis





Cladonia Rangiferina

bring a unique way of natural beauty to indoors, transforming bland spaces into vibrant, green environments. Unlike traditional gardens, they don't require soil,

these are perfectly adapted for mounted vertical gardening installations. The moss can be attached to a substrate, like foam or fabric, which is mounted

onto the wall, that serve as a natural accent in living rooms, offices, restaurants, or public spaces.

Types of Moss Walls

1. Live Moss Walls: Require moss species like sheet moss, cushion moss, or mood moss, which can tolerate some moisture and low light.

2. Preserved Moss Walls: These do not require care, such as reindeer moss, feather moss, and sheet moss, these are treated and preserved, eliminating the need for light or water while maintaining its vibrant appearance.

Moss species suitable for indoor or outdoor living moss walls

1. Atrichum Undulatum (Wave or Star moss): Called by name wave moss for its wavy or transversely undulate leaves.

2. Brachythecium Rivulare: This species is bright golden or yellow-green coloured moss, forms a unique cushiony mat



Dicranum Scoparium

Leucobryum Glaucum



with its small, delicate leaves.

3. Bryum argenteum: Known as silver moss, because of its silver-green colour and forms a dense matt with its small leaves.

4. Fern Moss (Thuidium sp.): A small, delicate, bright green coloured moss with leaves that look like ferns.

5. Toothed moss (Plagiomnium sp.): For its unique tooth like leaves called as tooth moss, has vibrant soft green moss of feathery appearance.

6. Silver moss (Syntrichia Ruralis): This moss is also known as 'twisted moss', 'rural haircap moss' or 'star moss'. It has

deeper, darker green colored leaves and its stem has unique hair-like components called "setae" that allow the moss to adhere to its surroundings.

7. Sheet Moss (Hypnum Cupressiforme): A type of carpet moss that grows to form a sheetlike coverage over rocks





Selaginella Kraussiana



Selaginella Kraussiana

and soil.

8.Reindeer Moss (*Cladonia Rangiferina*): A lichen that grows in arctic lands. It is resistant to cold and does not grow roots.

9.Pillow Moss: It has a thick, mounded growth habit.

10.Mood Moss (*Dicranum Scoparium*): It grows in thick, large clumps and gets its name by the temperamental appearance.

11.Cushion Moss (*Leucobryum Glaucum*): This moss has a bushy, compact form that provides depth and a three-dimensional effect.



Chondrus Crispus

12. Feather Moss (*Pleurozium Schreberi*):

A more delicate type, it adds intricate, feathery texture to the wall

13. Bun Moss (*Leucobryum Albidum*):

Bun moss forms tight, mounded clumps, much like cushion moss. It prefers moist, shady areas, making it ideal for indoor moss walls with moderate humidity.

14. Club Moss (*Selaginella Kraussiana*):

It is not a true moss, club moss is often used in moss walls due to its fern-like, trailing growth and bright green colour. Prefers high humidity and low to moderate light. Requires misting to stay fresh. Adding vertical dimension, as its trailing growth creates a cascading effect.

15. Sphagnum Moss (*Sphagnum spp.*):

This moss is known for its ability to retain moisture, making it suitable for live moss walls. It has a light, fluffy texture and varies in colour from green to brown. Thrives in wet, boggy environments with high humidity.

16. Irish Moss (*Chondrus Crispus*):

Technically a type of algae rather than true moss, it's occasionally used for its

unique texture and dense growth pattern.

Benefits of living moss wall

- Moss walls bring an organic and calming atmosphere to indoor spaces. Their soft, green tones create a soothing ambience, making them a popular choice for creating a natural feel in urban environments.
- Improve indoor air quality by absorbing toxins and pollutants while releasing fresh oxygen
- Moss can capture dust particles from the air, reducing dust levels in the space.
- Preserved moss walls can last for many years without deteriorating, making them a long-term, sustainable solution for adding greenery to indoor spaces.
- The moss dampens echoes and absorbs sound vibrations, thus reduce noise from any adjoining rooms
- A simple and low-maintenance option to help to reduce the carbon footprint of a building.
- By absorbing excess moisture, moss walls help

regulate indoor humidity. This prevents mould growth and also regulate room's temperature by absorbing heat during the day

- Bringing elements of nature indoors is known to reduce stress and improve mental well-being. Moss walls are a core component of biophilic design, helping to connect people with nature, even in urban environments.
- Moss walls offer the benefits of having plants indoors without taking up valuable floor space. This is especially useful in small or crowded areas, allowing you to incorporate greenery in a space-efficient way.

Essential materials for moss wall installation

1. Type of moss: For low-maintenance option, preserved moss likesheet moss, reindeer moss, or feather moss is ideal. For a more natural living installation, moss species likesheet moss, cushion moss and mood moss are suitable, but they will need humidity and occasional care.

2. Substrate: Lightweight and easy to cut, foam is a popular choice for preserved moss walls.

Steps to install moss wall

Prepare the Substrate (Cut the substrate foam, wood, or fabric to the desired size and fit the space where the moss wall to be installed)

Attach the Moss (Use hot glue gun/ spray adhesive, or staples to attach the moss to the substrate)

Frame the Moss Panel (Using a frame, assemble it around the moss panel)

Mount the Moss Wall (Use brackets or hooks to mount the wall)

Watering and lighting (Set up any required misting or watering system and ensure appropriate lighting for live moss installations)

Plywood or MDF (medium-density fibreboard) panels can provide a sturdy backing for both live and preserved moss

3. Adhesive: For attaching preserved moss to the backing material hot glue gun or pins or nails are used, it provides a quick bond but is not suitable for live moss.

4. Mounting structure: A wooden frame or box is often built around the moss panel to protect the edges. Can use metal brackets, D-ring hooks, or other hanging hardware, depending on the weight of the wall

5. Protective layer: A fine mesh net can be applied over live moss to hold it in place while

allowing it to grow. For indoor preserved moss walls, to seal the back of the frame to prevent moisture or dust from collecting behind the installation

6. Watering system: An in-built irrigation system of automatic misters or hand-held sprayers are commonly used to moisten the moss regularly, ensuring it stays moist. Along with humidifier can help maintain adequate moisture levels without directly watering the moss. Water tray or basin at the base to be connected to collect runoff water from misting.

7. Lighting (optional): Low-intensity lights designed for plants, which can help to maintain healthy growth in live

moss walls. For preserved moss, lighting is purely aesthetic, that highlights the texture and colour of the moss.

Specification to install moss wall

- Room temperature between 15-24 degrees Celsius and humidity 50-70%.
- Hang the living moss wall in a well ventilated area.
- Prefer lots of indirect sunlight.
- Moss needs misting of weekly 1-2 times
- Moss thickness of 2-6cm
- Thickness of material under moss substrate/panel should be 5-10mm
- Weight of substrate wall 6-7kg per sq. m

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Hanging in the Shade

Perfect
Low Light
Hanging
Plants for
Every Home

Introduction

In the hustle and bustle of modern life, creating a tranquil and inviting living space is more important than ever. One of the most effective ways to bring a sense of calm and nature into your home is through the use of indoor plants. However,



Spider plant (*Chlorophytum comosum*)

not all homes are blessed with abundant natural light, which can be a limiting factor when choosing the right greenery for your space. This is where low light hanging plants come to the rescue. Low light hanging plants are a versatile and aesthetically pleasing solution for those dimly lit corners of your home. These plants are specifically adapted to thrive in environments with limited sunlight, making them ideal for apartments, offices, or rooms with small windows.

Their ability to grow well in low light conditions means you don't have to compromise on greenery just because you lack bright, direct sunlight.

Benefits of Low Light Hanging Plants

1. Space-Saving: Hanging plants utilize vertical space, freeing up valuable floor area and making them perfect for small homes or rooms. They can be suspended from ceilings, mounted on walls, or placed on high shelves, adding a layer of

greenery without crowding your living space.

2. Air Purification: Many low light plants are known for their air-purifying qualities. They help to filter out toxins and pollutants, improving the air quality in your home. This can lead to better respiratory health and a fresher living environment.

3. Stress Reduction: The presence of plants has been scientifically proven to reduce stress and anxiety. Greenery can create a soothing atmosphere,

Money plant (*Epipremnum Aureum*)



promoting relaxation and mental well-being. The gentle movement of hanging plants can also add a dynamic, calming effect to your interiors.

4. Decorative Appeal:

Hanging plants add a unique decorative element to your home. Their cascading foliage

and trailing vines can soften architectural lines, create focal points, and add a touch of nature-inspired beauty to any room. They blend seamlessly with various decor styles, from modern to bohemian.

5. Low Maintenance: Many low light hanging plants are

incredibly resilient and require minimal care. This makes them an excellent choice for busy individuals, beginners, or anyone who may not have a green thumb. With the right selection, you can enjoy the beauty of plants without the stress of high-maintenance care routines.



Arrowhead vine (*Syngonium podophyllum*)



Swiss cheese plant (*Monstera Adansonii*)

Selecting the Right Low Light Hanging Plants

Choosing the right low light hanging plants involves understanding the specific needs of each plant species. Factors such as watering requirements, humidity preferences, and growth

habits should be considered to ensure your plants thrive in your home environment. Some popular and easy-to-care-for low light hanging plants include Pothos, Spider Plants, Philodendrons, Boston Ferns, and English Ivy. Each of these

plants brings its own unique charm and benefits, making them wonderful additions to any indoor space.

Top Low Light Hanging Plants

1. Spider plant

(*Chlorophytum comosum*)

The Spider Plant is a

quintessential low light hanging plant known for its long, arching leaves, typically green with white or cream stripes, and its resilience in dimly lit interiors. Thriving in average room temperatures and able to filter pollutants like formaldehyde from the air, it's both aesthetically

pleasing and beneficial for health. Spider plants prefer well-draining, loamy soil, and moderate watering, allowing the top inch of soil to dry out between waterings to avoid root rot. Easily propagated through its spiderettes or by division, this



Heartleaf Philodendron

(Philodendron hederaceum)



Neon Pothos

(Epipremnum aureum 'Neon')

non-toxic plant is safe for homes with pets. To maintain its health, mist occasionally for humidity, feed with a balanced fertilizer during the growing season, and trim brown tips. Ideal for hanging baskets or high shelves, spider plants add a dynamic, natural element to any decor, complementing various interior styles while also reducing stress and improving mood. With its ease of care and adaptability, the Spider Plant is a versatile

choice for both novice and experienced indoor gardeners.

2. Money plant

(Epipremnum aureum)

The Money Plant is a versatile low light hanging plant known for its heart-shaped, glossy leaves that can be variegated with shades of green, yellow, or white, and its vigorous, trailing vines, making it ideal for hanging baskets or trailing from shelves. Thriving in low to moderate indirect light and average room temperatures (60-80°F or 15-27°C), it is also excellent at purifying indoor air by removing toxins like formaldehyde, benzene, and xylene. Preferring well-draining potting soil and moderate watering (allowing the top inch of soil to dry out between waterings), it can be easily propagated through stem cuttings or layering. Maintenance involves regular trimming to control growth, occasional misting to maintain humidity, and wiping leaves to keep them shiny. While mildly toxic to pets if ingested, it can be kept out of reach to avoid issues. Ideal for adding a lush, tropical feel to indoor spaces, the money plant complements various

decor styles, reduces stress, improves mood, and serves as an excellent educational tool for teaching plant care and biology. Its resilience, adaptability, and air-purifying qualities make it a popular choice for enhancing indoor environments.

3. Arrowhead vine

(Syngonium podophyllum)

The Arrowhead Vine is a versatile low light hanging plant characterized by its arrowhead-shaped leaves, which start heart-shaped and gradually develop into their distinct form, often variegated with white, cream, or pink. It thrives in low to moderate indirect light and average room temperatures (60-75°F or 15-24°C), and it is known for its air-purifying abilities, filtering pollutants like formaldehyde and benzene. Preferring well-draining, rich potting soil, it can be propagated easily through stem cuttings or air layering. Regular watering to keep the soil evenly moist, high humidity levels achieved through misting, and occasional feeding with a balanced fertilizer ensure its healthy growth. Pruning helps maintain its shape and encourages bushier growth. The

plant's aesthetic appeal makes it perfect for hanging baskets, high shelves, or as a climbing plant on trellises, complementing various decor styles. Despite its benefits, including stress reduction and air purification, it's essential to keep it out of reach of pets due to its mild toxicity from calcium oxalate crystals. The Arrowhead Vine is an excellent choice for enhancing indoor spaces with its beauty and resilience.

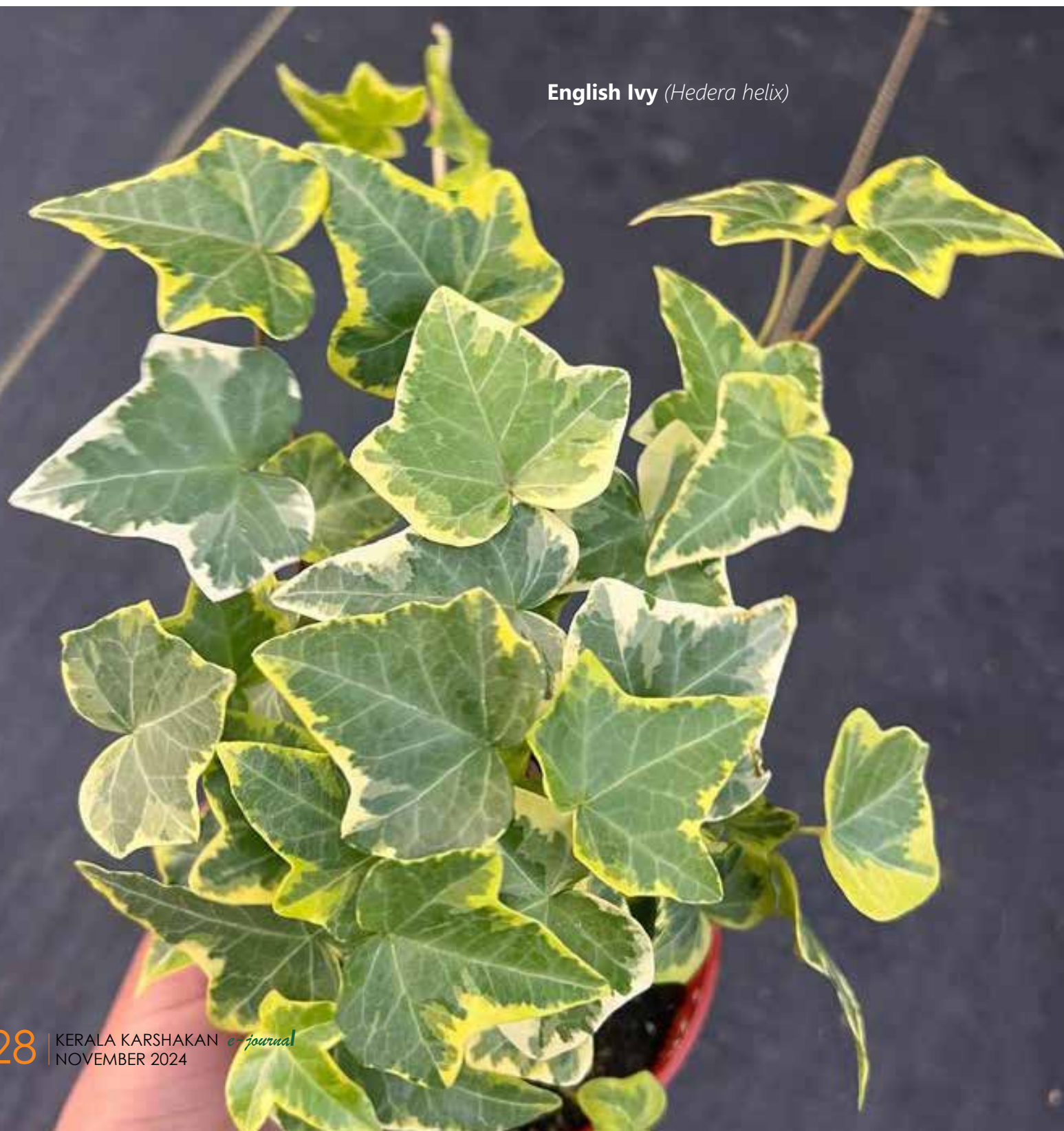
4. Boston Fern

(Nephrolepis exaltata 'Bostoniensis')

The Boston Fern is a beautiful and resilient low light hanging plant characterized by its long, arching fronds that range from light to dark green with a feathery texture, creating a dense, bushy growth ideal for hanging baskets. It thrives in low to moderate indirect light and prefers cool to average room temperatures (60-75°F or 15-24°C) with high humidity, making it sensitive to dry air and sudden temperature changes. This fern excels at purifying indoor air, removing pollutants like formaldehyde, xylene, and toluene, and is non-toxic to pets, making it a safe choice

for households with animals. It prefers rich, well-draining, slightly acidic soil and can be planted in pots with drainage holes to prevent waterlogging, often showcased in hanging baskets or elevated containers to highlight its cascading fronds. Propagation is straightforward, typically done by dividing the root ball in the spring or using offsets that grow from the plant's base. For maintenance, the soil should be kept consistently moist but not soggy, with thorough watering when the top inch feels dry, and the fronds should be misted regularly to maintain high humidity. Feeding with a balanced, water-soluble fertilizer every 4-6 weeks during the

English Ivy (*Hedera helix*)





Boston Fern

(Nephrolepis exaltata 'Bostoniensis')

growing season (spring and summer) helps promote growth, while dead or yellowing fronds should be removed to keep the plant tidy. Occasional rinsing of the fronds with lukewarm water helps prevent pest infestations such as spider mites, scale, and mealybugs, which can be treated with insecticidal soap or neem oil if necessary. The Boston Fern's lush, feathery

fronds add a touch of greenery and elegance to indoor spaces, complementing various interior decor styles and promoting a healthier living environment by reducing stress and improving mood. Its ease of propagation makes it an excellent educational tool for teaching children about plant care and biology. Overall, the Boston Fern is a versatile and rewarding plant that enhances

home decor and contributes to a healthier, more aesthetically pleasing indoor environment.

5. Swiss cheese plant

(Monstera Adansonii)

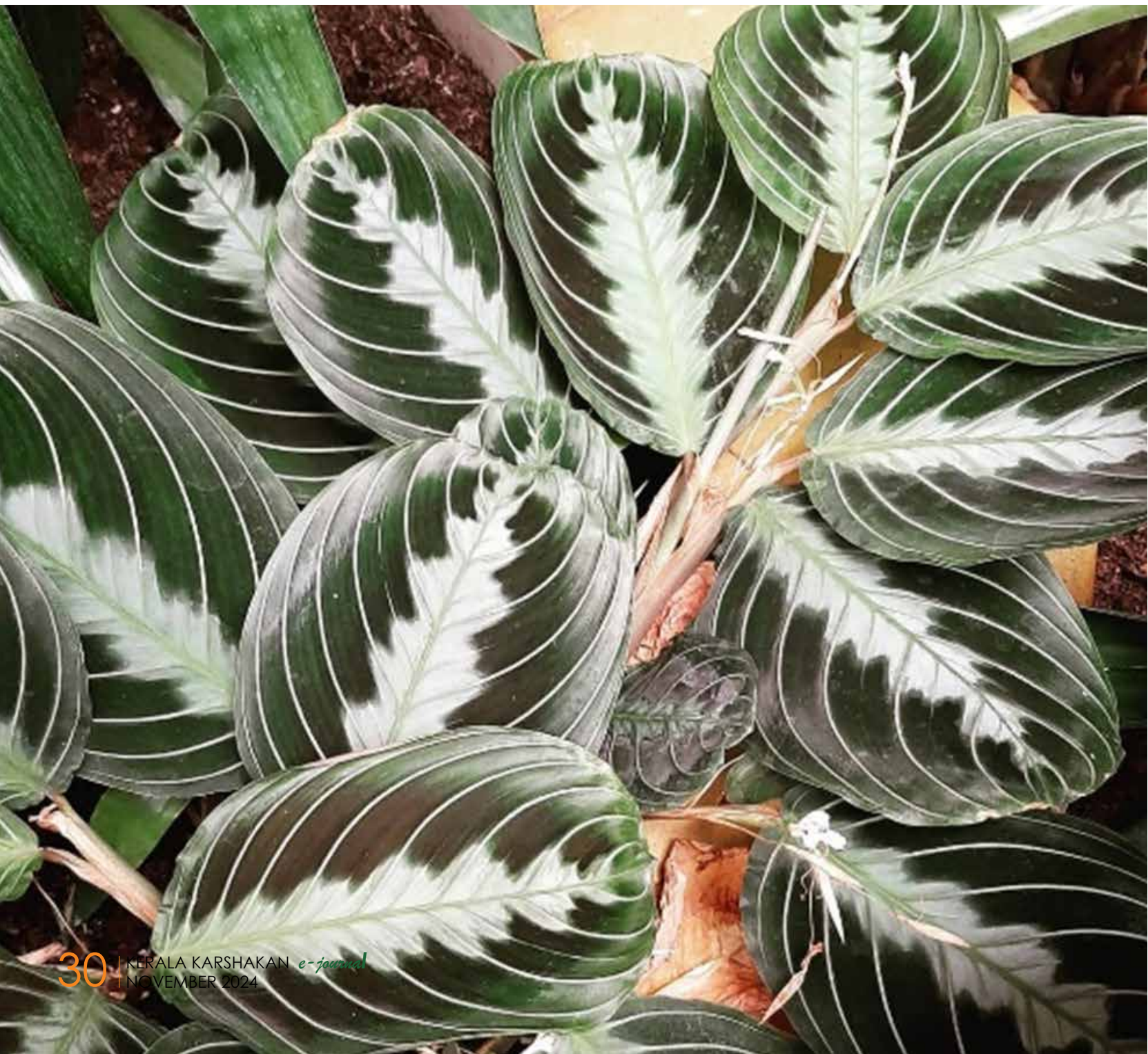
The Swiss Cheese Plant is a striking and adaptable low light hanging plant renowned for its distinctive heart-shaped leaves adorned with unique perforations, giving it an exotic and eye-catching appearance.

Thriving in low to moderate indirect light and preferring average room temperatures (65-80°F or 18-27°C), this plant is sensitive to cold drafts and requires high humidity to flourish. It grows as a vining or climbing plant, making it perfect

for hanging baskets, trailing from shelves, or climbing trellises. The Swiss Cheese Plant thrives in well-draining, rich potting soil, and should be watered when the top inch of soil feels dry to keep the soil evenly moist without becoming waterlogged.

Regular misting or the use of a humidifier helps maintain the necessary humidity levels. Easily propagated through stem cuttings or offsets, it allows for straightforward multiplication and sharing. Maintenance includes regular pruning to

Black prayer plant (*Maranta leuconeura* Var. 'Black')



manage its growth and maintain its shape, as well as wiping the leaves to remove dust and prevent pest infestations from common pests like spider mites, mealybugs, and scale, which can be treated with insecticidal soap or neem oil. The plant's ability to filter pollutants such as formaldehyde from indoor air enhances its appeal as an air purifier, contributing to a healthier living environment. Its lush, dramatic foliage adds a tropical touch to various decor styles, from contemporary to traditional, and its presence has been shown to reduce stress and improve mood. While mildly toxic if ingested by pets, causing irritation and digestive issues, it should be kept out of reach of animals. The Swiss Cheese Plant (*Monstera adansonii*) is not only a beautiful addition to any indoor space but also a beneficial one, combining aesthetic appeal, air-purifying qualities, and ease of care, making it an ideal choice for both novice and experienced indoor gardeners.

6. Heartleaf Philodendron

(Philodendron hederaceum)

The Heartleaf Philodendron is a popular low light hanging plant admired for its glossy, heart-

shaped leaves that are typically deep green and grow up to 4 inches long. Its trailing or vining growth habit makes it perfect for hanging baskets, shelves, or as a cascading plant from high spots, and it can also be trained to climb supports or trellises. This plant thrives in low to moderate indirect light and prefers average room temperatures (65-80°F or 18-27°C), though it should be kept away from direct sunlight and cold drafts. Effective at improving indoor air quality by filtering pollutants like formaldehyde, the Heartleaf Philodendron also benefits from well-draining, rich potting soil and moderate to high humidity. It requires regular watering when the top inch of soil feels dry, and feeding with a balanced, water-soluble fertilizer every 4-6 weeks during the growing season. Regular pruning helps manage its growth and maintain its shape, while occasional leaf wiping prevents dust and pest infestations. This plant is easily propagated through stem cuttings or offsets, making it excellent for teaching children about plant care and biology. Though mildly toxic if ingested by pets, causing irritation and

digestive issues, it adds a lush, elegant touch to any indoor space and has been shown to reduce stress and improve mood, making it a versatile and beneficial addition to living rooms, bedrooms, and offices.

7. Neon Pothos

(Epipremnum aureum 'Neon')

The Neon Pothos is a vibrant low light hanging plant distinguished by its bright lime-green to yellow, heart-shaped, glossy leaves that add a striking splash of color to any indoor space. Thriving in low to moderate indirect light, it can tolerate various lighting conditions but should be kept out of direct sunlight to prevent leaf scorch. This plant prefers average room temperatures (65-85°F or 18-29°C) and well-draining potting soil, such as a mix of peat moss, pine bark, and perlite. Ideal for hanging baskets or high shelves, its trailing or climbing growth habit is showcased beautifully. The Neon Pothos is known for its resilience and air-purifying qualities, effectively removing pollutants like formaldehyde, benzene, and xylene from the air, though it contains calcium oxalate crystals, making it mildly toxic if ingested by pets and

humans. Watering should be done when the top inch of soil feels dry, and the plant appreciates moderate humidity, with occasional misting in drier environments. Feeding with a balanced, water-soluble fertilizer

every 4-6 weeks during the growing season helps maintain its vibrant foliage. Regular pruning encourages bushier growth and controls its size, while wiping the leaves keeps them shiny and dust-free. Easy to

propagate through stem cuttings or division, the Neon Pothos is a perfect plant for teaching children about plant care and biology. Its vibrant color and trailing vines complement various interior decor styles, from

Wandering Jew (*Tradescantia zebrina*)



modern to eclectic, while also reducing stress and improving mood. Despite its mild toxicity, it can be safely kept out of reach of pets and children, making it a versatile and rewarding choice for brightening up any indoor space with minimal maintenance.

8. English Ivy (*Hedera helix*)

English Ivy is a versatile and attractive low light hanging plant, characterized by its glossy, dark green, lobed leaves that often feature striking variegations in white, cream, or yellow. Known for its trailing or climbing growth habit, this plant uses aerial rootlets to cling to surfaces, making it perfect for hanging baskets, high shelves, or training along trellises and walls. Thriving in low to moderate indirect light, English Ivy prefers cool to average room temperatures (50-70°F or 10-21°C) and well-draining, fertile soil, ideally a mix of potting soil, peat moss, and perlite. It is highly effective at removing indoor air pollutants like formaldehyde, benzene, and mold spores, contributing to a healthier indoor environment. Despite its resilience, it contains saponins, making it mildly toxic if ingested by pets, potentially

causing vomiting and diarrhea. For optimal growth, the soil should be kept consistently moist, and the plant benefits from moderate to high humidity, with regular misting or the use of a humidifier. Feeding with a balanced, water-soluble fertilizer every 4-6 weeks during the growing season supports its lush foliage. Regular pruning helps control its growth and encourages bushier development, while occasional leaf cleaning prevents dust buildup and pest infestations such as spider mites, aphids, and scale, treatable with insecticidal soap or neem oil. Easily propagated through stem cuttings or layering, English Ivy is not only a beautiful addition to indoor spaces, enhancing various decor styles from classic to modern, but also an excellent educational tool for teaching children about plant care and biology. Its presence helps reduce stress and improve mood, making it a rewarding choice for brightening up homes while promoting a healthier living environment.

9. Black prayer plant

(*Maranta leuconeura* Var. 'Black')

The Black Prayer Plant is

a captivating low light hanging plant known for its dark green to black velvety leaves adorned with silvery veins and purple undersides. This visually striking plant has oval-shaped leaves that exhibit nyctinasty, folding up at night and opening in the morning, giving it the name "prayer plant." Thriving in low to moderate indirect light, it prefers average room temperatures (65-75°F or 18-24°C) and stable conditions, avoiding cold drafts and sudden temperature changes. The Black Prayer Plant flourishes in well-draining, rich potting soil, ideally a mix of peat moss, pine bark, and perlite, which retains moisture while allowing proper drainage. It is well-suited for hanging baskets or high shelves, showcasing its beautiful foliage. Propagation is straightforward, either by dividing the plant during repotting in the spring or through stem cuttings placed in water or directly in soil until roots develop. To maintain its health, the soil should be kept consistently moist but not waterlogged, with watering when the top inch feels dry, and high humidity levels should be maintained through regular misting, a humidifier, or a pebble

tray with water. Feeding every 4-6 weeks with a balanced, water-soluble fertilizer during the growing season (spring and summer) supports its lush growth, while regular trimming of dead or yellowing leaves encourages new growth and maintains its appearance. Wiping the leaves occasionally removes dust and enhances photosynthesis. Though not the most efficient air purifier, the Black Prayer Plant still contributes to a healthier living environment and reduces stress and improves mood, making it an excellent addition to living rooms, bedrooms, and offices. Safe for households with pets, as it is non-toxic to cats and dogs, this plant's unique leaf movement can also serve as an educational tool for children to observe plant behaviors. Overall, the Black Prayer Plant is a versatile, low-maintenance, and visually stunning choice for enhancing indoor spaces with its elegance and tranquility.

10. Wandering Jew

(Tradescantia zebrina)

The Wandering Jew is a striking low light hanging plant renowned for its colorful, lance-shaped leaves featuring a vibrant mix of green, purple, and

silver stripes, with deep purple undersides. It thrives in low to moderate indirect light and average room temperatures (60-80°F or 16-27°C), preferring well-draining, fertile soil and moderate humidity. Ideal for hanging baskets or elevated pots, it displays a trailing growth habit that adds a dynamic touch to indoor spaces. The plant is easily propagated through stem cuttings or layering, requiring regular watering when the top inch of soil feels dry and occasional misting to maintain humidity. While not a top air purifier, it still contributes to a healthier indoor environment and can help reduce stress, making it a great addition to living rooms, bedrooms, and offices. It should be noted that the Wandering Jew contains compounds that are mildly toxic if ingested, causing digestive discomfort and skin irritation, so it should be kept out of reach of pets. Overall, its vibrant foliage and ease of care make it a versatile and visually appealing choice for enhancing indoor decor.

Conclusion

In conclusion, low light hanging plants offer a fantastic

opportunity to infuse greenery and vibrancy into indoor spaces with minimal light exposure. Their diverse characteristics, from the striking foliage of the Black Prayer Plant to the vibrant hues of the Neon Pothos, provide a range of aesthetic and practical benefits.

These plants are not only visually appealing but also adaptable to varying light conditions, making them ideal for areas where natural light is limited. Their ease of cultivation and maintenance, coupled with their ability to improve indoor air quality and reduce stress, make them invaluable companions for enhancing home and office environments. Whether you're drawn to the trailing vines of the Wandering Jew or the lush foliage of the Spider Plant, integrating low light hanging plants into your décor can transform dull spaces into vibrant, refreshing retreats. By choosing the right plant for your specific light conditions and care preferences, you can enjoy the beauty and benefits of indoor greenery throughout the year, all while creating a welcoming and serene atmosphere in your living space.



Introduction

Saffron (*Crocus sativus*), commonly referred to as the “Golden Spice,” is the most expensive aromatic spice, belonging to the Iridaceae family, originated from Greece extending to Southwest Asia. It is cultivated

Saffron

cultivation in india
Challenges and
opportunities

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commercially in regions such as Pulwama (74.6%), Pampore, Budgam (16.13%), and Srinagar (6.68%) within Jammu and Kashmir. The red stigmatic lobes of the saffron flower contain components such as safranal, picrocrocin (imparting taste), and crocin (providing pigments) (Neghbi, 1989).

Saffron has numerous health benefits, including reducing cardiovascular and Alzheimer's diseases, alongside its medicinal, anti-inflammatory, and antioxidant properties. It is widely utilized as a spice in various food products and as a coloring agent in foods and beverages. Despite these considerable benefits, saffron cultivation is challenged by biotic and abiotic factors, climate

change and issues related to post-harvest management and value addition.

Challenges in Saffron Cultivation in India

Nearness to Cement Factories
Cement plants emit substantial quantities of dust, leading to a 60% reduction in the saffron cultivation area in Pulwama over the past two decades. This dust contains toxic gases that damage saffron blossoms, cause premature leaf fall, hinder growth, and affects the crocin content in Kashmiri saffron, subsequently affecting its color and medicinal properties.

Climate change and Environmental Factors

Climate change, particularly rising temperatures and inconsistent snow and rainfall

patterns adversely affecting saffron cultivation. have led to low yields

Lack of Post Harvest handling

The premium quality saffron, both domestically and internationally, holds significant market value. However, Jammu and Kashmir face substantial post-harvest challenges with this valuable commodity, adversely affecting saffron quality and cultivation efforts. There is a reduction in crocin content due as a result of delayed stigma separation and delayed flower harvesting during their blooming phase (Husaini et al., 2010).

Adulteration with other materials

Saffron, being a high-value cash crop, is frequently subjected



Harvesting of saffron in Kashmir



Harvesting of saffron in Kashmir

to adulteration owing to its distinctive characteristics. The government's insufficient regulatory measures against saffron adulteration and the illicit influx of low-cost saffron from Iran pose significant threats. Adulteration practices include incorporating weight-gaining substances, sugar-coated paper cuttings, dried meat fibers, and various organic materials. Such



unethical activities weaken the saffron market and reduce the reputation of Kashmiri saffron.

Lack of Marketing

In Kashmir, saffron marketing is managed by a limited number of intermediaries due to the relatively low production volume. These intermediaries, such as brokers, regional merchants, agents, and corporate societies, seize a disproportionate share of the profits, thereby exerting considerable influence over the disorganized marketplaces. This dominance results in economic losses for small and marginal farmers.

Labour-intensive

Saffron cultivation is labor-intensive occupation. Experts with experience carry out each stage, from planting corms to harvesting blossoms to delicately removing the crimson stigmas from petals, to the final grading process.

Opportunities and Suggestions for saffron cultivation

1. The establishment of certified nurseries could contribute to an increased supply of superior saffron corms to farmers, indirectly enhancing production.

2. India, as a vast nation, faces a significant discrepancy between its annual domestic demand for saffron, which stands at 40 tons, and the current production of merely 15 tons. Therefore, efforts to revive saffron production are imperative to address this shortfall.

3. The government must maintain rigorous quality standards. As suggested by the administration of Jammu and Kashmir, the establishment of a packing facility named "Koung Posh" is essential to promote high-quality saffron.

4. The cultivation of saffron in Kashmir is under considerable threat from urbanization and population growth. Due to Srinagar's proximity to the renowned saffron fields of Pampore, there is a propensity for these areas to be converted into urban townships. Such detrimental initiatives must be prevented

5. Traditional post-harvest practices are primarily responsible for the degradation of saffron quality. These should be supplanted with advanced techniques, such as precise

timing for flower collection, swift removal of stigmas and the employment of vacuum or solar drying methods, to support the industry's growth.

6. The proximity of cement mills to these historic saffron-growing regions has led to pollution. Government intervention is necessary to relocate these cement factories

7. Given the high reliability of weather forecasts, establishing a weather station in Kashmir's principal saffron-growing area is advisable to provide growers with daily meteorological updates.

8. Additionally, growers should have unrestricted access to an array of disease-control agents, including fungicides, pesticides and biocontrol agents, to effectively combat devastating diseases promptly. Integrated pest and disease management is ecofriendly practice to control pest and diseases.

9. To support small and marginal farmers, a strategy should be implemented to facilitate the direct sale of their saffron produce.

10. Effective regulation of Iranian saffron smuggling and the prevention of adulteration

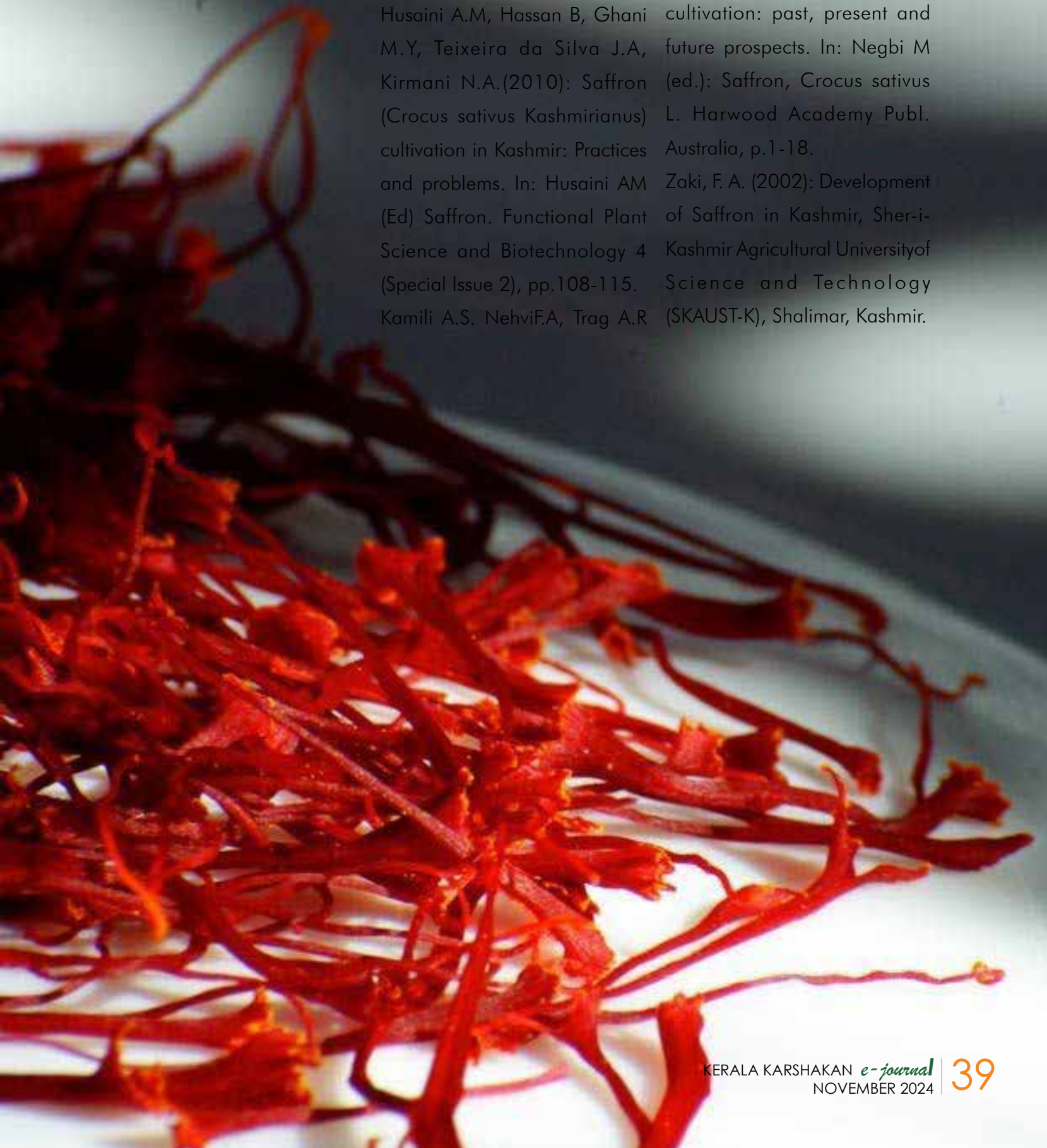
with both natural and synthetic substances are imperative
11. Additionally, the establishment of spice parks, marketing hubs, exhibition areas

and advanced training programs for farmers would significantly enhance the industry's growth and success.

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SORGHUM

A potential
crop for kerala
in the context of
climate change
and nutritional
security

INTRODUCTION

Sorghum, is a common crop, also known as *Sorghum bicolor*, belonging to the Graminae family. Africa is where it all began, but now it's grown all across the world, reaching America, Asia, and Australia. Its adaptability to various soil types and climates helps explain why millions of people throughout the world rely on it as a vital source of basic food. Section Magnoliophyte, class Liliopsida, order Cyperales, family Poaceae, subfamily Panicoideae, tribe Andropogoneae, subtribe Sorghinae, subsp. Bicolor are the divisions and orders to which the genus Sorghum belongs. The

four main types of sorghum are grain sorghum, sweet sorghum, forage sorghum, and biomass sorghum.

Grain sorghum is a grass used to feed cattle and is processed to make flour for human use. It is available in shades of white, tan, orange, red, bronze, and black. Sorghum in the colors red, orange, and bronze is adaptable enough to be utilized for fuel as well as animal feed. Sorghum flour can be produced from the tan, cream and white grain, used in food manufacturing. Black sorghum and burgundy have particularly high antioxidant content. A more recent kind of

sorghum was created by Texas University researchers and is called onyx. The composition is related to ancient black and high-tannin sorghum varieties, and it's designed to be super high in antioxidants (Warwick, 2023).

Due to its adaptability and standing as the fifth leading cereal crop in terms of productivity globally in terms of both production volume and area use, sorghum plays a crucial part in the agricultural economy. With its innate resistance to biotic and abiotic stressors, it grows well in a wide range of conditions. From an ecological standpoint, sorghum also contributes to

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Nutrient / ha	Irrigated crop	Rainfed crop
N	90 kg	45 kg
P ₂ O ₅	45 kg	25 kg
K ₂ O	45 kg	25 kg

soil conservation because of its deep root system and ability to withstand saline, which protects biodiversity in agricultural systems. When compared to other crops, sorghum requires fewer agricultural inputs, which makes it a good option for farmers who have limited resources.

Compared to other cereal crops, particularly C3 varieties, sorghum is recognized for its hardiness. The crop's drought-resilient and high-energy characteristics, makes it an optimal crop choice in consideration of climate change and considered as best choice for converting solar energy and water utilization. In terms of nutritional value, sorghum is comparable to other cereals when it comes to protein, fat, carbohydrates, and non-starch polysaccharides, as well as bioactive compounds such as vitamin B, fat-soluble vitamins (D, E and K) and a range of micronutrients, macronutrients, and non-nutrient compounds like carotenoids and polyphenols. These ingredients support the grain's many health advantages, which include strong antioxidant activity, free radical scavenging, anti-inflammatory, and anti-cancer properties and so on.

TIME-HONOURED ROLE

Grain sorghum has been traditionally used in many civilizations for a variety of purposes. Commonly used as a maize alternative in traditional recipes. Worldwide, sorghum millet-based non-alcoholic drinks are a popular choice. A traditional Lesotho meal called "motoho" is made using sorghum that has first been turned into a thin slurry with warm water and sorghum grain. The fermentation process is then started by inoculating this slurry with a traditional starter culture called "tomoso".

The preparation of malted sorghum grains, known locally as "zurria", is the first step in the traditional processing steps involved in Sudan's "hulu-mur" manufacture. The method of producing traditional hulu-Mur, which is made from two sorghum landraces in Sudan, Abjaro and Hegarii, entails examining variations in phytochemical components and antioxidant properties. To promote germination, the last stage of malting called "urrais", the grains are wetted with water over a period of 4–5 days. Malting the sorghum grains to cause them to sprout is a crucial manufacturing step that enhances the nutritional

profile of the finished product while also influencing the taste and texture characteristics of hulu-mur Boza is a traditional fermented cereal beverage from Turkey that is exceedingly viscous and low in alcohol. It is also popular in certain Balkan, Middle Eastern, Asian and African nations. For ages, the Chinese people have relied on baijiu, a traditional Chinese liquor, for their everyday needs. It is now regarded as China's national alcoholic beverage and is deeply ingrained in Chinese culture.

By using solid-state fermentation, baijiu is usually prepared from sorghum alone or in conjunction with other grains like wheat, corn, peas, millet and rice. The use of dry heat to pop or puff sorghum and millet is another widely consumed snack food. China produces old-maturity vinegar, also called Shanxi vinegar, by fermenting sorghum solid-state. Shanxi cuisine is known for its vinegar made using this age-old technique that has been used for millennia.

CULTIVATION ASPECTS OF THE CROP

Sorghum can be cultivated as rainfed (May – August) and irrigated (January – April) crop. Co-1, Co-10, Co-12, Co-17, K-1, K-2 Hybrids - CSH-1 to CSH-4, Co-11 are the varieties that are widely cultivated. The required seed rate is 12-15 kg ha⁻¹. Two seeds



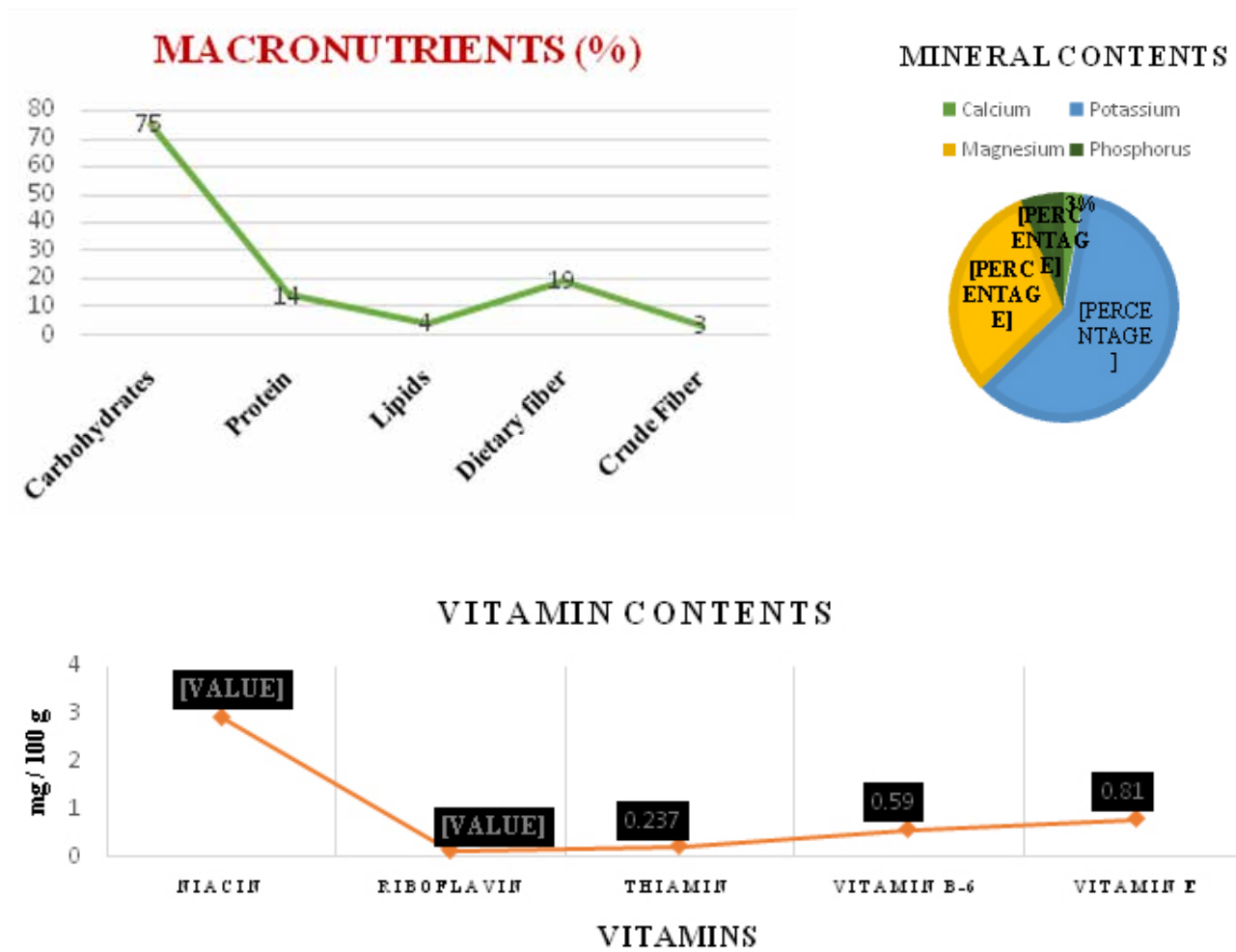


Fig. 1. Nutritional composition of sorghum crop

can be dibbled per hole at a spacing of 45 cm x 15 cm. Manuring: For both irrigated and rainfed crops FYM / compost may be applied @ 5 t ha⁻¹. Apply FYM and entire quantity of phosphorus and potash as basal dose. Apply nitrogen in two equal splits, half as basal and the rest 30 days after sowing. Thinning, weeding and hoeing may be done on the 20th day after sowing. Irrigate the crop on the day of sowing and give life irrigation and thereafter at 10 days interval.

NUTRITIONAL COMPOSITION OF SORGHUM MILLET DEFENSIVE DYNAMICS

Antioxidant activity: Sorghum's phenolic compounds appear to be important for promoting health and preventing disease because of their antioxidant activity. Sorghum grain has the highest level of phenolic compound antioxidant activity when compared to other cereal grains. Antioxidant activity and total phenolic levels have a strong relationship.

Antidiabetic activity: Glucosidase and amylase enzymes are strongly inhibited by sorghum extracts. By changing the way sugar is metabolized, sorghum extracts and products lowers the risk of hyperglycemia and decreased glucose absorption. As a result, sorghum contributes significantly to glucose homeostasis, which is an essential strategy for effectively managing diabetes. Proanthocyanidins and deoxyanthocyanins added to a sorghum drink dramatically lowers the excess glycemia.

Antimicrobial activity: Sorghum phenolic extract has shown a number of therapeutic effects and is an efficient natural antibacterial substitute. Elevations in phenolic compounds are also linked to enhanced antimicrobial and anticarcinogenic characteristics. A technique that combines ion precipitation and acidic ethanol extraction has been created to extract highly active phenolic chemicals from fresh sweet sorghum stalks. Sorghum high in procyanidins can reduce dental caries, a chronic illness brought on by *Streptococcus* bacteria, hence preventing tooth cavities.

Anti-cancer activity: Phenolic acids and flavonoids, two bioactive compounds that target multiple cancer symptoms, are linked to sorghum's anti-cancer properties. Among other polyphenols, sorghum contains tannins, policosanols, anthocyanins, phytosterols, and phenolic acids. Black sorghum's 3-deoxy anthocyanins have anti-inflammatory and anti-tumor properties. Flavones found in sorghum have estrogenic characteristics and have demonstrated anticancer effects in vitro.

Anti-obesity activity: Sorghum has properties that help prevent obesity. Sorghum extracts are essential for the lipid metabolism of pancreatic lipase enzymes and help reduce the accumulation of triglycerides. Eating extruded sorghum lowers waist circumference, body fat

percentage, and encourages weight loss. The main cause of obesity is an excessive buildup of fat. One important regulator of adipogenesis, peroxisome proliferator, activates the peroxisome proliferator-activated receptor, which controls the expression of particular adipogenic genes such as fatty acid synthase (FAS) and lipoprotein lipase (LPL).

Anti-atherosclerotic activity: 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, a crucial enzyme in the synthesis of cholesterol, is inhibited by lipids derived from sorghum. Bifidobacterium and plasma HDL cholesterol are elevated following ingestion of sorghum grain lipid extract, suggesting that these bacteria have a beneficial role in maintaining cholesterol homeostasis (Tanwar et al., 2023).

Anti-inflammatory activity: Prolonged oxidative stress can produce chronic inflammation, which in turn can cause chronic diseases. Prostaglandin E2 (PG-E2), tumor necrosis factor (TNF), cyclooxygenase (COX)-2 and interleukin (IL) are among the inflammatory chemicals that are produced in response to inflammation. Numerous phenolic compounds found in sorghum have the ability to prevent the synthesis of these pro-inflammatory molecules (Makanjuola et al., 2019).

Together with extracts from cowpea and sorghum that are high in quercetin, flavone apigenin and flavanol quercetin have strong synergistic anti-inflammatory properties that increase their bioavailability in cells.

CONCLUSION

The millet crop, sorghum, represents the cutting edge of sustainable agriculture and nutrition benefits. Additionally, because of its diverse defensive mechanisms and phytochemical functions, sorghum should be cultivated in a wider range of contexts, which also requires increased investment from researchers and the agro-industries.

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INTRODUCTION

Skyblue clustervine, scientifically known as *Jacquemontia pentanthes* is a neo-tropical, evergreen, trailing, freely blooming, perennial vine belongs to morning glory family Convolvulaceae, it bears showy violet-coloured flowers which attract pollinators. This twiner also known as Key West morning glory, Pineland clustervine and Jakshini.

All species which come under genus *Jacquemontia* are usually called as clustervine. The genus name *Jacquemontia* given in the honour of French botanist and explorer Victor Jacquemont.

They are attractive to a variety of pollinators including

the Nessus sphinx (*Amphion floridensis*), Tantalus sphinx (*Aellopus tantalus*) and Tersa sphinx (*Xylophanestera*) moths.

TAXONOMY

Division: Angiospermia

Class: Eudicots

Sub - class: Asterids

Order: Solanales

Family: Convolvulaceae

(commonly known as morning glory family)

Sub-family: Convolvuloideae

Genus: *Jacquemontia*

Botanical name:

Jacquemontia pentanthes

(Jacq.) G. Don

HABITAT AND

DISTRIBUTION:

Skyblue clustervine native to Tropical America which

includes South Florida, West Indies, Mexico, Central America and South America. In South Florida, it occurs naturally in coastal hammocks and along wetlands. *J. pentanthes* listed under endangered by the State of Florida. Native habitat is coastal hammocks especially on dunes. In India, earlier clustervine found in special areas like Gujarat Forestry Research Foundation, Indroda Park, Sarita Udyan, Van Chetana Kendra and Infocity whereas now it can be seen in most of the gardens. This climber thrives well under full sun or light shade, in moist, well-drained sand or lime rock. Tolerant to brief inundation, it also withstands significant and

Skyblue clustervine

A light and pretty Perennial twiner

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ongoing amounts of salty wind and salt spray without injury.

USES

Skyblue clustervine can be grown on arbors, pergolas, trellises, fences, hanging baskets, ground covers and in pots.

SIMILAR SPECIES:

J. paniculate has calyx lobes ovate to lanceolate nearly 5-6 mm broad, and corolla shorter barely 1 cm long.

MORPHOLOGY AND BOTANY:

Skyblue clustervine is a trailing, sprawling, salt tolerant, perennial sub-woodyvine with twining, slender, green, velvety, cylindrical stems can grow up-to a height of 6-12 feet tall (180-360cm).

Leaves are ovate-cordate, deeply veined, shiny and small sized with pointed tips, 1-3

inch long (2-7cm) arranged alternatively.

A profusion of funnel/ bowl shaped, ultramarine blue to pinkish lavender coloured small sized (2.5 cm) showy flowers with white throats and five unequal stamens attached to petals.

Sepals and petals(4-5 x 2-4 mm) are ovate to lance shaped, pointed to tapering, velvet-hairy are borne from the leaf axils singly or in clusters at the ends for long pedunculate cymes. Sepals are of unequal, wavy margins and 5 in number. Ovary is 2- celled, style is slender and two stigmas are clavate.

Clustervine is freely blooming from every fall through late spring. The creeper looks gorgeous with its many flowers spread on it after rains and in the cooler season. The blossoms open in the morning and close after dark. Fruit is capsular, spherical, brown and hairless. Seeds are brown, 2.5 mm long and also hairless.

Propagation: Propagate by seeds, cuttings and air layering. Prune in late spring or early summer, after flowering has ceased. Do not prune heavily in late summer as it may adversely affect fall/ winter blooms and it is free from pests and diseases.

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