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Review Article

Sansevieria Trifasciata: A Low-Maintenance, Air-Purifying Plant for Improved Indoor Health

Shaikh Bushra*, Thange Shejal, Shaikh Muskan

Shanriniketan College of Pharmacy, Dhotre Bk, Tal Parner, Ahmednagar-414304.

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ABSTRACT

Sansevieria Trifasciata, commonly known as Snake Plant, is a popular, low-maintenance houseplant renowned for its exceptional air-purifying properties and aesthetic appeal. Native to West Africa, this plant has been widely cultivated for its ability to remove toxic pollutants, such as formaldehyde, benzene, and trichloroethylene, from indoor air. Its sleek, upright leaves and adaptability to low-light conditions make it an ideal choice for indoor spaces. being Studies have shown that Snake Plant can improve sleep quality, reduce stress, and enhance cognitive function. With minimal care requirements, including infrequent watering and average humidity levels, Sansevieria Trifasciata is an excellent addition to any home or office seeking to promote indoor well. The leaves and rhizomes are traditionally used against acne, fungal infections, skin itches, allergy, ulcer, helminths, earache, pharyngitis, urinary diseases, jaundice, analgesic and antipyretic in various countries. The snake plant containing chemical constituent saponins having antimicrobial and antifungal activity, Flavonoids having antioxidant activity, Alkaloids having antimicrobial activity, Steroid having anti-inflammatory activity.

INTRODUCTION

In current scenario, medicinal plants are worthy replacement for synthetic chemical drugs as an environmental renovation in the medical field. One of the major reasons for alternative is minimum side effects than synthetic chemical drugs. Also, the field of herbal products has significantly contributed to the advancement of

pharmacology and medicine [1] The extraction and isolation of wide range of phytochemicals from numerous plants are still motivates many researchers globally to discover new bio-active compounds and their pharmacological actions [2] The snake plant (Sansevieria trifasciata), also known as mother-in-law's tongue, is a popular and hardy houseplant known for its striking

***Corresponding Author:** Shaikh Bushra

Address: Shanriniketan College of Pharmacy, Dhotre Bk, Tal Parner, Ahmednagar-414304.

Email ✉: Shaikhbushrajaved512@gmail.com

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appearance and low maintenance needs. Native to West Africa, particularly regions like Nigeria and the Congo, the snake plant is a succulent that thrives in arid environments, making it highly drought-tolerant. Its long, upright, sword-shaped leaves are typically green with variegated patterns, often featuring light green, yellow, or white borders, giving it a distinctive, elegant look [3]a In addition to its aesthetic appeal, the snake plant is highly regarded for its ability to purify indoor air. Studies, including NASA's Clean Air Study, have shown that the plant can absorb toxins such as formaldehyde, benzene, and carbon dioxide, improving indoor air quality and making it a favorite in homes and offices. Moreover, the snake plant is resilient and can survive in low light and with minimal water, making it ideal for beginners or individuals with less time for plant care.[4] Throughout history, it has been valued not only for its ornamental and air-purifying qualities but also for its practical uses, such as the strong fibers used in traditional crafts and its inclusion in medicinal remedies in various cultures. Today, the snake plant continues to be a symbol of resilience, good luck, and natural beauty, making it a versatile and popular choice for modern indoor spaces.[5]

History of snake plant. : The snake plant has a rich history, including its origins, naming, and cultural significance **Origins** The snake plant is native to the deserts of Ethiopia and other places. **Naming** The snake plant has been renamed several times: In 1753, Carl Linnaeus grouped it with Aloe. In 1787, Vincenzo Petagna named the genus *Sanseverinia* to honor his patron Pietro Antonio Sanseverino.[6] In 1794, Carl Peter Thunberg named the genus *Sansevieria* after Raimondo di Sangro, the Italian Prince of San Severo. **Cultural significance-** In African folklore, the snake plant was associated with spiritual protection and was believed to shield homes from evil spirits[7]. The plant's strong, fibrous leaves were also used to

craft bowstrings, symbolizing strength and resilience.

Popularity

The snake plant has become a popular houseplant worldwide due to its hardiness, low maintenance requirements, and air-purifying qualities.[8] The snake plant is also known by other names, including Mother-in-Law's Tongue, Viper's Bowstring Hemp, and Saint George's Sword.

Physical and chemical mechanism:

Water Conservation and CAM Photosynthesis: Snake plants are well-adapted to dry environments and can survive with minimal water. [9]They use a special type of photosynthesis called Crassulacean Acid Metabolism (CAM), which allows them to open their stomata (tiny pores on the leaves) at night to reduce water loss. During the day, the stomata remain closed to conserve moisture.[10] At night, carbon dioxide (CO₂) is absorbed and stored in the form of organic acids, which are then used for photosynthesis during the day.2. **Tough Leaf Structure.**[11]The leaves of the snake plant are thick, tough, and fibrous. This tough structure helps to prevent water loss through evaporation, making the plant more drought-resistant. The leaves also have a waxy cuticle, which provides an extra layer of protection against moisture loss.3.[12] **Root Structure:** Snake plants have rhizomes, which are underground stems that store water and nutrients. These rhizomes allow the plant to survive in poor soil conditions and grow new shoots.[13] This root structure contributes to its ability to propagate easily, as new plants can grow from rhizome segments.4. **Air Purification:** Snake plants are known for their ability to purify indoor air by absorbing toxins like formaldehyde, benzene, and xylene. [14]This is largely due to their efficient stomatal regulation and gas exchange mechanisms. Their ability to absorb these chemicals makes them popular in improving indoor air quality.[15] **Crassulacean Acid Metabolism (CAM) Photosynthesis:** CAM

photosynthesis is an adaptation to arid environments, allowing the plant to reduce water loss by fixing carbon dioxide (CO₂) at night.[16] The process involves a series of chemical reactions: Night (CO₂ fixation): The stomata open at night, allowing the plant to take in CO₂, which is combined with phosphoenolpyruvate (PEP) to form a four-carbon compound called oxaloacetate.[17] This is converted into malic acid and stored in the vacuoles of leaf cells. Day (Calvin cycle): During the day, the stomata close to conserve water, and the stored malic acid is released from the vacuoles and converted back to CO₂[18]. This CO₂ is then used in the Calvin cycle for photosynthesis, allowing the plant to produce sugars. This mechanism is highly water-efficient and allows the plant to survive in dry conditions with minimal water loss.2.[19] Air Purification and Toxin Removal: Snake plants are known for

their ability to absorb and metabolize harmful chemicals from the air, making them excellent indoor air purifiers.[20] The plant uses the following chemical processes: Formaldehyde Removal: Snake plants can absorb formaldehyde, a common indoor pollutant found in household products, through their leaves[21] Once inside the plant, formaldehyde undergoes enzymatic reactions, breaking down into simpler, non-toxic compounds like carbon dioxide and water. Benzene and Xylene Absorption: These volatile organic compounds (VOCs) are absorbed through the leaves and metabolized in a similar manner.[22] The plants convert these toxins into less harmful compounds via detoxification pathways involving enzymes such as monooxygenases and peroxidases.[23]

Plant Profile:

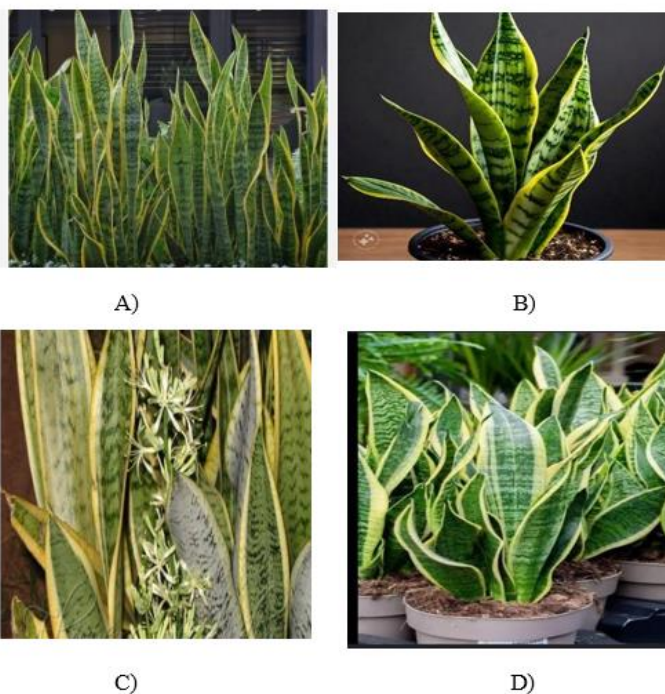


Fig (1)

Common Names:

- 1.Snake Plant
- 2.Mother-in-Law's Tongue
- 3.Sansevieria
- 4.Devil's Tongue Scientific Name:

Dracaena trifasciata (formerly *Sansevieria trifasciata*)

Family: Asparagaceae

Native Region: West Africa (Nigeria, Congo, Senegal [24])

Description:

1. Evergreen perennial plant
2. Sword-shaped, upright leaves (2-4 feet long, 1-2 inches wide)
3. Dark green leaves with yellow or white edges
4. Stiff, fibrous, and pointed leaves
5. Grows vertically, 2-4 feet tall

Characteristics:

1. Low-maintenance, drought-tolerant
2. Air-purifying properties (removes toxins)
3. Releases oxygen at night
4. Hardy, adaptable to indoor conditions
5. Pest- and disease-resistant

Cultivation:

1. Well-draining soil
2. Indirect sunlight to partial shade
3. Water sparingly (allow soil to dry between waterings)
4. Temperature range: 65-75°F (18-24°C)
5. Fertilize during growing season (spring-fall)

Uses:**Ornamental Uses:**

1. Interior decoration: Low-maintenance, stylish addition to homes and offices.
2. Landscaping: Used in gardens, parks, and public spaces.
3. Floral arrangements: Unique, architectural element.

Medicinal Uses:

1. Wound healing: Leaf extracts accelerate wound closure.
2. Antimicrobial properties: Effective against bacteria, fungi, and viruses.

3. Anti-inflammatory: Relieves pain, reduces swelling.
4. Antioxidant properties: Protects against cell damage.

Practical Uses:

1. Insect repellent: Keeps mosquitoes and other pests away.
2. Natural fertilizer: Leaf extracts promote plant growth.
3. Biodegradable dyes: Leaves yield natural pigments.

Traditional Medicine:

1. Fever reduction: Leaf extracts reduce fever.
2. Digestive issues: Treats constipation, diarrhea.
3. Skin conditions: Treats acne, eczema.

Cosmetic Uses:

1. Skincare: Anti-aging, moisturizing properties.
2. Haircare: Promotes hair growth, reduces dandruff.

Food and Beverages:

1. Leaf extracts as food additives.
2. Beverages: Tea, juice, and other infused drinks.

Environmental Uses:

1. Phytoremediation: Removes heavy metals from soil.
2. Soil stabilization: Prevents erosion.
3. Carbon sequestration: Absorbs CO₂.

Other Uses:

1. Bioactive compounds: Source of novel pharmaceuticals.
2. Biotechnology: Genetic engineering for improved traits.
3. Insecticidal properties: Potential pest control agent.





Fig (2)

Chemical constitution for active constituent

Primary Active Constituents:

- 1.Saponins: Anti-inflammatory, antimicrobial, and antioxidant properties.
- 2.Flavonoids: Antioxidant, anti-inflammatory, and antimicrobial properties.
- 3.Phenolic acids: Antioxidant, anti-inflammatory, and antimicrobial properties.
- 4.Alkaloids: Anti-inflammatory, antimicrobial, and analgesic properties.

Secondary Active Constituents:

- 1.Glycosides: Antimicrobial and anti-inflammatory properties
- 2.Terpenoids: Antimicrobial and antioxidant properties.
- 3.Steroids: Anti-inflammatory and antimicrobial properties.
- 4.Polysaccharides: Immunomodulatory and antioxidant properties.

Bioactive Compounds:

- 1.Chlorophyll: Antioxidant and anti-inflammatory properties.
- 2.Vitamin C: Antioxidant and immune-boosting properties.
- 3.Beta-sitosterol: Anti-inflammatory and antimicrobial properties.

4.Lupeol: Anti-inflammatory and antimicrobial properties.

Medicinal Properties:

- 1.Wound healing
- 2.Anti-inflammatory
- 3.Antimicrobial
- 4.Antioxidant
- 5.Antiseptic
- 6.Anti-arthritis
- 7.Anti-diabetic

Traditional Use:

- 1.Wound treatment
- 2.Fever reduction
- 3.Pain relief
- 4.Digestive issues
- 5.Respiratory problems
- 6.Skin condition

Modern Research:

- 1.Air-purifying properties
- 2.Anti-cancer potential
- 3.Neuroprotective effects
- 4.Cardiovascular benefits
- 5.Immunomodulatory effects [26]

Chemical constituent for active constituent

1.Leaves:

Chemical Constituent: Saponins: Known for their detergent-like properties, saponins contribute to

the plant's natural defense against microbes and pests. They are also credited for the snake plant's air-purifying abilities.[27]

Flavonoids: These are antioxidants that help protect the plant from environmental stress and oxidative damage. Flavonoids are also important for potential medicinal properties.[28]

Steroids: These help in plant growth regulation and have potential anti-inflammatory properties when used medicinally.[29]

Role:

-Air purification: Snake plants absorb pollutants like formaldehyde and benzene.

-Défense: The saponins and flavonoids protect the plant against herbivores and pathogens.

-Medicinal use: Antioxidant and anti-inflammatory properties may be beneficial for human use.[30]

2.Roots:

Chemical Constituents:

Alkaloids: These are often involved in the plant's defense mechanism, making the roots resistant to pests and diseases.

Phenolic compounds: These compounds help in nutrient absorption and are involved in the plant's defense system against microbial infections.

Role:

-Nutrient uptake: The roots absorb essential nutrients from the soil and protect the plant from pathogens.

-Defense: The alkaloids deter herbivores and pests from feeding on the roots.[31]

3.Rhizomes:

Chemical Constituents:

Steroidal glycosides: These compounds are important for plant metabolism and may also have medicinal benefits.

Role:

-Storage of nutrients: Rhizomes act as storage organs for nutrients, helping the plant survive during unfavorable conditions.

-Propagation: Rhizomes allow the plant to reproduce vegetatively, ensuring its spread [32].

4.lowers (Rarely Blooms): Chemical Constituents:
Essential oils: These oils contribute to the fragrance of the flowers and may have anti-inflammatory or antimicrobial properties

Role:

- Attraction of pollinators: The essential oils attract insects or other pollinators for reproduction.[33]

Toxicification of *Dracaena trifasciata* plant

Toxicity Levels:

1.Oral toxicity: Moderate to severe.

2.Dermal toxicity: Mild to moderate.

3.Inhalation toxicity: Low.[34]

Symptoms of Poisoning:

Oral ingestion	Dermal exposure	Eye exposure
Nausea vomiting, Diarrhea, abdominal pain, Excessive drooling, Oral and throat irritation.	Skin irritation, redness, Blistering, rashes.	- Conjunctivitis, redness.

Yielding of *Dracaena trifasciata*:

1) Vegetative Yield: Leaf yield: 20-30 leaves per plant per year, Stem yield: 2-5 stems per plant per year, Rhizome yield: 1-2 rhizomes per plant per year

2) Reproductive Yield: Flowering frequency Rarely flowers in cultivation, Seed yield: 10-20

seeds per flower, Fruit yield: None (seeds are sterile)

3) Commercial Yield: Leaf harvesting: Every 6-8 weeks, Stem harvesting: Every 12-18 months, Rhizome harvesting: Every 2-3 years

4) Factors Affecting Yield: Light intensity, Watering frequency, Temperature,



Fertilization, Pruning, Pest and disease management, Soil quality

5) Profit Margin: Ornamental plant market: 20-50%, Herbal medicine market: 30-60%, Essential oil market: 40-70%

6) Cultivation Costs: Initial investment: \$500-2,000 (greenhouse setup), Maintenance costs: \$100-500 per month (water, fertilizer, labor), Harvesting costs: \$50-200 per harvest (labor, equipment)

7) Profit Margin: Ornamental plant market: 20-50%, Herbal medicine market: 30-60%, Essential oil market: 40-70%[35]

Importance of snake plant;

Physical importance

1. Air Purification: Removes toxic pollutants (e.g., formaldehyde, benzene, trichloroethylene) from indoor air.

2. Oxygen Production: Releases oxygen through photosynthesis, improving indoor air quality.

3. Temperature Regulation: Helps regulate indoor temperature, reducing heat loss.

4. Humidity Control: Maintains optimal humidity levels, preventing moisture buildup.

5. Noise Reduction: Acts as a natural sound barrier.[36]

Biological Importance:

1. Medicinal Properties: Used in traditional medicine for wound healing, fever reduction, and antimicrobial treatments.

2. Antimicrobial Activity: Inhibits growth of bacteria, fungi, and viruses.

3. Insect Repellent: Repels mosquitoes and other insects.

4. Soil Remediation: Absorbs heavy metals, improving soil quality.

5. Carbon Sequestration: Stores carbon dioxide, contributing to climate regulation[37].

Ecological Importance:

1. Habitat Creation: Provides shelter for beneficial insects and microorganisms.

2. Soil Stabilization: Prevents erosion, maintains soil structure.

3. Water Conservation: Low water requirements, suitable for drought-tolerant landscaping.

4. Biodiversity.[38]

Different Types of Snake Plant [39]



Fig 03

Study of importance snake plant:[40]

Factor	Presence of snake plant	Absence of snake plant	Health / death impact
Indoor air quality	50-60% improved	50-60% decline	Better air quality improved respiratory health, reducing long term risk like asthma or allergies. Poor air quality

			risk of respiratory diseases .
Mental & Emotional well-being	40-50% improved	40-50% decline	Reduced stress, improved mood & cognitive function can enhance mental health. Absence may lead to higher stress

CONCLUSION:

There are many indoor plants that are useful for indoor decoration and removal of air pollutants in which Sansevieria effectively removes benzene, toluene, trichloroethylene and other VOCs. It is hardy plant that grows in insufficient light, dry air and drought condition etc. It has CAM mode of photosynthesis so, it absorbs CO₂ and release O₂ in night time too, so it is ideal bedroom plant. It shows minimum rate of change under benzene stress and absorbs higher CO. Sansevieria also inhibits the growth of aerial pathogenic micro fungi like *Cladosporium* spp., *A. fumigatus*, *A. flavus* etc. In propagation, middle leaf segment gives longest shoot length and maximum leaf area whereas, apical segment gave more number of root per segment, fresh and dry weight of roots in soil:compost media for indoor culture. In offices, houses, and other indoor settings without vegetation, the air quality deteriorates significantly. Poor air quality not only triggers health issues but also exacerbates existing conditions. In the United States, the Environmental Protection Agency has ranked indoor air pollutants amongst the top five threats of public health. Without air purification, pollutants such as chemicals, building materials, bio effluents, and household products open a new can of worms. Snake plants have tiny pores called “stomata” that open and close while the photosynthesis process occurs. These pores are used for the gas interchange of carbon dioxide.

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