World Journal of Botany
www.worldbotanyjournal.com
Online ISSN:
Received: 04-07-2025, Accepted: 03-08-2025, Published: 18-08-2025
Volume 1, Issue 1, Jul-Sep, 2025, Page No. 1-7

Ethnobotanical survey on natural dye yielding plants in Bilaspur District of Himachal Pradesh, India

Sanjeev Kumar
Associate Professor, Department of Botany, Govt College, Bilaspur, Himachal Pradesh, India

Abstract
The ethnobotanical survey conducted in Bilaspur District, Himachal Pradesh, India, documents the traditional knowledge and utilization of natural dye-yielding plants among local communities. This study explores the rich biodiversity of the region, focusing on plant species used for dyeing textiles, handicrafts, and other cultural artifacts. Through field surveys, interviews with indigenous communities, and consultations with local artisans, 25 plant species belonging to 18 families were identified as sources of natural dyes. These plants provide a spectrum of colors, including red, yellow, blue, and green, derived from various plant parts such as leaves, roots, bark, and flowers. The survey highlights the ecological and cultural significance of these plants, emphasizing their role in sustainable practices and local economies. Traditional extraction methods, including boiling, fermentation, and sun-drying, were recorded, alongside challenges such as declining traditional knowledge and habitat degradation due to modernization and deforestation. The study underscores the need for conservation of these plant species and documentation of ethnobotanical knowledge to preserve cultural heritage and promote eco-friendly dyeing practices. Recommendations include integrating these plants into sustainable textile industries and raising awareness among younger generations to ensure the continuity of traditional knowledge. This survey contributes to the global understanding of ethnobotanical resources and their potential in fostering environmentally conscious practices in the face of synthetic dye dominance.

Keywords: Ethnobotany, natural dyes, Bilaspur, Himachal Pradesh, traditional knowledge, plant biodiversity, sustainable practices, textile dyeing

Introduction

The use of natural dyes derived from plants has been an integral part of human culture for centuries, deeply rooted in traditional practices across the globe. In India, a country renowned for its rich biodiversity and cultural heritage, natural dyes have played a significant role in textile production, religious ceremonies, and artistic expressions. The Bilaspur District of Himachal Pradesh, nestled in the foothills of the Himalayas, is a region characterized by diverse flora and indigenous communities with a wealth of ethnobotanical knowledge. This survey aims to document the natural dye-yielding plants of Bilaspur, exploring their traditional uses, ecological significance, and potential for sustainable applications in modern contexts.

Himachal Pradesh, with its varied topography ranging from low hills to high-altitude mountains, hosts a unique array of plant species adapted to its climatic and ecological conditions. Bilaspur, located in the Shivalik range, experiences a subtropical climate with temperatures ranging from 5°C in winter to 40°C in summer, and an annual rainfall of approximately 1,200 mm. This climatic diversity supports a wide variety of vegetation, including forests, grasslands, and agricultural landscapes, which provide resources for local communities. The district is home to several ethnic groups, including the Gujjar, Gaddi, and other indigenous communities, who have historically relied on local flora for food, medicine, and dyes. The traditional knowledge of these communities, passed down through generations, forms the backbone of this ethnobotanical study.

Natural dyes, derived from plant parts such as leaves, roots, bark, flowers, and fruits, offer an eco-friendly alternative to synthetic dyes, which are often associated with environmental pollution and health hazards. In Bilaspur, natural dyes have been used for coloring traditional textiles, such as Kullu shawls, handwoven fabrics, and other handicrafts, as well as for cultural practices like decorating homes during festivals. The vibrant colors produced by plants—ranging from deep reds and yellows to blues and greens—are not only aesthetically pleasing but also carry cultural significance, often symbolizing prosperity, protection, or spiritual values. For instance, turmeric (Curcuma longa) is widely used for its bright yellow hue, associated with auspiciousness in Indian traditions.

The methodology of this survey involved a combination of field observations, structured interviews, and participatory approaches with local artisans, farmers, and elders in Bilaspur. Over a period of 12 months, researchers visited rural and semi-urban areas across the district, including villages like Ghumarwin, Jhandutta, and Bilaspur town, to document plant species and their dyeing applications. Informants, primarily women and elderly community members, shared insights into plant identification, dye extraction techniques, and their cultural uses. The survey recorded 25 plant species from 18 botanical families, including well-known dye-yielding plants like Rubia cordifolia (Indian madder) for red, Butea monosperma (flame of the forest) for orange-yellow, and Indigofera tinctoria for blue. These plants were found in diverse habitats, including forests, riverbanks, and cultivated fields, reflecting the region's ecological richness.

Traditional dye extraction methods in Bilaspur are diverse and sustainable, often involving minimal environmental impact. Common techniques include boiling plant material in water, fermenting leaves or roots, and sun-drying extracts to concentrate pigments. Mordants, such as alum and iron

salts, are used to fix dyes to fabrics, enhancing color fastness. These practices, however, are at risk of being lost due to the increasing availability of synthetic dyes, which are cheaper and easier to use but environmentally harmful. The survey also identified challenges such as habitat loss due to deforestation, urbanization, and agricultural expansion, which threaten the availability of dye-yielding plants. Additionally, younger generations in Bilaspur are increasingly disconnected from traditional practices, leading to a decline in ethnobotanical knowledge.

The significance of this study lies in its contribution to the preservation of cultural and ecological heritage. By documenting the ethnobotanical knowledge of Bilaspur's communities, this survey highlights the potential of natural dyes in promoting sustainable textile industries. Natural dyes align with global efforts to reduce the environmental footprint of textile production, which is responsible for significant water pollution and carbon emissions. Furthermore, the cultivation and sustainable harvesting of dye-yielding plants can support local economies, providing income opportunities for rural communities. For example, plants like Lawsonia inermis (henna) and Terminalia chebula (myrobalan) are not only used for dyes but also have medicinal and commercial value, making them viable candidates for agroforestry initiatives.

This survey also underscores the need for conservation strategies to protect dye-yielding plant species. Many of these plants are wild-harvested, and overexploitation, coupled with habitat degradation, poses a threat to their survival. Initiatives such as community-based conservation programs, ex-situ cultivation, and awareness campaigns can help safeguard these resources. Additionally, integrating traditional knowledge into modern education systems can ensure its transmission to future generations. Collaboration between local communities, researchers, and policymakers is essential to create a framework for sustainable use of natural dyes, balancing cultural preservation with economic development.

In conclusion, the ethnobotanical survey of natural dye-yielding plants in Bilaspur District provides a comprehensive understanding of the region's botanical and cultural wealth. By documenting the diversity of dye-yielding plants and their traditional applications, this study contributes to the global discourse on sustainable practices and ethnobotanical conservation. The findings advocate for the revival of natural dyeing practices, not only to preserve the cultural heritage of Bilaspur but also to promote environmentally conscious alternatives in the textile industry. Future research should focus on phytochemical analysis of these plants to explore their dyeing potential further and develop standardized extraction methods for commercial applications.

Methods

The ethnobotanical survey on natural dye-yielding plants in Bilaspur District, Himachal Pradesh, was conducted over a 12-month period from June 2024 to May 2025, targeting rural and semi-urban areas known for their rich biodiversity and traditional practices. The study employed a combination of qualitative and quantitative methods to document plant species, their uses in natural dyeing, and associated traditional knowledge. The methodology was designed to ensure comprehensive data collection while respecting the cultural sensitivities of local communities.

Study Area

Bilaspur District, located in the Shivalik hills of Himachal Pradesh, was selected due to its diverse flora and long-standing ethnobotanical traditions. The district spans an area of approximately 1,167 km², with elevations ranging from 300 to 1,900 meters above sea level. The subtropical climate, characterized by hot summers (up to 40°C), cold winters (down to 5°C), and an annual rainfall of about 1,200 mm, supports varied vegetation, including subtropical forests, grasslands, and agroecosystems. Key study sites included villages such as Ghumarwin, Jhandutta, Beri, and areas around Bilaspur town, chosen for their proximity to forests and active artisan communities.

Data Collection

Data were collected through field surveys, structured interviews, focus group discussions, and participant observations. A purposive sampling technique was used to select 120 informants, including 70 women and 50 men, aged between 25 and 80 years, from indigenous communities such as the Gujjar, Gaddi, and other local groups. Informants were chosen based on their knowledge of traditional dyeing practices, identified with the help of village heads and local non-governmental organizations. Interviews were conducted in Hindi and local dialects, with informed consent obtained from all participants. A semi-structured questionnaire was used to gather information on plant species, parts used, dye colors, extraction methods, mordants, and cultural significance. Open-ended questions allowed informants to share detailed narratives about traditional practices.

Field surveys involved transect walks with knowledgeable informants to identify and collect specimens of dye-yielding plants. Botanical samples were collected ethically, ensuring minimal environmental impact, and were identified using regional floras and validated by botanists at the Himachal Pradesh Agricultural University. Voucher specimens were deposited at the university's herbarium for future reference. GPS coordinates of collection sites were recorded to map the distribution of plant species across different habitats, such as forests, riverbanks, and farmlands.

Data Analysis

Qualitative data from interviews and focus groups were analyzed using thematic analysis to identify recurring themes, such as traditional extraction techniques and challenges in knowledge transmission. Quantitative data, including the number of plant species and their frequency of use, were analyzed using descriptive statistics. The Use Value (UV) index was calculated for each plant species to assess its relative importance in dyeing practices, using the formula $UV = \Sigma U/n$, where U is the number of citations per species and n is the total number of informants. Plant species were categorized by family, plant part used, and dye color to understand their diversity and applications.

Ethical Considerations

The study adhered to ethical guidelines, ensuring informed consent, confidentiality, and respect for indigenous knowledge. Participants were informed of the study's objectives and their right to withdraw at any time. Prior approval was obtained from local community leaders, and the research complied with the Convention on Biological Diversity's principles on access and benefit-sharing.

Challenges and Limitation

Challenges included limited access to remote areas during the monsoon season and reluctance from some younger informants to share knowledge due to declining interest in traditional practices. The study mitigated these by scheduling field visits during dry seasons and engaging community elders to encourage participation. Despite these efforts, the sample size was limited to 120 informants, which may not fully represent the entire district's diversity.

Results

The ethnobotanical survey in Bilaspur District identified 25 plant species from 18 botanical families used as sources of natural dyes by local communities. These plants, found across diverse habitats such as subtropical forests, riverbanks, and cultivated fields, produce a wide range of colors, including red, yellow, blue, green, and brown, used primarily for dyeing textiles, handicrafts, and cultural artifacts. The results provide insights into the botanical diversity, traditional extraction methods, cultural significance, and challenges associated with these dye-yielding plants.

Plant Species and Their Distribution

The 25 identified plant species belonged to families such as Rubiaceae, Fabaceae, Asteraceae, and Moraceae, reflecting the rich biodiversity of Bilaspur's ecosystems. Table 1 summarizes the key species, their botanical names, families, parts used, and resulting dye colors.

Table 1: Dye-Yielding Plants of Bilaspur District

Botanical Name	Family	Part Used	Dye Color	Habitat	Use Value (UV)
Rubia cordifolia	Rubiaceae	Root	Red	Forests, Hills	0.85
Butea monosperma	Fabaceae	Flower	Orange-Yellow	Forests, Plains	0.78
Indigofera tinctoria	Fabaceae	Leaf	Blue	Riverbanks, Fields	0.82
Curcuma longa	Zingiberaceae	Rhizome	Yellow	Cultivated Fields	0.90
Lawsonia inermis	Lythraceae	Leaf	Orange-Red	Gardens, Plains	0.75
Terminalia chebula	Combretaceae	Fruit	Brown-Yellow	Forests	0.70
Tagetes erecta	Asteraceae	Flower	Yellow-Orange	Gardens, Fields	0.65
Acacia catechu	Fabaceae	Bark	Brown	Forests	0.60
Ficus religiosa	Moraceae	Bark	Brown	Villages, Forests	0.55
Rheum emodi	Polygonaceae	Root	Yellow-Red	Hills	0.50

Note: The table includes 10 representative species for brevity; the full list of 25 species was documented.

The most frequently cited species included Curcuma longa (UV = 0.90), Rubia cordifolia (UV = 0.85), and Indigofera tinctoria (UV = 0.82), indicating their high cultural and practical significance. These plants were distributed across varied habitats, with 60% found in natural ecosystems (forests and riverbanks) and 40% in cultivated or semi-cultivated areas. GPS mapping revealed that species like Indigofera tinctoria were abundant along the Sutlej River, while Rubia cordifolia was more common in higher-altitude forested areas.

Dye Extraction and Application

Traditional dye extraction methods were predominantly manual and eco-friendly. The most common techniques included:

- **Boiling:** Used for 70% of species, such as Rubia cordifolia roots and Butea monosperma flowers, where plant material was boiled in water for 1–2 hours to release pigments.
- **Fermentation:** Applied to Indigofera tinctoria leaves, soaked in water for 24–48 hours to produce indigo blue through oxidation.
- **Sun-Drying:** Used for Curcuma longa rhizomes, dried and powdered to create a concentrated yellow dye.
- **Maceration:** Employed for soft plant parts like Tagetes erecta flowers, crushed and soaked to extract pigments.

Mordants, such as alum (used by 80% of informants), iron salts (15%), and plant-based tannins (5%), were applied to enhance color fastness and variety. For example, alum with Rubia cordifolia produced a vibrant red, while iron salts yielded darker shades. The dyed products, primarily cotton and wool fabrics, were used for traditional clothing (e.g., Kullu shawls), household items, and festival decorations. Informants reported that natural dyes were preferred for their non-toxic nature and cultural significance, with turmeric-dyed fabrics often used in religious ceremonies.

Cultural and Economic Significance

The survey revealed that natural dyes are deeply embedded in Bilaspur's cultural fabric. For instance, yellow dyes from Curcuma longa and Tagetes erecta were associated with auspiciousness and used in weddings and festivals like Diwali. Red dyes from Rubia cordifolia symbolized protection and were applied to sacred threads and textiles. The Gaddi and Gujjar communities emphasized the spiritual value of these dyes, linking them to ancestral traditions.

Economically, dye-yielding plants supported small-scale livelihoods, particularly for women artisans. Approximately 40% of informants sold dyed products in local markets, generating supplementary income. Plants like Lawsonia inermis and Terminalia chebula were also harvested for their medicinal and commercial value, enhancing their economic importance.

Challenges and Threats

The survey identified several challenges threatening the sustainability of natural dyeing practices:

- **Decline in Traditional Knowledge:** Only 20% of informants under 35 years were actively engaged in dyeing practices, indicating a generational gap. Elders noted that younger community members preferred synthetic dyes for their ease of use.
- **Habitat Degradation:** Deforestation and agricultural expansion reduced the availability of wild species like

Rheum emodi and Acacia catechu. Approximately 30% of informants reported difficulty accessing these plants.

- **Competition from Synthetic Dyes:** Synthetic dyes, being cheaper and more vibrant, were used by 25% of artisans alongside natural dyes, reducing demand for traditional methods.

- **Lack of Documentation:** Prior to this study, little systematic documentation existed, risking the loss of knowledge due to oral transmission.

Conservation and Future Prospects

The results underscore the need for conservation of dye-yielding plants and their habitats. Community-based initiatives, such as seed banks and cultivation of species like Curcuma longa and Lawsonia inermis, were suggested by 60% of informants. Awareness programs targeting youth were proposed to revive interest in natural dyeing. The survey also identified potential for integrating these plants into sustainable textile industries, with species like Indigofera tinctoria showing promise for commercial cultivation due to global demand for natural indigo.

Discussion

The diversity of dye-yielding plants in Bilaspur highlights the region's ecological and cultural richness. The high Use Value of species like Curcuma longa and Rubia cordifolia reflects their versatility and cultural importance. However, the decline in traditional knowledge and habitat loss necessitates urgent action. The documented extraction methods, being eco-friendly, offer a model for sustainable dyeing practices globally. Future research should focus on phytochemical analysis to optimize dye yield and explore commercial applications, while conservation efforts should prioritize protecting wild populations and promoting cultivation.

Discussion

The ethnobotanical survey of natural dye-yielding plants in Bilaspur District, Himachal Pradesh, provides a comprehensive insight into the region's rich botanical diversity and cultural heritage. The identification of 25 plant species from 18 botanical families underscores the ecological wealth of Bilaspur's subtropical landscapes, which support a variety of dye-yielding plants across forests, riverbanks, and cultivated fields. These findings align with broader ethnobotanical studies in the Himalayan region, where diverse flora has historically supported traditional practices (Sharma *et al*., 2019) [13]. The high Use Value (UV) indices of species such as *Curcuma longa* (UV = 0.90), *Rubia cordifolia* (UV = 0.85), and *Indigofera tinctoria* (UV = 0.82) reflect their prominence in local dyeing practices, likely due to their vibrant colors, ease of extraction, and cultural significance. This section discusses the implications of these findings in the context of cultural preservation, ecological sustainability, economic potential, and challenges facing traditional dyeing practices in Bilaspur.

Botanical and Ecological Significance

The diversity of dye-yielding plants in Bilaspur highlights the region's ecological adaptability, with species distributed across varied habitats. For instance, *Indigofera tinctoria* thrives along the Sutlej River's moist banks, while *Rubia cordifolia* is prevalent in higher-altitude forests. This distribution reflects the influence of Bilaspur's subtropical climate and varied topography, which ranges from 300 to 1,900 meters above sea level. The survey's documentation of 18 botanical families, including Rubiaceae, Fabaceae, and Zingiberaceae, mirrors findings from other Himalayan regions, such as Uttarakhand, where similar families dominate dye-yielding flora (Tiwari *et al*., 2020) [15]. The ecological significance of these plants extends beyond dyeing, as species like *Terminalia chebula* and *Lawsonia inermis* also have medicinal and commercial applications, making them valuable for agroforestry and conservation initiatives.

The survey's focus on sustainable harvesting practices, such as collecting only specific plant parts (e.g., roots of *Rubia cordifolia* or leaves of *Indigofera tinctoria*), aligns with traditional ecological knowledge that minimizes environmental impact. However, the reported decline in wild populations of species like *Rheum emodi* and *Acacia catechu* due to deforestation and agricultural expansion raises concerns about habitat degradation. These findings echo global trends, where overexploitation and habitat loss threaten ethnobotanical resources (Cunningham, 2001) [2]. The integration of dye-yielding plants into community-based conservation programs, such as seed banks or ex-situ cultivation, could mitigate these threats while ensuring sustainable access to these resources.

Cultural and Social Relevance

The cultural significance of natural dyes in Bilaspur is profound, as evidenced by their use in traditional textiles, religious ceremonies, and festivals. Colors like yellow from *Curcuma longa* and red from *Rubia cordifolia* carry symbolic meanings, representing auspiciousness and protection, respectively. These associations are deeply rooted in the traditions of the Gaddi and Gujjar communities, who view dyeing as an integral part of their cultural identity. The prominence of women artisans in dyeing practices highlights the gendered nature of this knowledge, with 70% of informants being women. This aligns with studies in other Indian regions, where women are primary custodians of ethnobotanical knowledge (Kala, 2015) [5].

However, the survey revealed a significant generational gap, with only 20% of informants under 35 years actively engaged in dyeing practices. This decline is attributed to the allure of synthetic dyes, which are cheaper and more accessible, and the broader shift toward modernization among younger generations. The loss of traditional knowledge poses a risk to Bilaspur's cultural heritage, as oral transmission, the primary mode of knowledge transfer, is waning. Comparative studies in Rajasthan and Northeast India report similar trends, where globalization and urbanization have eroded traditional practices (Mahanta & Tiwari, 2005) [7]. To counter this, educational initiatives that integrate ethnobotanical knowledge into school curricula or community workshops could foster interest among youth, ensuring the continuity of these practices.

Economic Potential and Sustainability

The economic potential of natural dye-yielding plants in Bilaspur is significant, particularly for rural communities. The survey noted that 40% of informants sold dyed

products, such as Kullu shawls and handwoven fabrics, in local markets, providing supplementary income. Species like *Lawsonia inermis* and *Terminalia chebula* offer additional economic value due to their medicinal and commercial applications, aligning with global trends toward natural products. The growing demand for eco-friendly textiles in international markets presents an opportunity to scale up natural dyeing practices in Bilaspur. For instance, *Indigofera tinctoria*, a source of natural indigo, is highly sought after in sustainable fashion industries, with global indigo markets projected to grow (Market Research Future, 2023) [8].

The eco-friendly nature of traditional dye extraction methods—boiling, fermentation, and sun-drying—offers a sustainable alternative to synthetic dyes, which contribute to water pollution and carbon emissions in textile industries. The use of natural mordants like alum and plant-based tannins further enhances the environmental credentials of these practices. However, scaling these methods for commercial use requires addressing challenges such as inconsistent dye quality and labor-intensive processes. Phytochemical analysis of key species, as suggested in the results, could optimize pigment extraction and standardization, making natural dyes competitive with synthetic alternatives. Collaborative efforts between artisans, researchers, and policymakers could facilitate the development of small-scale dyeing enterprises, boosting local economies while preserving cultural heritage.

Challenges and Recommendations

The survey identified several challenges threatening the sustainability of natural dyeing in Bilaspur. The decline in traditional knowledge, driven by disinterest among younger generations, is a critical issue. Community-based workshops and training programs, potentially supported by local NGOs or government schemes, could address this by engaging youth in hands-on dyeing activities. The loss of plant habitats due to deforestation and agricultural expansion, reported by 30% of informants, necessitates conservation strategies. In-situ conservation, such as protected forest areas, and ex-situ cultivation of high-value species like *Curcuma longa* and *Indigofera tinctoria* could ensure long-term availability. These efforts should be coupled with awareness campaigns to highlight the ecological and cultural value of these plants.

Competition from synthetic dyes, noted by 25% of artisans, poses another challenge. Synthetic dyes offer vibrant colors and ease of use but are associated with environmental and health risks. Promoting the unique qualities of natural dyes, such as their non-toxic nature and cultural significance, could enhance their market appeal. Certification schemes, such as "eco-friendly" or "heritage" labels, could differentiate natural dye products in local and global markets, as seen in successful models in Gujarat's Kutch region (Vankar, 2017) [16].

Future Research Directions

The survey's findings lay the groundwork for further research into Bilaspur's dye-yielding plants. Phytochemical studies to identify active dye compounds and optimize extraction methods could enhance the commercial viability of these plants. For example, analyzing anthraquinones in *Rubia cordifolia* or indigotin in *Indigofera tinctoria* could lead to standardized dyeing protocols. Additionally, ecological studies on the population dynamics of wild species could inform conservation strategies. Socioeconomic research exploring the feasibility of natural dye-based enterprises in Bilaspur could provide actionable insights for policymakers and entrepreneurs. Finally, comparative studies with other Himalayan regions could contextualize Bilaspur's ethnobotanical practices within broader regional trends, fostering knowledge exchange and collaboration.

Broader Implications

The survey contributes to global efforts to promote sustainable practices in the face of environmental challenges. By documenting Bilaspur's natural dye-yielding plants, it aligns with the United Nations' Sustainable Development Goals, particularly those related to sustainable production and biodiversity conservation. The revival of natural dyeing in Bilaspur could serve as a model for other regions, demonstrating how traditional knowledge can address modern environmental and economic challenges. Furthermore, the study highlights the importance of preserving indigenous knowledge systems, which are critical for cultural resilience and ecological sustainability in the Himalayan region.

Table 2: Distribution of Dye-Yielding Plants by Habitat

Habitat Type	Number of Species	Percentage (%)	Examples
Forests	10	40	Rubia cordifolia, Acacia catechu
Riverbanks	6	24	Indigofera tinctoria, Alnus nitida
Cultivated Fields	6	24	Curcuma longa, Tagetes erecta
Gardens/Plains	3	12	Lawsonia inermis, Hibiscus rosa

Table 3: Dye Extraction Methods and Their Prevalence

Extraction Method	Number of Species	Percentage (%)	Commonly Used For
Boiling	18	72	Rubia cordifolia, Butea monosperma
Fermentation	4	16	Indigofera tinctoria
Sun-Drying	2	8	Curcuma longa, Terminalia chebula
Maceration	1	4	Tagetes erecta

Table 4: Cultural Uses of Natural Dyes

Dye Color	Plant Source	Cultural Use	Community Association
Yellow	Curcuma longa	Weddings, Diwali decorations	Gaddi, Gujjar
Red	Rubia cordifolia	Sacred threads, festival textiles	Gaddi, Local Hindus

Blue	Indigofera tinctoria	Traditional shawls, religious fabrics	Gujjar, Artisans
Orange-Yellow	Butea monosperma	Holi festival, household items	Local Communities
Brown	Acacia catechu	Handicrafts, ceremonial items	Gaddi, Gujjar

Table 5: Challenges to Natural Dye Practices

Challenge	Percentage of Informants (%)	Proposed Solutions
Decline in Traditional Knowledge	80	Community workshops, school curricula
Habitat Degradation	30	In-situ conservation, ex-situ cultivation
Competition from Synthetic Dyes	25	Eco-friendly certification, market promotion
Lack of Documentation	60	Systematic ethnobotanical surveys
Limited Market Access	35	Local cooperatives, online platforms

Table 6: Economic Contributions of Dye-Yielding Plants

Plant Species	Economic Use	Percentage of Informants Involved (%)
Lawsonia inermis	Dye, medicinal sales	40
Curcuma longa	Dye, spice market	35
Terminalia chebula	Dye, medicinal products	30
Indigofera tinctoria	Dye for textiles	25
Butea monosperma	Dye for local handicrafts	20

Table 7: Conservation Status of Key Species

Plant Species	Habitat Status	Conservation Need
Rubia cordifolia	Declining (Forests)	In-situ protection, cultivation
Rheum emodi	Threatened (Hills)	Seed banks, restricted harvesting
Acacia catechu	Declining (Forests)	Reforestation, community management
Indigofera tinctoria	Stable (Riverbanks)	Sustainable harvesting protocols
Curcuma longa	Stable (Cultivated)	Promote organic cultivation

Conclusion

The ethnobotanical survey of natural dye-yielding plants in Bilaspur District, Himachal Pradesh, reveals a rich tapestry of botanical diversity and cultural heritage, with 25 plant species from 18 families used in traditional dyeing practices. These plants, yielding vibrant colors like red, yellow, and blue, are integral to the cultural and economic fabric of local communities, particularly the Gaddi and Gujjar. However, challenges such as declining traditional knowledge, habitat degradation, and competition from synthetic dyes threaten their sustainability. The survey underscores the need for conservation of these plant species through in-situ and ex-situ strategies, alongside educational initiatives to engage younger generations. The economic potential of natural dyes, driven by global demand for eco-friendly textiles, offers opportunities for rural livelihoods and sustainable industries in Bilaspur. Future research should focus on phytochemical optimization and commercial applications to enhance the viability of natural dyeing. By preserving these practices, Bilaspur can contribute to global sustainability goals while safeguarding its cultural legacy. This study serves as a call to action for stakeholders to integrate traditional knowledge with modern innovation, ensuring that Bilaspur's natural dye heritage thrives for future generations.

References

1. Bhatt VP, Negi GCS. Ethnobotanical studies of dye-yielding plants in the Himalayan region: A case study from Uttarakhand. Journal of Ethnobiology and Ethnomedicine,2018:14(1):45–56.
2. Cunningham AB. Applied ethnobotany: People, wild plant use, and conservation. Earthscan Publications, 2001.
3. Gaur RD. Traditional dye-yielding plants of India. Natural Product Radiance,2008:7(4):365–72.
4. Jain SK, Rao RR. A handbook of field and herbarium methods. Today & Tomorrow Publishers, 1977.
5. Kala CP. Indigenous knowledge systems and sustainable management of natural resources in the Himalayas. Journal of Traditional Knowledge,2015:14(3):321–9.
6. Kumar S, Sharma A. Natural dyes from Himalayan plants: Potential and challenges. Indian Journal of Natural Products,2020:36(2):88–95.
7. Mahanta D, Tiwari SC. Traditional dyeing practices in Northeast India: A review. Ethnobotany,2005:17(1):42–50.
8. Market Research Future. Global natural dyes market outlook: Trends and forecast to 2028. Market Research Future Reports, 2023.
9. Mishra PK, Singh R. Ethnobotanical survey of textile dyes in Himachal Pradesh. Journal of Plant Science Research,2019:35(1):12–20.
10. Pandey A, Misra P. Conservation of dye-yielding plants in the Shivalik hills. Biodiversity and Conservation,2021:30(4):987–1002.
11. Purohit MC, Rawat MS. Traditional knowledge and sustainable use of Himalayan flora. Indian Forester,2017:143(6):521–30.
12. Samant SS, Pant S. Diversity and conservation status of dye-yielding plants in Himachal Pradesh. Ethnobotanical Leaflets,2006:10(1):89–102.
13. Sharma PK, Dhyani SK. Ethnobotanical studies on natural dyes in the Western Himalayas. Journal of Ecological Studies,2019:22(3):134–45.
14. Singh KN, Lal B. Ethnomedicinal and dyeing plants of the Gaddi tribe in Himachal Pradesh. Journal of Economic and Taxonomic Botany,2008:32(2):211–20.

15. Tiwari L, Pande PC. Traditional dyeing practices in Uttarakhand: A case study of natural dye plants. Ethnobotany Research and Applications,2020:19(1):1–15.
16. Vankar PS. Handbook on natural dyes for industrial applications. National Institute of Industrial Research, 2017.
17. Chauhan NS. Dye-yielding plants of Himachal Pradesh: Traditional and modern perspectives. Himalayan Journal of Sciences,1999:2(1):45–52.
18. Das PK, Mondal AK. Natural dyes and their eco-friendly applications in textiles. Indian Journal of Fibre and Textile Research,2012:37(3):264–70.
19. Gupta D, Gulrajani ML. Studies on the use of natural dyes in India. Colourage,2001:48(5):23–30.
20. Joshi P, Rawat A. Indigenous knowledge of dye-yielding plants in the Himalayan region. Journal of Non-Timber Forest Products,2014:21(2):87–94.
21. Negi YS, Rawal RS. Biodiversity and traditional knowledge in Bilaspur District, Himachal Pradesh. Indian Journal of Traditional Knowledge,2016:15(3):412–20.
22. Rana TS, Datt B. Ethnobotanical wealth of the Shivalik hills. Journal of Medicinal and Aromatic Plant Sciences,2000:22(4):345–52.
23. Siva R. Status of natural dyes in the Indian subcontinent. The Botanical Review,2007:73(2):155–88.
24. Uniyal PL, Sharma RK. Conservation strategies for dye-yielding plants in the Himalayas. Environmental Conservation,2013:40(3):287–95.
25. Yadav S, Agarwal M. Sustainable textile dyeing using natural resources: A case study from India. Journal of Cleaner Production,2022:345(1):131–42.