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From the Editor's

Dear Readers,

In the October issue of our Newsletter, we received several popular articles from diverse fields. All the authors deserve great appreciation for sharing articles in huge numbers. Please continue sending articles to our Publication team and share published newsletter with your friends also.

I would like to thank the Editorial team including Print, Designer and Publication committee for their efforts throughout the edition.

Your suggestions are always welcomed for improvement.

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## **AI AND WEATHER FORECASTING: A NEW HOPE FOR DROUGHT- PRONE REGIONS**

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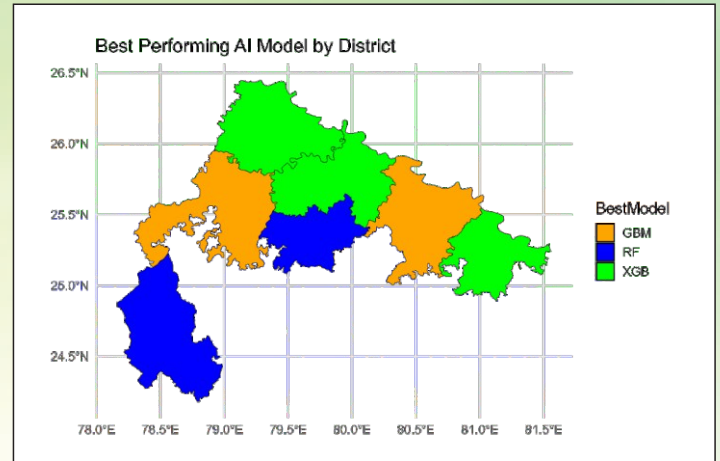
Drought is among the most devastating natural hazards, significantly affecting agricultural productivity, water availability, and socio-economic stability in many parts of the world. Unlike other disasters, droughts evolve slowly and are often difficult to detect and predict accurately, leading to delayed mitigation and management responses. Traditional weather forecasting models, which rely on numerical and statistical approaches, have contributed greatly to understanding climate variability. However, their limitations in handling complex, nonlinear climatic relationships, sparse data, and region-specific anomalies often result in reduced accuracy for drought-prone areas. In this context, the advent of Artificial Intelligence (AI) and Machine Learning (ML) technologies has introduced a paradigm shift in the field of weather forecasting and drought prediction, providing new opportunities for early warning, adaptive management, and sustainable water resource planning.

*AI-based forecasting systems can process vast amounts of historical and real-time data from diverse sources such as satellite imagery, ground-based weather stations, soil moisture sensors, and remote sensing platforms. By identifying hidden patterns and correlations within large datasets, AI models outperform conventional prediction techniques in terms of both speed and precision. Machine learning algorithms, including Artificial Neural Networks (ANNs), Random Forests (RF), Support Vector Machines (SVMs), and Long Short-Term Memory (LSTM) networks, have shown remarkable ability to capture temporal dependencies and spatial variability in climatic parameters such as temperature, precipitation, evapotranspiration, and soil moisture. These models not only enhance short-term weather forecasts but also enable long-term drought monitoring through indices like the Standardized Precipitation Index (SPI), Palmer Drought Severity Index*

(PDSI), and Vegetation Health Index (VHI). For drought-prone regions such as those in India's Bundelkhand, Sub-Saharan Africa, and parts of Australia AI offers a transformative approach to improve resilience and preparedness. Integrating AI-driven forecasting with Geospatial Information Systems (GIS) and Internet of Things (IoT) technologies enables the creation of dynamic, near-real-time monitoring systems. These systems support early warning alerts, guide crop management decisions, and optimize irrigation scheduling based on predictive soil-water balance models.

Moreover, the fusion of AI with climate reanalysis datasets and ensemble modeling improves spatial downscaling, allowing regional agencies to tailor forecasts to local conditions with higher accuracy than traditional models. Another significant advantage of AI-based drought forecasting is its potential to incorporate socio-economic and environmental variables, such as groundwater depletion, vegetation stress, and land-use changes, into predictive frameworks. This multidimensional analysis helps policymakers and agricultural planners design proactive drought mitigation strategies, including adaptive cropping systems, efficient water allocation, and community-based resource management. By translating complex climate data into actionable insights, AI bridges the gap between scientific modeling and practical decision-making, fostering a culture of anticipatory rather than reactive response to drought.

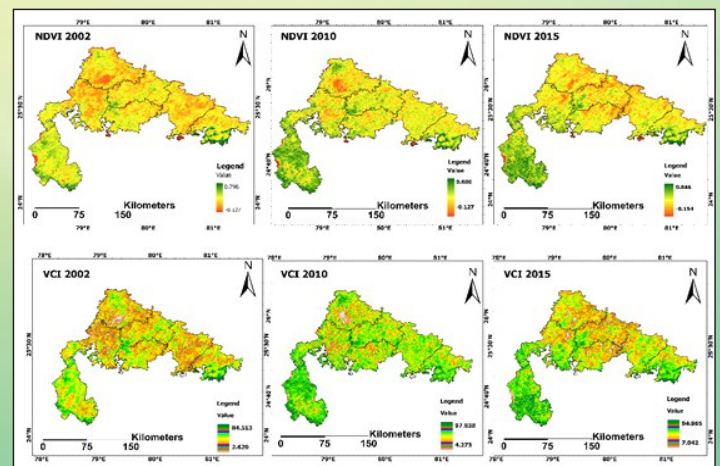
Drought remains one of the most persistent and economically damaging natural disasters threatening Indian agriculture. The Indian Meteorological Department (IMD) estimates that nearly 68% of India's arable land is drought-prone, with the Bundelkhand region among the most severely affected. Characterized by erratic monsoon rainfall, high evapotranspiration, and poor soil moisture retention, Bundelkhand frequently experiences prolonged dry spells that result in crop losses, groundwater depletion, and rural livelihood distress. Traditional weather forecasting models, while valuable, often lack the spatial precision and adaptability needed for local-scale drought prediction. Here, Artificial Intelligence (AI) provides a transformative solution. By integrating long-term meteorological and satellite data, AI can capture complex, nonlinear relationships between climate and vegetation factors that traditional methods overlook. Through machine learning (ML) and deep learning (DL) techniques, vast datasets such as rainfall, temperature, humidity, and vegetation indices (NDVI, VHI) can be analyzed to generate accurate and location-specific drought forecasts. This innovation supports climate-resilient farming, enabling farmers to make informed decisions about sowing, irrigation, and crop management even under unpredictable climatic conditions.



**Fig. 1: The map highlights the core drought-affected districts.**

an AI-based drought forecasting model tailored for Bundelkhand. The initiative combines nearly four decades (1985-2024) of rainfall and temperature data to compute Standardized Precipitation Index (SPI) and Standardized Precipitation Evapotranspiration Index (SPEI), alongside 24 years (2000-2024) of satellite-derived vegetation indices (NDVI and VHI) from MODIS and AVHRR archives. These datasets are harmonized to create a spatio-temporal database, forming the foundation for training algorithms such as Random Forest (RF), Gradient Boosting Machine (GBM), and Long Short-Term Memory (LSTM) networks.

The trained models simulate climate-vegetation interactions and capture drought progression, producing district and block level forecasts validated using  $R^2$  and RMSE metrics. These outputs include drought severity maps and time-series risk forecasts, serving as decision-support tools for policymakers and extension agencies. Integrated with mobile-based advisory systems, these forecasts can issue early drought alerts, helping farmers plan timely intervention thus making AI a practical instrument for drought resilience in Bundelkhand.



**Fig. 2: Temporal variation of NDVI and VHI for Bundelkhand, showing rainfall variability and major drought years.**

Bundelkhand's fragile agro-ecosystem, shaped by erratic rainfall, limited irrigation, and high climate variability, demands such advanced forecasting systems. Over the years, increasing drought frequency has led to agricultural losses, groundwater decline, and migration. AI-based forecasting bridges this gap by providing localized, short- to medium-term predictions, enabling proactive agricultural and policy responses. Policymakers can better allocate water resources and design contingency plans, while farmers gain actionable insights for sustainable management. As climate uncertainty intensifies, the RLBCAU initiative signifies a strategic shift toward data-

driven agriculture. Future plans include integrating real-time satellite inputs, soil moisture monitoring, and AI-powered mobile advisories for dynamic, farmer-centric alerts. Scaling this model to other drought-vulnerable regions across India could revolutionize drought preparedness nationwide. The union of AI and agrometeorology is more than innovation it represents hope for sustainability and resilience. In drought-prone landscapes like Bundelkhand, precision forecasting not only strengthens agricultural planning but also empowers communities toward a climate-secure and productive future.

## A MIRACULOUS MEDICINAL PLANT FROM BASTAR: *AMORPHOPHALLUS CAMPANULATUS*

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**Introduction:** Araceae is a large family comprising of about 105 genera and nearly 3000 species of herbaceous monocots. These are distributed predominantly in the tropical regions. *Amorphophallus campanulatus*, belonging to the family *Araceae*, is commonly known as elephant foot yam and locally as jungli Suran. It is a perennial herb with rounded tuberous root stock (corm) which is used as an edible item worldwide. It is a tuber crop of South East Asian origin and is extensively cultivated throughout the plains of India for using its corm as food. This plant is an important source of biologically active compounds.

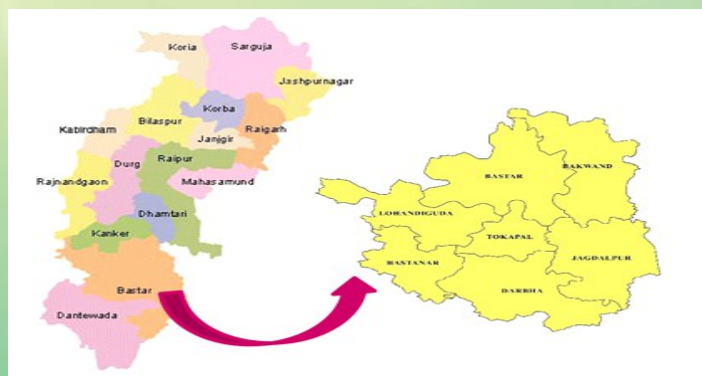
**Description:** *A. campanulatus* is distributed throughout India. It is a perennial herb, subscandent with underground depressed dark brown hemispherical corm which is a flattened rough sphere. Its outer surface is dark brown and inner surface is pale yellow and starchy. The leaves are segmented as pinnate or bipinnate with peduncles usually long, spathes broadly oblong or ovate, limb is funnel shaped open or convuluted. Flowers are monoecious with anthers sessile, stamens 1-6, ovaries are usually ovoid or globose and styles are generally long or short. Seeds are exalbuminous and berries are ovoid or subglobose.

**Distribution:** *A. campanulatus* is widely distributed in Africa, Bangladesh and India. The *Amorphophallus* species are mostly found in Eastern boundary of Polynesia, Western Africa, Japan, Taiwan, Phillipines, Central Thailand, New

Guinea, southward via Indonesia, Malaysia, Sumatra and many other parts of South Asian Countries *viz.*, Malaya and Ceylon. They are widely distributed throughout India *viz.*, Sikkim, Bengal, Kerala, Khasia Hills, north Gujarat, Maharashtra, Uttar Pradesh, Tamil Nadu, Punjab, Assam, Bihar, Madhya Pradesh and Odisha. *Amorphophallus* are long been used in Japan, China, and South East Asia as traditional medicine.

**Therapeutic Potential:** Its tuberous roots are used as antihelmintic, aphrodisiac, astringent, thermogenic, appetizer, anodyne, antihemorrhoidal, anti-inflammatory, antitumor, expectorant, hemostatic, liver tonic, carminative, digestive, stomachic. It is beneficial in curing abdominal pain, enlargement of the spleen, asthma, rheumatism, emmenagogue, and is also very effective in the treatment of dysentery and piles. The tuberous roots are well documented for its antibacterial, antifungal, antioxidant, hepatoprotective, cytotoxic as well as analgesic activities. Its tuberous roots are traditionally used as immunomodulatory.

**Site of Study:** Bastar district (19.1071°N, 81.9535°E) is located in southern part of Chhattisgarh and has an area of 4029.98 km<sup>2</sup>. The population of the district is 1,411,644 according to the 2011 census. It is surrounded by Bijapur, Dantewada, Kondagaon, Narayanpur and Sukma districts of the state. Bastar district is divided into seven Tehsils *viz.*, Jagdalpur, Bastar, Bakawand, Bastanar, Darbha, Lohandiguda and Tokapal. Jagdalpur is both district and divisional headquarter of Bastar district (Figure 1).



**Figure 1: Map of Bastar district showing sample collection area.**

**Sample Collection and Identification:** *Amorphophallus campanulatus* (Family: Araceae) was collected from Bastar region based on its traditional usage by the tribal community of Bastar district in curing several ailments and its ethno-medicinal importance as herbal drug. The bulb,

stem and leaves of fresh and apparently healthy plant of *Amorphophallus campanulatus* (Figure 2) were collected from the nursery and field area within the campus of Shaheed Gundadthur College of Agriculture and Research Station, Kumhrawand, Jagdalpur, Chhattisgarh, India after



Kingdom Plantae  
 Division Tracheophyta  
 Class Liliopsida  
 Order Alismatales  
 Family Araceae  
 Genus *Amorphophallus*  
 Species *campanulatus*

**Figure 2: Sample collection from Bastar region of Chhattisgarh.**

its authentication and identification at department of Agronomy and Horticulture, SGCARS, Jagdalpur, Chhattisgarh, India.

**Drying and Grinding of the Sample:**

The collected plant samples were washed thoroughly under running tap water to remove debris and were separated into bulb, stem and leaf and shade dried at room

temperature for about three weeks to attain a constant weight. Exposure to direct sunlight was avoided to prevent the loss of active compounds from the sample. The dried samples were mechanically grinded by pestle & mortar and finally powdered by grinding machine (Remi), packed in plastic bags and stored in airtight bottles at 4°C for further use (Figure 3).

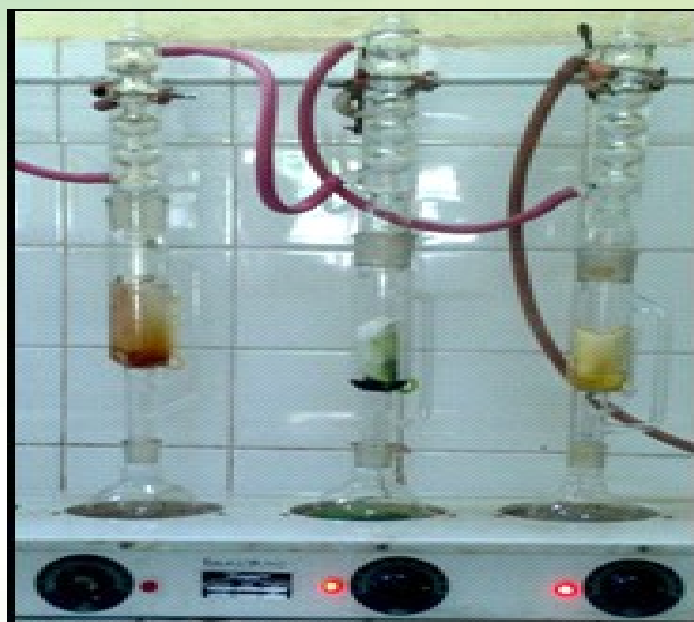


**Figure 3: Dried and Powdered Sample of *Amorphophallus campanulatus*.**

**Extraction Method:**

The extraction was done through hot extraction. In soxhlet apparatus powdered material was placed in a thimble of filter paper, which was loaded into the extracting unit of the apparatus. The extracting unit was placed onto round bottom flask containing the solvent and the top was equipped with a condenser. The entire assembly was set on

a heating mantle with temperature regulator. The solvent in the flask was heated and its vapour traveled up to the distillation arm and after condensation flew into the extracting unit housing the thimble (Figure 4). The powdered material was extracted sequentially in four different solvents viz., chloroform, acetone, methanol and aqueous. 15g powdered material was extracted in 150 ml of



**Figure 4: Soxhlet Apparatus for Extraction.**

chloroform, acetone, methanol and in aqueous according to their increasing polarity index in the soxhlet apparatus (Tempo) for 8-10 hours at a temperature not exceeding the boiling point of the respective solvents. The extracted material was dried to residue.

**Qualitative Phytochemical Analysis:** The qualitative phytochemical analysis of *A. campanulatus* extract showed that alkaloids were present in aqueous and methanol extracts of root and stem (Table 1). The alkaloids were absent in the acetone and chloroform extracts of all plant parts. Flavonoids were found to be present in all the solvent extracts of the plant except chloroform leaf extract. The content was high in methanol root extract. The methanol and acetone extracts of stem also gave moderately positive reaction for flavonoids. The phytosterols were detected in all the solvent extracts with strong positive reaction in methanol extracts of root and stem followed by their corresponding acetone and aqueous extracts respectively. Tannins gave positive test for methanol extract of root followed by acetone root and methanol stem extracts. However, tannins were not detected in chloroform extracts of root, stem and leaf. Saponins gave positive test in all the solvent extracts except chloroform. Quinones were absent in all the three parts of the plants in all extracts. Resins were prominently detected in chloroform root extracts and were feebly present in other solvent extracts but were found to be absent in aqueous extracts. The glycosides were detected in all the extracts except chloroform.

**Quantitative Phytochemical Analysis:** The quantitative

**Table 1: Qualitative phytochemical analysis of root, stem and leaf extracts of *A. campanulatus*.**

Tests	Aqueous			Methanol			Acetone			Chloroform		
	R	S	L	R	S	L	R	S	L	R	S	L
Alkaloids												
Mayer's	+	+	-	+	+	-	-	-	-	-	-	-
Wagner's	+	+	-	+	+	-	-	-	-	-	-	-
Hager's	+	+	-	+	+	-	-	-	-	-	-	-
Flavonoids												
Alkaline reagent	+	+	+	+++	++	++	++	++	+	++	+	-
Lead acetate	+	+	+	+++	++	++	++	++	+	++	+	-
Phytosterols												
Salkowski	++	++	++	+++	+++	+	++	++	+	+	+	+
Liebermann-Burchard	++	++	++	+++	+++	+	++	++	+	+	+	+
Tannins												
Ferric chloride	+	+	+	+++	++	+	++	+	+	-	-	-
Gelatin	+	+	+	+++	++	+	++	+	+	-	-	-
Saponins												
Foam test	+	+	+	++	+	+	+	+	+	-	-	-
Quinones	-	-	-	-	-	-	-	-	-	-	-	-
Resins	-	-	-	+	+	+	+	+	+	+++	++	+
Glycosides	+	+	+	+++	++	+	++	+	+	-	-	-

+++ Strongly positive; ++ moderately positive; + positive; - negative; R- Root; S- Stem; L- Leaf

estimation of alkaloid, flavonoid, saponin and total phenol in root stem and leaf of *A. campanulatus* is presented in Figure 5 and Figure 24. The root contains highest amount of total phenol (1.156±0.016%) followed by flavonoid (0.809±0.029%), saponin (0.585±0.015%) and alkaloid (0.492±0.031%) followed by stem and leaf in the same order. The root contains higher amount of total phenol (1.156±0.016%) followed by stem (0.802±0.015%) and

leaf (0.614±0.017%). Similarly, flavonoid was found to be high in root (0.809±0.029%) followed by stem and leaf. Saponin was found to be more in root (0.585±0.015%) followed by stem and leaf. Alkaloids (0.492±0.031%) were also more in root followed by stem (0.286±0.016%) and leaf (0.234±0.014%). The total phenol content was highest followed by flavonoid, saponin and alkaloid in all parts of *A. campanulatus*.

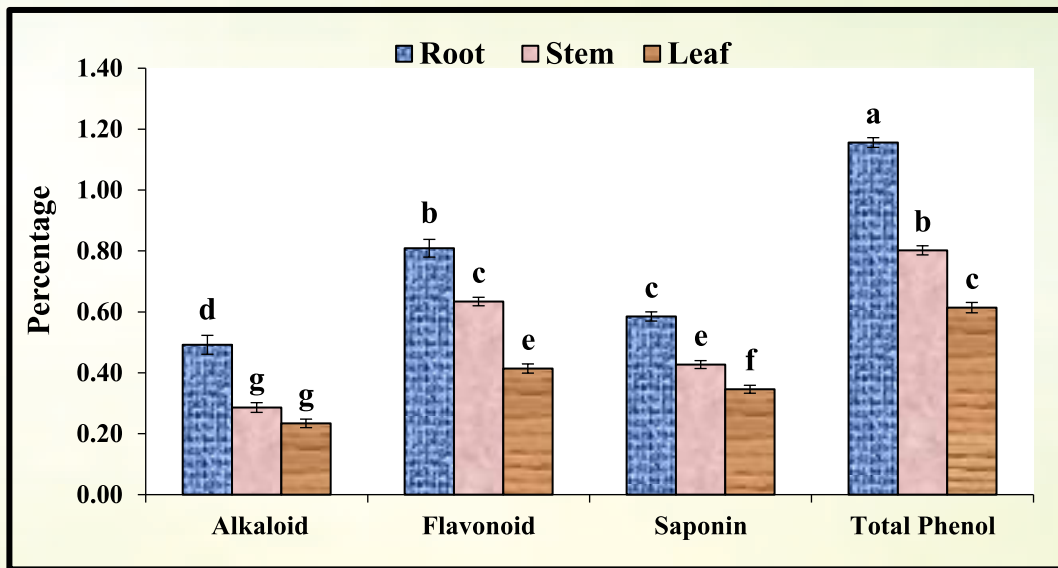


Figure 5: Alkaloids, flavonoids, saponins and total phenols in root, stem and leaf of *A. campanulatus* (ANOVA Summary:  $F_{11,24} = 193.98, p < 0.001$ , Means having different alphabets, as superscripts, are statistically significant from each other at  $p < 0.001$ ) (Based on Duncan's multiple-range test).

**Conclusion:** The present investigation is an attempt to study the ethno-medicinal importance and to extract the bioactive compound present in *Amorphophallus campanulatus* conferring immense therapeutic potentiality. The fresh root, stem and leaf samples were collected from the sample collection site of SGCARS, Bastar, Jagdalpur, Chhattisgarh, India. The samples were washed, dried and grinded in the research laboratory and subsequently extracted using four different solvents viz., chloroform, acetone, methanol, and aqueous by the Soxhlet apparatus and the extracts so obtained were subjected to qualitative phytochemical analysis which showed that more phytochemicals were extracted in methanol and acetone as compared to that of aqueous and chloroform. Furthermore, the root extract was found to contain more phytochemicals as compared to stem and leaf samples under investigation. The root methanolic extract showed the presence of more flavonoids, phytosterols, and tannins as compared to that of glycosydes, saponins, alkaloids, and

resins. Subsequently, the root, stem, and leaf samples were subjected to quantitative phytochemical analysis documented that root contains highest amount of total phenol followed by flavonoid, saponin and alkaloid followed by stem and leaf in the same order. The root contains higher amount of total phenol followed by stem and leaf. Similarly, flavonoid was found to be high in root followed by stem and leaf. Saponin was found to be more in root followed by stem and leaf. Alkaloids were also more in root followed by stem and leaf. The total phenol content was highest followed by flavonoid, saponin and alkaloid in all parts of *A. campanulatus*. The above investigation revealed that bioactive compound present in *Amorphophallus campanulatus* is of polar nature conferring tremendous therapeutic bio-efficacy. Moreover, in future active efforts will be made to purify and characterize the active compounds of *Amorphophallus campanulatus* and study its several pharmacological benefits to use it as herbal drugs for future generations.

## RELEVANCE OF FOX IN OUR LIVES

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The fox is an intelligent and clever wild animal. It is a member of the canine family. The fox has a medium-sized body, a long muzzle and sharp ears. Its tail is quite large and beautiful like a comb. Foxes are usually black and white or brown in color and are active at night. They are small animals and are usually found in forests and rural areas.

### Habit and habitat

The fox is very clever and curious. It has a long tail, sharp ears and bright eyes. The fox sleeps during the day and comes out at night to look for food. Where does the fox live? Foxes can be seen in forests, open fields, near villages, and even in the outskirts of cities. Foxes like to eat meat, sometimes eat fruits. Foxes are very brave, but also very cunning. So they always see people from afar.

The fox is mainly nocturnal, that is, it is active at night. They use their sense of smell and hearing to find food. Their diet includes small animals, birds, fruits, insects, and dead animals. Sometimes they even sneak into villages and eat chickens or ducks.

Foxes are very clever and alert animals. When in danger, they run away or hide in holes. Foxes are shown as intelligent and clever characters in many folk tales, such as the story of the “clever fox” that we have heard since childhood.

Foxes play an important role in nature. They keep the environment clean by eating dead animals and help preserve forest biodiversity. So instead of killing foxes, we



should protect their habitat and environment. Foxes are an important part of our nature—clever, hardworking, and the real cleaners of the forest!

### Role in our ecosystems

Foxes are animals of small forests, fields, and rural areas. They are not only part of our nature, but also help maintain the balance of the environment.

Foxes keep the environment clean by eating dead animals and decaying food. This reduces the chance of spreading germs and diseases. Foxes eat small animals such as rabbits, mice or insects. This keeps the number of these animals under control, which is good for crops and other living things. Foxes eat fruits and roots and spread seeds through their anus. This helps new trees grow and the forest remains fertile.

Foxes are a small but important helper of our nature. So we can keep them safe and help maintain a balanced life in nature. Foxes are an important part of our nature. They not only eat small animals and insects, but also eat the flesh of dead animals and keep the environment clean. If foxes suddenly disappear completely: the number of insects and small animals will increase, which can damage crops and gardens. The amount of dead animals and garbage will increase, which will increase the risk of disease. The balanced food chain of nature will be disrupted, that is, the balance of all animals will be disrupted. Foxes help keep our environment safe. Therefore, it is very important to protect them.

### Foxes in Indian literature, arts and traditions

Foxes are not only a part of nature, but they have also occupied a special place in Indian literature and various art forms. Foxes are generally known as cunning, clever, and opportunistic animals. These character traits not only make them part of the natural food chain; but, also make them a powerful symbolic animal in Indian literature and folklore. Foxes are often seen as a symbol of deceit, cunning, and trickery.





Foxes have been given a very important place in various Indian literatures and folklores. Fox stories are especially abundant in children's literature. For example, fox-hamiri stories, fox-dog stories, and fox-chicken stories are used to teach children moral lessons through proverbs. Foxes here symbolize deceit, cleverness, and often moral education. Many distinguished Indian children's writers have used foxes as the center of stories. Foxes are often seen as characters who use tricks to gain their own advantage, but are often punished. These stories teach children strategy and caution.

In Indian folklores, the fox is known as “cunning and deceitful”. The character of the fox has been portrayed very colorfully in rural drama, dance and mask play. In jungle tales, puppet dances and plays, the fox is often shown in cartoonistic or allegorical characters. Through this, the symbolic image of the fox has found a place in society.

The fox is not just limited to children's literature or folklore; but, in adult literature it has been used as a symbol of cunning, deceit, and sometimes intelligence. Poets and storytellers have tried to make the reader think by using the fox as a form of the moral subconscious of human society.

The presence of the fox in children's literature, folklore, drama and poetry teaches us strategy, caution, patience and

sometimes stories of lies and deceit in adult society. The complex relationship between nature and human character has been beautifully portrayed in Indian literature, art and culture through the fox.

### **Foxes in global literature, arts and tradition**

The fox has been seen as a symbol of intelligence, cunning and sometimes cunning or fraud in many cultures. The image of the fox is seen from different perspectives in the literature and works of art of different countries. In ancient Indian, Egyptian, Babylonia, Chinese and African folklores; the fox is presented as a clever and cunning animal. In Indian Pali and Sanskrit literature such as the *Badraparna* or the *Panchatantra*, the fox is described as a character who is cunning, cunning and sometimes deceives others.

Foxes are also depicted in Western literature as cunning and cunning creatures. For example, in French and English folklore, foxes are often depicted as wise and cunning predators. The fox's cunning is often used to mock human vanity or greed. Foxes are often depicted as humorous or cunning characters in children's literature and cartoons worldwide. From Japanese animation to Western cartoons, such as *Animal Farts* or storybooks, fox characters are usually used as part of educational or moral stories.

In painting, sculpture and film, foxes are often used to represent the intelligence of wildlife and their relationship with their environment. In African and Asian artwork, foxes' facial expressions and body language are often depicted as symbols of their cunning or intelligence.

In modern times, foxes have been depicted in various forms—sometimes as symbols of social justice, sometimes as symbols of human selfishness and cunning. The fox has always been discussed in world literature as an intelligent, cunning, and sometimes deceitful character. It is not only a means of entertainment, but also a powerful symbol for human character and the morality of society.

## **SILICA RECOVERY FROM RICE HUSK ASH (RHA): CONVERTING AGRICULTURAL WASTE INTO A VALUABLE RESOURCE**

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### **Rice Husk Ash: An Abundant Agro-Industrial By-Product**

Rice is a major staple crop cultivated across Asia, and rice milling generates large quantities of rice husk as a by-product. Rice husk constitutes nearly 20 percent of the paddy weight, and when it is burned for energy generation or disposal, it produces rice husk ash (RHA). Traditionally, RHA has been treated as a low-value waste and often dumped or disposed of in open areas, leading to environmental concerns. However, scientific investigations have revealed that RHA is an exceptionally rich source of silica, making it a valuable raw material for industrial applications.

### **Composition and Nature of Silica in Rice Husk Ash**

Rice husk ash typically contains 80–95 percent silica,

depending on the combustion conditions. When rice husk is burned under controlled temperatures (500–700°C), the silica formed is largely amorphous in nature, which is highly reactive and desirable for industrial use. In contrast, uncontrolled or high-temperature burning results in crystalline silica, which is less reactive and less suitable for advanced applications. Therefore, proper combustion plays a crucial role in determining the quality of silica that can be recovered from RHA.

### Need for Silica Recovery from Rice Husk Ash

The recovery of silica from RHA addresses multiple challenges simultaneously. Environmentally, it helps reduce solid waste accumulation and air pollution caused by open dumping and burning of ash. Economically, it converts an agricultural by-product into a high-value material that can replace commercially mined silica. From a sustainability perspective, silica recovery supports circular economy principles by promoting efficient resource utilization and reducing dependence on non-renewable mineral sources.

### Pre-Treatment of Rice Husk Ash

Before silica extraction, rice husk ash must be properly pre-treated to remove impurities. The ash is usually sieved to eliminate unburnt carbon and foreign particles. Washing with water helps remove soluble salts, while acid leaching using dilute hydrochloric or sulfuric acid removes metallic impurities such as iron, calcium, and magnesium. These pre-treatment steps improve the purity of the recovered silica and enhance its performance in downstream applications.

### Alkali Extraction and Acid Precipitation Method

The most widely used technique for silica recovery from RHA is alkali extraction followed by acid precipitation. In this method, pre-treated RHA is mixed with an alkaline solution, commonly sodium hydroxide, and heated. The silica present in the ash dissolves to form sodium silicate. After filtration to remove insoluble residues, the sodium silicate solution is treated with a mineral acid. As the pH decreases, silica precipitates as a gel, which is then washed, dried, and ground to obtain fine silica powder. This method can yield silica with purity exceeding 95 percent.

### Sol-Gel and Advanced Processing Techniques

For applications requiring high-purity or specialized silica, sol-gel techniques are employed. These methods allow precise control over particle size, surface area, and porosity. Sol-gel-derived silica from RHA is particularly useful in producing catalyst supports, adsorbents, specialty ceramics, and nano-silica. Although more expensive than conventional methods, these advanced techniques add significant value to the final product.



### Emerging Green and Low-Energy Approaches

Recent research has focused on developing environmentally friendly methods for silica recovery. These include the use of organic acids, microwave-assisted extraction, and bioleaching processes. Such approaches aim to reduce chemical consumption, energy requirements, and environmental impact, making silica recovery more suitable for decentralized and small-scale operations.

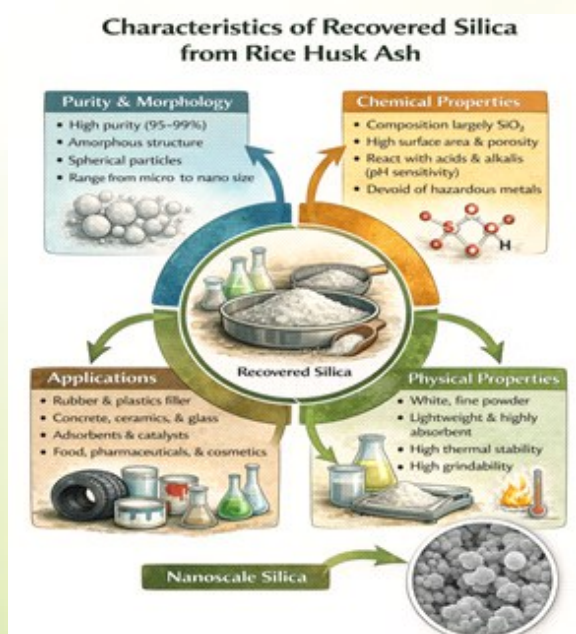
### Properties of recovered Silica from Rice husk Ash

Recovered silica from rice husk ash is a high-purity, amorphous material with versatile industrial applications. It is typically obtained as a fine white powder or nanoscale particles through alkali extraction and acid precipitation. The silica exhibits desirable chemical properties, including high surface area, porosity, and pH-sensitive reactivity, while being free of hazardous metals. Physically, it is lightweight, highly absorbent, thermally stable, and easily grindable. Its applications span multiple sectors, including rubber and plastics as a reinforcing filler, construction materials like concrete and ceramics, adsorbents and catalysts in chemical processes, and even in food, pharmaceutical, and cosmetic industries. The

nanoscale form of silica further enhances its reactivity and utility in advanced material applications.

**Table: Key Properties and Applications of Recovered Silica from Rice Husk Ash.**

Aspect	Details
Purity & Morphology	95–99% purity, amorphous structure, spherical particles, micro- to nanoscale
Chemical Properties	Largely SiO <sub>2</sub> , high surface area & porosity, pH-sensitive, free of hazardous metals
Physical Properties	White fine powder, lightweight, highly absorbent, thermally stable, easily grindable
Applications	Rubber & plastics filler, concrete, ceramics, glass, adsorbents, catalysts, food, pharmaceuticals, cosmetics
Advanced Form	Nanoscale silica with enhanced reactivity and surface area



**Applications of Recovered Silica**

Silica recovered from rice husk ash finds applications across diverse sectors. It is used as reinforcing filler in rubber and plastics, a component in cement and concrete, an ingredient in paints and coatings, and a raw material for glass and ceramic industries. High-purity silica can also be used in pharmaceuticals, cosmetics, food additives, and environmental remediation, provided it meets regulatory standards.

**Economic and Environmental Benefits**

Recovering silica from RHA offers significant economic advantages, particularly in rice-producing regions. Establishing local silica extraction units can generate employment, create new value chains, and reduce reliance on imported raw materials. Environmentally, this process minimizes waste disposal problems, reduces greenhouse gas emissions, and promotes cleaner production technologies.

**Challenges and Future Prospects**

Despite its potential, large-scale adoption of silica recovery from RHA faces challenges such as variability in ash

quality, process optimization, and initial capital costs. Increased awareness, technological innovation, and policy support are needed to encourage industrial uptake. With rising demand for sustainable materials, silica recovery from rice husk ash holds strong promise for future agro-industrial development.

**Conclusion**

Rice husk ash, once regarded as an unwanted waste, is now recognized as a valuable source of high-quality silica. Through appropriate processing techniques, this agricultural by-product can be transformed into an important industrial material. Silica recovery from RHA not only supports waste management and environmental protection but also contributes to sustainable economic growth and resource efficiency.

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## MICROPLASTICS, NANOPLASTICS & EMERGING PLASTIC PARTICLES IN COSMETICS: HUMAN EXPOSURE AND RISKS

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### Introduction

The extensive use of plastics in modern society has led to the widespread occurrence of microplastics (MPs) and nanoplastics (NPs) in environmental and biological systems. While much attention has focused on environmental degradation of large plastic debris; cosmetics and personal care products (CPCPs) represent a direct and intentional source of plastic particles which so far caught least attention from us! These products are designed for repeated application on the human body, resulting in chronic exposure through dermal contact, inhalation, and inadvertent ingestion. Although the use of plastic microbeads has been restricted in many countries, polymer-based ingredients continue to be extensively used in cosmetic formulations, giving rise to both conventional and newly emerging forms of micro- and nano-sized plastics.

### Definitions and Classification

Microplastics are generally defined as synthetic polymer particles smaller than 5 mm, whereas nanoplastics typically refer to particles in the size range below 100–1000 nm. However, the absence of a universally accepted definition has led to inconsistencies in scientific reporting and regulatory frameworks. In cosmetics, plastic particles may occur as primary microplastics intentionally manufactured at small sizes or as secondary micro- and nanoplastics formed through fragmentation of larger polymeric ingredients during product use, storage, or environmental weathering. Recent studies emphasize the need to consider micro and nanoplastics collectively, as their physicochemical properties and biological interactions often overlap.

### Emerging forms of cosmetic derived plastics

Beyond traditional microbeads, cosmetics increasingly contain novel polymeric materials that can generate micro and nano-sized plastic particles. These include polymeric film-formers, acrylate and methacrylate copolymers, multilayer glitter particles, and surface-functionalized polymers designed to improve texture, stability, or aesthetic properties. Such materials may fragment into irregularly shaped micro- or nanoplastics during

mechanical abrasion or washing. These emerging forms are particularly challenging to identify and regulate because they are often not explicitly listed as microplastics in ingredient declarations and may behave differently from classical spherical beads.

### Occurrence in cosmetic products

Microplastics have been reported in a wide range of cosmetic products, including facial and body scrubs, cleansers, shampoos, toothpastes, sunscreens, creams, lotions, and decorative cosmetics such as lipsticks and eye shadows. Commonly detected polymers include polyethylene, polypropylene, polymethyl methacrylate, polyethylene terephthalate, nylon-6, nylon-12, and various acrylate-based copolymers. While rinse-off products are considered the primary contributors to environmental release, leave-on products represent a continuous source of direct human exposure due to prolonged skin contact.

### Toxicological effects and biological interactions

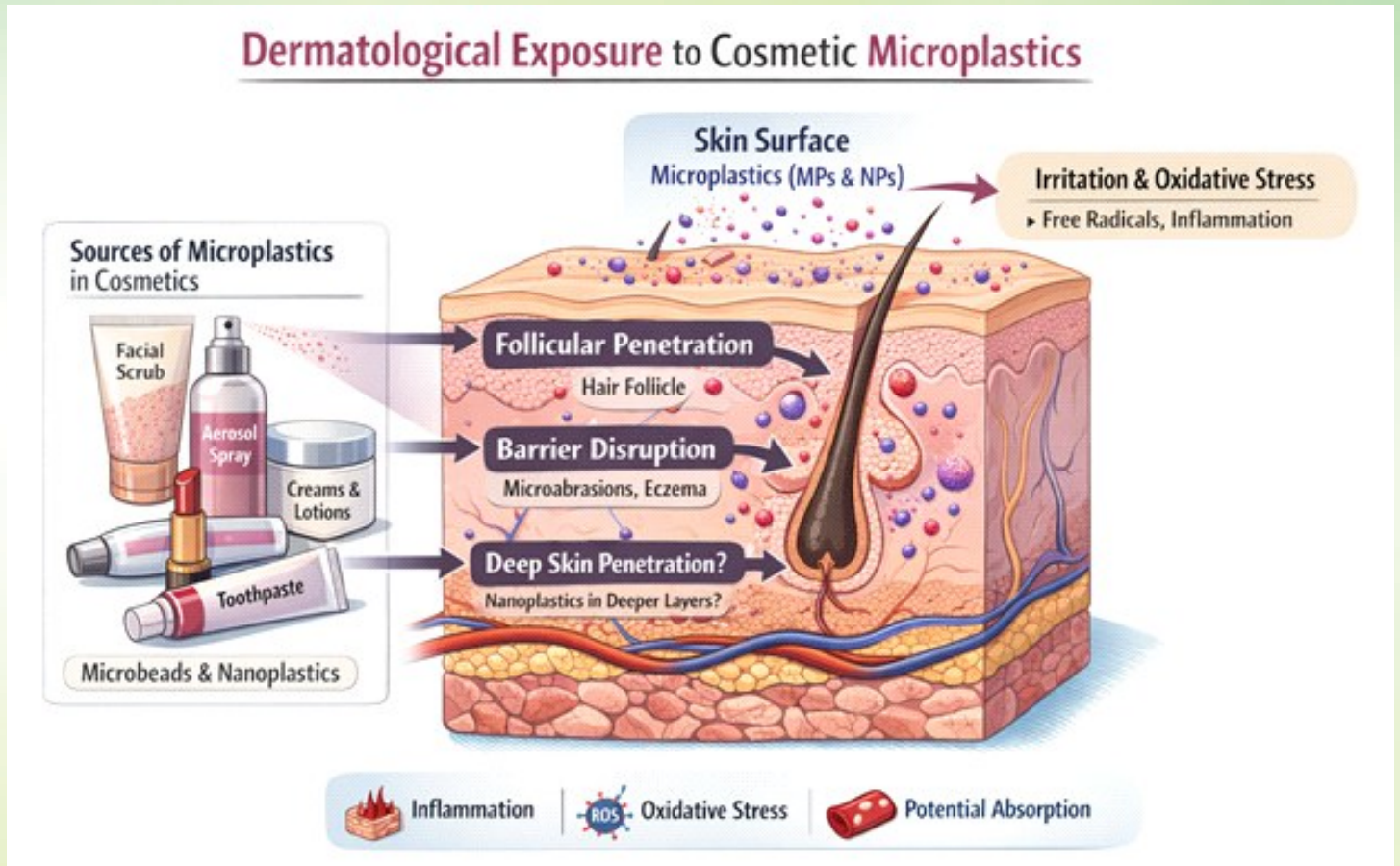
Experimental studies suggest that micro and nanoplastics can induce oxidative stress, inflammatory responses, and cytotoxic effects in skin and other cell types. Particle size, shape, surface chemistry, and polymer composition strongly influence their biological behavior. Nanoplastics, in particular, may exhibit enhanced cellular uptake and interaction with subcellular structures. In addition, plastic particles can act as carriers for chemical additives, heavy metals, and environmental pollutants, potentially amplifying their toxic effects through a “Trojan horse” mechanism. Despite growing evidence from in vitro and animal studies, data on long-term human health effects from cosmetic-derived plastics remain limited.

### Dermal Exposure and Skin Health

Microplastics and nanoplastics are intentionally added to many cosmetic and personal care formulations (e.g., exfoliants, creams, sunscreens) and can also arise from breakdown of polymeric ingredients during product use. Although intact human skin forms a robust barrier, several recent studies suggest that very small plastic particles, particularly in the nano-range, may interact with the skin surface and its deeper appendages. Evidence from dermatology research shows that MPs can accumulate in the stratum corneum and may penetrate more readily when the skin barrier is compromised (e.g., microabrasions or eczema), or through structures such as hair follicles and sweat ducts. Once present on or within skin layers, plastic particles have been associated with oxidative stress and inflammatory responses in keratinocytes, which in vitro may contribute to skin irritation, premature aging, and disrupted barrier function due to increased free radical formation and mitochondrial dysfunction. This is consistent with broader toxicology findings where microplastics induce cellular oxidative stress and cytotoxicity in mammalian cells. Importantly, while direct

evidence for deep dermal penetration of NPs in humans remains limited, the potential for dermal uptake of

nanoscale plastics warrants further investigation, especially given repetitive and long-term cosmetic use.



**Respiratory Exposure and Lung Health**

A less recognized but critical exposure pathway relevant to cosmetics is inhalation, particularly from aerosolized products such as sprays, powders and certain liquid formulations. Airborne MPs and NPs in indoor environments are increasingly documented, with studies estimating that humans may inhale tens of thousands of microplastic particles per day, many small enough to reach the lower respiratory tract. Once inhaled, plastic particles can deposit along the respiratory epithelium, triggering chronic inflammation, oxidative stress, and impaired lung function. Evidence from toxicological reviews indicates that inhaled MPs can exacerbate or contribute to respiratory disorders, including asthma, chronic obstructive pulmonary disease (COPD), and hypersensitivity pneumonitis, by eliciting immune responses and persistent inflammatory signaling in pulmonary tissues. Observations of plastic fibers in human lung tissue from autopsies underscore the reality of pulmonary exposure and raise concerns about long-term effects, although causal links to specific disease outcomes remain under study.

**Inflammation, Oxidative Stress, and Systemic Effects**

Across exposure pathways, oxidative stress and

inflammatory responses emerge as consistent mechanistic themes in experimental models of plastic particle toxicity. Micro and nanoplastics, when internalized by cells, can generate reactive oxygen species (ROS), disrupt mitochondrial function, and activate pro-inflammatory signaling cascades, potentially leading to cell damage, altered gene expression, and apoptotic cell death. These effects have been documented in vitro and in animal studies, raising concerns about how chronic exposure even at low doses might contribute to systemic low-grade inflammation over time. For example, studies have linked airborne microplastics to inflammatory changes in lung tissue and suggested potential downstream impacts on cardiovascular health, although direct causal pathways in humans have not yet been fully elucidated.

**Barrier penetration and biological distribution**

The ability of nanoplastics to penetrate biological barriers, such as the gut epithelium and potentially the placenta or blood-brain barrier, has been reported in environmental exposure studies, highlighting their small size and surface properties as critical determinants of tissue distribution. While definitive human data are still emerging, these findings suggest that nanoplastics can cross key biological boundaries once inside the body, raising questions about potential effects on

vulnerable tissues beyond the skin and lungs.

#### **Limitations, Uncertainties, and Research Needs**

It is important to acknowledge that research on human health impacts of cosmetic-derived microplastics and nanoplastics is still in its early stages. Analytical challenges complicate detection and quantification of NPs in biological tissues, and methodological variability has led to debates about reported findings in human organs. There is currently no consensus on the extent of systemic absorption of MPs/NPs from dermal exposure, and epidemiological data linking cosmetic particle exposure to specific human health outcomes are lacking. As noted in recent reviews, rigorous, standardized studies are urgently needed to clarify exposure metrics, dose–response relationships, and long-term health effects across tissues and life stages.

#### **Regulatory Status and Policy Gaps**

Several countries have implemented bans on intentionally added plastic microbeads in rinse-off cosmetics, leading to a reduction in easily identifiable sources of cosmetic microplastics. However, many polymeric ingredients used as film-formers, fillers, or stabilizers remain outside the scope of existing regulations. Nanoplastics are largely unaddressed in current policies, and the lack of harmonized definitions and analytical standards complicates regulatory enforcement. Expanding regulatory frameworks to include emerging plastic forms and sub-micron particles is increasingly recognized as a priority.

#### **Sustainable alternatives and reformulation**

In response to regulatory pressure and consumer demand, the cosmetic industry is exploring sustainable alternatives to synthetic polymers. These include natural exfoliants, biodegradable polymers, and bio-based film-forming agents. Such an example is walnut shell originated fine scrub beads/exfoliants. While such alternatives show promise, their functional performance, stability, and cost-effectiveness must be carefully evaluated to ensure successful replacement without unintended environmental or health impacts.

#### **Knowledge Gaps and Future Perspectives**

Despite growing research interest, significant knowledge

gaps remain regarding the occurrence, fate, and biological effects of micro and nanoplastics in cosmetics. Future studies should focus on developing standardized detection methods, understanding dermal and systemic exposure mechanisms, assessing long-term health effects, and evaluating the safety of alternative ingredients through life-cycle assessments. Addressing these gaps is essential for informed risk assessment and evidence-based policy development.

#### **Conclusions**

Cosmetics and personal care products are an important but often underestimated source of microplastics, nanoplastics, and emerging polymeric particles. Although regulatory actions have reduced the use of traditional microbeads, polymer-based ingredients continue to contribute to environmental contamination and direct human exposure. Advancing analytical methodologies, strengthening regulatory frameworks, and promoting sustainable formulation strategies are critical to minimizing potential risks associated with cosmetic-derived plastic particles.

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## **ISOLATION, IDENTIFICATION, CHARACTERISATION AND BIOACTIVE FROM KINGIODENDRON PINNATUM MEDICINAL PLANT**

**Sankeerthana Renuka Prasad and**

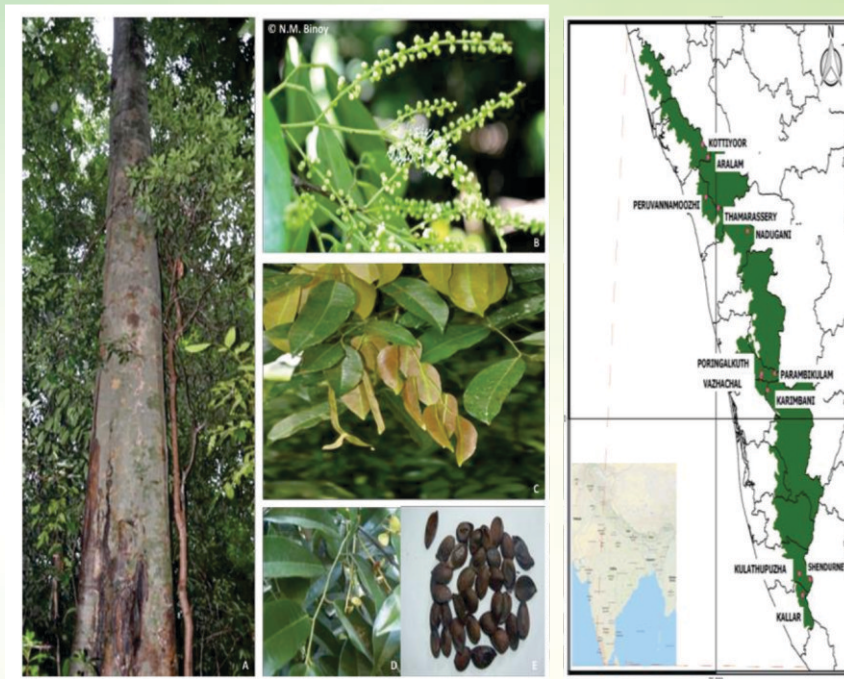
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Kingiodendron pinnatum, belonging to the Fabaceae family, is a massive evergreen tree, reaching heights of up to 40 meters, it is primarily located at altitudes between 170 and 950 meters. Which is an endemic species located in the Western Ghats of India. Particularly in some parts of Kerala, Karnataka, and Tamil Nadu. [Jose PA. *et al.* (2018)]. It is currently listed as Endangered or Vulnerable due to habitat loss and overexploitation. Known locally as Enne mara (Kannada) or Churali (Malayalam), it is prized for its reddish, oily resin and leathery pinnate leaves. [Javarappa, K. K *et al.* (2016)]



**Medicinal Applications**

**Ayurvedic Uterine Tonic:** One of its most significant applications is as a scientifically validated substitute for *Saraca asoca* (the Ashoka tree). It is used to prepare Asokarishta, a fermented tonic for treating gynecological disorders such as menorrhagia (excessive uterine bleeding). Studies confirm that it effectively reduces estrogen-induced uterine thickening.

**Anti-Inflammatory & Analgesic:** Traditionally, the bark and resin are used to treat joint pain, rheumatism, and gout. Modern research has identified Lupeol, a triterpenoid in the bark, which inhibits COX-2 enzymes to reduce swelling. Bark decoctions have shown significant pain reduction in osteoarthritis patients.

**Wound Healing:** The leaves and resin possess potent antimicrobial and healing properties. A paste of fresh leaves mixed with oil is used to accelerate wound closure by promoting collagen deposition.

**Antidiabetic & Antiobesity Potential:** Leaf extracts have demonstrated the ability to inhibit  $\alpha$ -amylase and lipoprotein lipase enzymes. This suggests a role in managing diabetes by improving glucose tolerance and aiding in weight management.

**Respiratory & Genito-Urinary Health:** The oleo-gum resin is traditionally used to treat gonorrhoea and catarrhal conditions of the respiratory and urinary tracts. It also exhibits antitubercular activity, specifically inhibiting *Mycobacterium tuberculosis* in laboratory assays.

**Phytochemical Profile**

The therapeutic efficacy of the plant is attributed to a rich array of bioactive compounds, including flavonoids,

phenols, tannins, terpenoids, and saponins. Specific compounds like Pinuspinnatin A and B provide free-radical scavenging benefits, while kaempferol derivatives may improve peripheral circulation, offering relief from diabetic neuropathy.

Despite its extensive uses, *K. pinnatum* remains under-appreciated outside of South India. Increased conservation efforts are essential to ensure the continued availability of this ecologically and medicinally significant species. [Schulz, B et.al. (2016)]

**Core Conservation Strategies**

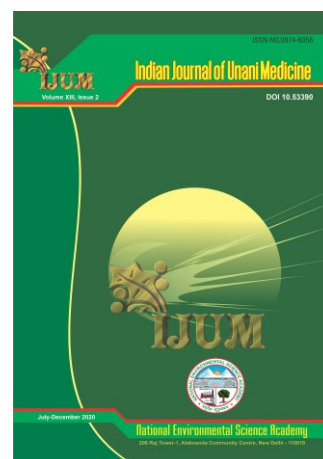
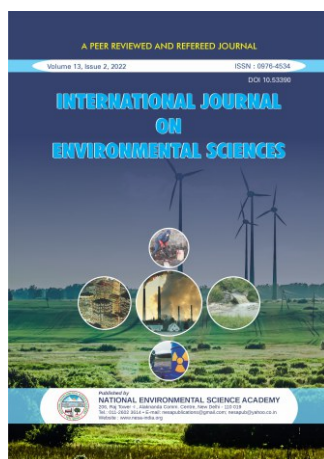
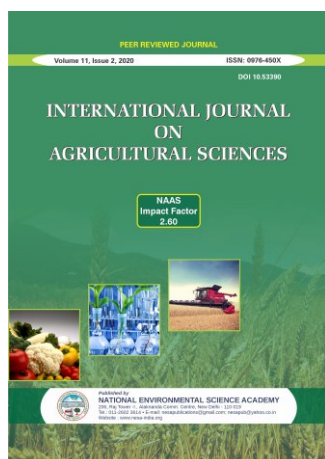
**In-situ Protection:** Priority is given to protecting natural habitats in the Southern Western Ghats. This includes maintaining the "ecological niche" in evergreen forests where the species serves as a critical canopy tree.

**Ex-situ Management:** National institutions, such as the Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI) and various Botanical Survey of India (BSI) gardens, maintain gene banks. These facilities use cryopreservation and in-vitro technology to store genetic material and ensure the species' survival outside its wild habitat.

**Restoration & Rewilding:** Localized restoration projects, particularly in regions like Wayanad, involve community nurseries that raise native saplings. These efforts aim to restore degraded lands and improve the connectivity between isolated tree patches. [Radha, R. K. et.al (2020)]

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## **NOTIFICATION NO. 3**

# **APPLICATIONS ARE INVITED FOR NESA ANNUAL AWARDS – 2025**

**LAST DATE EXTENDED TO : 31<sup>st</sup> October, 2025**



This is to notify that applications are invited for the **NESA Annual Awards 2025** from the Life Members of the Academy. The prescribed application forms for the following categories can be downloaded from our website: [www.nesa-india.org](http://www.nesa-india.org) • <https://nesa-india.org/nesa-annual-awards-2025/>

Separate applications should be submitted for independent awards. For detailed guidelines the website of NESA may be approached by log in to website: <https://nesa-india.org/nesa-annual-awards-2025/>

**The last date for all the categories of awards is 31<sup>st</sup> October, 2025**

- (1) NESA FELLOWSHIP AWARD - 2025
- (2) NESA EMINENT SCIENTIST AWARD - 2025
- (3) NESA DISTINGUISHED SCIENTIST AWARD - 2025
- (4) NESA SCIENTIST OF THE YEAR AWARD - 2025
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- (6) NESA GREEN TECHNOLOGY INNOVATIVE AWARD - 2025
- (7) WOMEN EXCELLENCE AWARD - 2025
- (8) NESA YOUNG SCIENTIST AWARD - 2025
- (9) NESA JUNIOR SCIENTIST AWARD - 2025

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