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Integrating Indian Knowledge System into Plant Science Education: Bridging Traditional and Modern Perspectives

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Abstract:

The implementation of the National Education Policy (NEP) has made the Indian Knowledge System (IKS) prominent in revitalizing subjects that were losing relevance due to the dominance of professional courses after Class XII. By integrating traditional wisdom, IKS preserves cultural heritage and ensures these subjects remain significant in modern academics. One such subject is the study of Plant sciences wherein integrating the Indian Knowledge System (IKS) fosters a comprehensive understanding by harmonizing traditional knowledge with modern scientific perspectives. Since ancient time, practices such as Ayurveda, ethnobotany, plant propagation techniques, sustainable agriculture etc., IKS provides valuable insights into plant biology, ecology, and applications (IKS, Ministry of education). Thus, by incorporating IKS into the curriculum of plant sciences, students are exposed to topics such as medicinal plant properties, indigenous farming techniques, biodiversity preservation, climate-resilient crops, and natural resource management. This interdisciplinary approach bridges the gap between classical practices and contemporary research, fostering innovation in fields like drug discovery, agroforestry, and phytochemistry. Moreover, it emphasizes sustainability, conservation, and the cultural significance of traditional practices, encouraging students to address several global challenges such as food security, climate change, and ecological degradation. The present study aims to enhance plant science by integrating IKS knowledge into the curriculum, offering examples that bridge traditional wisdom with modern scientific practices.

Key words: Plant sciences, IKS, Ayurveda, Plant biology, ethnobotany

Introduction:

The Indian Knowledge System (IKS) is an extensive and timeless repository of traditional wisdom, practices, and philosophies that have developed over centuries in the Indian subcontinent (Agarwal P and Kumar V, 2021). The integration of practical understanding with ethical and spiritual principles through the ancient texts like the Vedas, Upanishads, and Puranas, as well as oral traditions is made possible through the concept of IKS under NEP (2020) relevant to current higher education. The significance of IKS lies in its ability to address contemporary challenges by providing sustainable solutions in various fields, such as health through Ayurveda, mental well-being via Yoga, environmental balance with *Vaastu Shastra*, and logical reasoning through *Nyaya* (Banerjee S and Singh R, 2020). Thus, its interdisciplinary approach connects traditional knowledge with modern needs, offering valuable insights for sustainable development, mental health, and global education. This implies that by preserving and applying IKS system in the higher education, we enhance the knowledge of

rich cultural legacy and pave the way for inclusive growth and sustainable progress for the future (Srivastava R and Patel M, 2022).

The core subjects such as Arts, Humanities, Pure Sciences, Mathematics etc. introduced since 1940s in many Indian universities, are now on the verge of diminishing and being replaced by professional courses at a faster pace immediately after class XII. In the light of the above, the following article highlights the diminishing prominence of Plant Science as one of the core subject at the college level, in the context of its relevance to the Indian Knowledge System (IKS).

The decline of interest in plant sciences among students can be attributed to several interconnected factors: Lack of career opportunities, urbanization, dominance of modern disciplines, insufficient awareness to address global challenge, theoretical curriculum, changing student preferences etc. To reignite interest, it is essential to revamp the curriculum, promote the societal and environmental importance of plant sciences, and highlight its contributions to solving critical global issues. The following highlights the areas where improvement can help to reignite the interest among students of plant sciences.

A) Home remedies (Grandma's pouch):

The Indian Knowledge System (IKS) in home remedies is an integral part of India's cultural heritage, blending traditional wisdom with the use of natural and readily available resources to address common health issues. These remedies are rooted in centuries-old practices from Ayurveda, Siddha, and folk traditions, passed down through generations, and continue to play a significant role in Indian households today known as Grandma's pouch (National AYUSH mission). Core principles of home remedies in IKS are natural healing, boosting immunity, locally available and cost-effective plant materials and integration of remedies into rituals, cooking and lifestyle.

Table below enlists few examples of home remedies that can be reflected under IKS (referred from National AYUSH mission and Ayurveda Pharmacopeia of India):

Treatment	Home remedies	Properties
For Common Colds and Cough	Turmeric Milk (Haldi Doodh): Warm milk with turmeric, known for its anti-inflammatory and antimicrobial properties	**Curcumin** pigment possess anti-inflammatory and antioxidant properties.
	Tulsi Tea: Basil leaves boiled with ginger and honey to alleviate respiratory issues	Contains flavonoids, phenolics, terpenoids which provide antimicrobial properties, rich in antioxidants and contains many minerals and vitamins
	Honey and Ginger: A paste of ginger juice and honey helps soothe coughs.	Boost immunity and improve digestion
For Digestive Issues	**Jeera Water**: Boiling cumin seeds in water aids digestion and reduces bloating.	Good source of potassium and iron which strengthens immune system and have high vitamin C (antioxidant)
	Buttermilk with Hing (Asafoetida): Enhances gut health and treats flatulence.	Anti-spasmodic, anti-inflammatory, and anti-flatulent properties, keep you hydrated, especially in the summer
	Ajwain (Carom Seeds): Chewing ajwain with a pinch of black salt relieves indigestion.	Antibacterial and antifungal properties, which may help prevent food poisoning and other gastrointestinal issues, rich in fiber and can help with indigestion, bloating, and flatulence
For Skin and Hair Health	**Neem Paste**: A natural antiseptic to treat acne and skin infections.	Plant has potent pharmacological properties including anti-fungal, anti-bacterial, antihistamine and germ-killing qualities.

	Aloe Vera Gel: Applied for moisturizing and soothing skin irritations.	Rich in antioxidants that boost immune system, assist in blood sugar regulation, provide hydration to skin
	Amla (Indian Gooseberry): Consumed fresh or as juice to promote hair health and prevent greying	**Amla** is recognized for its high Vitamin C content, boosting immunity.
For Immunity Boosting	**Chyawanprash**: A herbal jam made from amla, honey, and over 40 medicinal herbs.	Alleviate nausea, vomiting, hyperacidity, dyspepsia, and flatulence. Also found to relieve gastritis, peptic ulcer, gut cramps, and correct the gastrointestinal functions.
	Golden Spice Mix: A blend of turmeric, black pepper, and ginger added to meals or drinks	Its active ingredient, curcumin, is an antioxidant and anti-inflammatory that helps prevent and treat chronic diseases
	Kadha: A decoction of spices like cloves, cinnamon, black pepper, and tulsi leaves to enhance immunity.	Anti-inflammatory, antiseptic, soothing and tonic effects
For Fever and Aches	**Tulsi and Black Pepper Tea**: Reduces fever naturally.	Tulsi's anti-inflammatory properties and black pepper's anti-inflammatory and antimicrobial properties can help clear respiratory passages
	Fenugreek Seeds (Methi): Soaked seeds help reduce body heat and inflammation.	Good source of protein, fiber, iron, magnesium, and other nutrients. Rich in antioxidants, which can help combat oxidative stress, Fenugreek seeds contain galactomannan, which can help regulate cholesterol levels
	Castor Oil: Applied topically for joint and muscle pain relief.	Natural laxative to treat occasional constipation. It works by stimulating the muscles in your intestines to move stool, has pain-relieving properties
For Stress and Mental Health	**Ashwagandha Tea**: Reduces stress and promotes relaxation.	Reduce stress and anxiety levels, sleeplessness and fatigue, and reduced serum cortisol levels
	Brahmi Leaves: Known for their memory-enhancing and calming properties.	Contain antioxidants, especially flavonoids, which help fight oxidative stress and protect cells
	Sandalwood Paste: Applied to the forehead for cooling and calming effects.	Antiseptic and cooling properties help reduce infection and prevent new pimples, reduces skin irritation and inflammation

Significance of home remedies in Modern Times: Emphasis on natural, chemical-free solutions, remedies are affordable and require minimal resources, complement allopathic treatments, and promote holistic healing. India's **AYUSH Ministry** encourages the documentation, promotion, and integration of traditional practices, including home remedies, into mainstream healthcare. Initiatives like **Ayushman Bharat** promote the inclusion of Ayurveda in health and wellness centres. **Traditional Knowledge Digital Library (TKDL)** documents traditional plant knowledge to prevent biopiracy.

B) Medicinal Botany in Indigenous Knowledge Systems (IKS):

Medicinal botany refers to the study and application of plants for their therapeutic properties. it forms a cornerstone of traditional healthcare, combining empirical knowledge passed through generations and is an integral part of **Indigenous Knowledge Systems (IKS)**. The following table enlists few examples of medicinal plants commonly used in the treatment of various ailments (referred from National AYUSH mission):

Treatment	Medicinal Plants and its purpose	Properties
a) Digestive Disorders:	Amla (Indian Gooseberry): Improves digestion, relieves acidity, and enhances metabolism.	High in Vitamin C; acts as a mild laxative and aids in nutrient absorption.
	Chebulic Myrobalan: treats constipation, bloating, and indigestion	Known as a natural colon cleanser and mild laxative
	Ajwain (Carom Seeds): Alleviates gas, acidity, and abdominal discomfort.	Contains thymol, which enhances digestive enzyme activity.
	Ginger: Reduces nausea, vomiting, and indigestion	Anti-inflammatory and promotes gastric motility.
	Triphala: Aids in constipation, detoxification, and general digestive health	Balances all three doshas (Vata, Pitta, Kapha).
	Fennel (Saunf): Relieves bloating, flatulence, and colic	Rich in essential oils that stimulate digestion and reduce spasms.
	Peppermint: Treats irritable bowel syndrome (IBS), flatulence, and indigestion.	Soothes the digestive tract and relieves spasms.
	Licorice (Mulethi): Soothes gastric ulcers, reduces acidity, and promotes gut health	Anti-inflammatory and mucoprotective properties
	Aloe Vera: Relieves constipation and soothes the gastrointestinal tract.	Contains anthraquinones, which act as natural laxatives.
	Tulsi (Holy Basil): Alleviates acidity and gastric ulcers.	Reduces stress-induced digestive issues and enhances digestion.
	Curry Leaves: Stimulates digestion and relieves diarrhoea and nausea	Rich in antioxidants and supports liver function
	Asafoetida (Hing): Reduces flatulence, bloating, and abdominal pain	Acts as a natural antispasmodic and carminative
b) Respiratory Problems	Tulsi (Holy Basil): treats cough, asthma, bronchitis, and cold	Has antimicrobial, anti-inflammatory, and immune-boosting properties.
	Vasaka (Malabar Nut): Treats asthma, bronchitis, and chronic cough	Contains vasicine, a bronchodilator and expectorant that relieves respiratory congestion
	Mulethi (Licorice): Alleviates throat irritation, cough, and bronchial inflammation.	Soothes mucous membranes and has anti-inflammatory properties.
	Ginger: treats cough, cold, and sore throat; aids in clearing mucus.	Acts as an anti-inflammatory and bronchodilator
	Ashwagandha (Indian Ginseng): Helps in respiratory weakness and boosts immunity.	Adaptogenic properties reduce stress-induced respiratory issues.
	Andrographis: Treats respiratory infections like colds and flu.	Antiviral and anti-inflammatory properties
	Eucalyptus: relieves congestion, clears nasal passages, and treats bronchitis	Contains cineole, which acts as an expectorant and decongestant.

	Turmeric: Helps in reducing inflammation in respiratory diseases like asthma and bronchitis	Contains curcumin, which has potent anti-inflammatory and antimicrobial properties.
	Thyme: treats bronchitis, cough, and throat infections.	Contains thymol, which acts as an antimicrobial and expectorant.
c) Pain Relief:	Ashwagandha: relieves joint pain, muscle pain, and stress-related body aches.	Anti-inflammatory and adaptogenic properties reduce chronic pain and inflammation
	Nirgundi: Relieves joint pain, muscle pain, and headaches	Anti-inflammatory and analgesic properties soothe pain and swelling.
	Clove: relieves toothaches, headaches, and joint pain.	contains eugenol, a natural analgesic with numbing effects.
	Guggul: Treats arthritis pain, joint stiffness, and muscle pain.	Anti-inflammatory properties reduce joint swelling and discomfort.
	Eucalyptus: alleviates muscle pain, headaches, and joint pain.	Eucalyptus oil has a cooling effect and improves circulation for pain relief.
d) Diabetes Management	Jamun: regulates blood sugar levels and improves insulin sensitivity.	The seeds contain jamboline and ellagic acid, which slow down the conversion of starch into sugar
	Bitter Gourd (Karela): Manages type 2 diabetes by reducing blood sugar levels.	Contains charantin and polypeptide-p, which mimic insulin and enhance glucose uptake by cells.
	Neem: Helps control blood sugar and prevents diabetes-related complications.	Acts as a natural hypoglycemic agent and enhances insulin receptor sensitivity
	Fenugreek (Methi): reduces fasting blood sugar levels and improves glucose tolerance.	Rich in soluble fiber, which slows carbohydrate absorption and improves insulin function.
	Indian Gooseberry: improves pancreatic function and controls blood sugar	High in Vitamin C, it helps reduce oxidative stress and boosts insulin secretion
	Triphala: Enhances glucose metabolism and reduces oxidative stress.	Balances blood sugar levels and detoxifies the body
	Shatavari: Supports pancreatic function and insulin secretion.	Adaptogenic and antioxidant properties improve glucose regulation.

Major Challenges in the field of Medicinal Botany:

- Loss of passing traditional knowledge from elders in the communities is the main cause of concern
- Rapid modernization in the scientific research and development
- Overexploitation of key species of medicinal plants due to huge demand in the global markets for medicinal plants
- Disputes arising related to Intellectual property rights involving pharmaceutical companies/organizations commercializing traditional knowledge without benefiting the communities involved.
- Proper documentation of indigenous medicinal knowledge and maintenance in the form of digital repositories for future research.

Modern Relevance of IKS in Medicinal Botany can be integrated with a structured framework in the following areas and can preserve indigenous medicinal knowledge (Mohanty A and Singh V. 2021):

- Pharmaceutical and Natural Plant based research
- Complementary Medicine
- Collaborative Projects such as ethnobotanical Database initiatives etc.

C) Biodiversity Conservation:

Biodiversity conservation refers to the protection, sustainable use, and restoration of the diversity of ecosystems, species, and genetic resources. It is deeply embedded in cultural, spiritual, and ecological practices such as indigenous communities have maintained biodiversity for centuries through sustainable practices, which are increasingly recognized as vital in addressing modern environmental challenges in IKS. The knowledge about the biodiversity can create a holistic view in terms of understanding the symbiotic relationships between humans with their environment, adapted to a localized ecosystems and helps in knowledge transfer over generations through oral traditions, rituals, and daily practices. One of the practices is to have Sacred Groves. Specific forests, water bodies, or landscapes are considered sacred and protected for spiritual and cultural reasons. These areas often harbour high biodiversity due to restrictions on human activities. These groves act as "mini-biospheres," maintaining the ecological balance by preserving water sources, preventing soil erosion, and regulating microclimates (Kumar N and Rao K, 2021). For example, certain sacred groves in the Western Ghats, a biodiversity hotspot in India, harbor unique flora and fauna that are crucial for ecosystem stability such as *Kalbhairvanatha, Kudavale, Ratanwadi, Udhadavne* Sacred Groves (from Maharashtra state) etc. These protect rare, threatened and endemic species of plants and animals and are also an important landscape features in the deforested hill ranges of the Western Ghats of Maharashtra. Some trees that are worshipped in these sacred groves include: Banyan tree (*Ficus benghalensis*), Peepal tree (*Ficus religiosa*), *Borassus*, *Alstonia scholaris*, *Antiaris toxicaria*, *Hopea parviflora*, *Strychnos nux-vomica* etc.

Modern Relevance of IKS in Biodiversity Conservation:

- Climate Change Adaptation**:** Indigenous knowledge helps communities adapt to climate variability by:
- Using drought-resistant crops and traditional water conservation techniques.
- Observing ecological indicators to predict environmental changes.
- Indigenous communities contribute to reforestation, wetland restoration, and soil regeneration using traditional practices. *Example*: The Bishnoi community in India has conserved wildlife and forests for over 500 years.

Conclusion

By blending the ancient wisdom of the Indian Knowledge System with modern plant sciences, we can develop sustainable solutions for agriculture, healthcare, and biodiversity conservation. This synergy not only honours India's rich heritage but also addresses contemporary challenges such as climate change, food security, and environmental.

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