

Diversity of Dye Yielding Plants Traditionally Used by Different Ethnic Communities of Assam, India

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Abstract

Numerous plant species possess natural colouring pigments in their leaves, seeds, fruits, barks, or roots, making them suitable for dye production across various industries. This paper explores the diversity of traditional dye-yielding plants utilised by different ethnic communities in Assam, between 24°13' and 28°00' N latitudes and 89°46' to 96°04' E longitude, covering an area of 78,438 km² with distinct ecological conditions. A field survey was conducted in rural areas of upper, middle, and lower Assam. Information was gathered through interviews, semi-structured questionnaires, and discussions with prominent tribal groups. This study identifies 45 species of plants that produce natural dyes used by 13 tribal communities, documenting the specific plant parts used and their local names. Women across these ethnic groups possess a wealth of traditional knowledge regarding textile dyeing techniques with pigments derived from locally sourced plants and fixing these dyes onto various substrates. The significance of dye-yielding plants extends beyond their economic value; they hold cultural importance within these tribal communities. A thorough documentation and exploration of these plants and the promotion of their products will aid in preserving traditional knowledge related to local biodiversity, ultimately benefiting both the communities and human society.

Keywords: Natural dye, Traditional knowledge, Community, Exploration, Documentation

Introduction

Natural sources have been used for dyeing for centuries, with the earliest records

of plant-based natural dyes found in China around 2600 BC. The Indus Valley Civilization also demonstrated using dyes derived from plants (Siva, 2007). Both

plant and animal materials can be used for dyeing (Gupta, 1990). Various parts of plants, including leaves, fruits, bark, seeds, and roots, are used to extract the colours. Many regions worldwide rely on natural resources endemic to their area for traditional dyeing practices. In the second half of the nineteenth century, the invention of synthetic dyes led to a decline in the use of natural dyes (Saravan & Chandramoham, 2011). Synthetic dyes became more popular due to their easy availability and the simple application process in ready-to-use forms, facilitating the rapid industrialisation of textile production.

Nevertheless, the beauty of natural dyes has remained appreciated among specific communities, where knowledge of these traditional practices is passed down through generations without formal documentation. Numerous studies around the globe have highlighted the toxic effects of synthetic dyes. These dyes release harmful chemicals that pose health risks and disrupt the ecological balance. The effluents from synthetic dyes contain carcinogenic and mutagenic substances that can severely threaten living organisms (Novotny et al., 2006; Mathur & Bhatnagar, 2007; Uddin et al., 2014). With growing awareness of health and environmental issues, natural dyes have been revived thanks to their eco-friendly and biodegradable characteristics (Prusty et al., 2010). Around the world, the textile industry has demonstrated considerable growth and export potential for natural dyes (Cautisicos, 2006). Applying natural dyes to natural fibres enhances environmental compatibility and provides health benefits to the wearer (Sarkar, 2004; Singh et al., 2005). However, despite the numerous advantages of natural dyes over synthetic

ones, international consumption accounts for only 1% of synthetic dyes. The main challenges hindering the growth of natural dyes include a lack of scientifically validated information on dye-yielding sources and technical difficulties related to dye extraction and standardisation (Patil et al., 2012).

Natural dye-yielding plants are one of the most important natural resources found in Assam, with high potential for commercial and industrial exploration, which has not been explored till now among the ethnic people. Women in every ethnic group of Assam have perfected ways of colouring textiles and other objects with dyes extracted from locally available plants and fixing them onto different bases. Assam is inhabited by many major tribes and sub-tribes, mainly belonging to the Indo-Mongoloid racial stock. Among these are ethnic groups like the Tai Ahom, Kacharis, Rabhas, Chutias, Bodos, Tiwas, Sarania Kacharis, Mech Kacharis, Thengal-Kacharis, and Deoris. The information regarding dye-yielding plants in Northeast India is meagre (Borthakur, 1990; Rongmei & Yadav, 2005; Sharma et al., 2005; Tiwari & Mahanta, 2005; Ahmed & Borthakur, 2005). Kar & Borthakur (2008) reported 47 dye-yielding plants from Assam. Akimpou et al. (2005) reported 25 dye yielding plants used by Karbis of Assam. Further, due to a lack of scientific knowledge and rural-based technology, exploration and extraction of dye-yielding plants are not systematically carried out. Hence, the present study has been undertaken to investigate and explore the availability of plant species yielding natural dye in Assam and to collect information on traditional knowledge about using natural dye. Proper exploration of dye yielding plants is a need of the hour to generate a

database of natural dye yielding sources of plant origin, traditionally used by ethnic communities of Assam, that will significantly help in the augmentation of the textile industry.

Material and methods

Study area

For the exploration of natural dye-yielding plants, the entire region of Assam of North-East India is considered. Assam is one of the significant states of North-East India, covering an area of 78,438 km² with diverse ecological conditions.

Survey of dye-yielding plants

The survey started in April 2019 and was completed in March 2021. Extensive surveys were conducted in 8 Upper Assam districts, two middle Assam districts and one lower Assam district. Rural artisans from 13 communities were interviewed, and structured questionnaires were provided with information regarding the traditional use of dye yielding plants and preparation methods.

Sample collection

Surveyed plants were photographed, and different parts of the plants, like roots, seeds, leaves and bark, which are used to extract dyes, were collected to prepare herbarium using the standard herbarium technique (Jain & Rao, 1977). The collected plant samples were subjected to identification in consultation with plant taxonomists, monographs and relevant literature.

Results and discussion

Various communities in Assam utilise plant-based natural dyes for traditional dyeing practices. The parts of the

plants used for dye extraction and their vernacular names are detailed in Table 1. A total of 45 dye-yielding plants have been documented from 13 communities across Assam. Rutaceae, Rubiaceae, Moraceae, and Euphorbiaceae families are particularly prominent. The Garo community uses eight different plant species for dyeing, the highest among all communities. Members of these communities have employed these plants to dye silk, woollen yarns, cotton, and other garments.

Traditional costumes and colour combinations play a significant role in expressing the identity of specific communities. Ethnic groups utilise various parts of plants to extract dyes to colour natural fibres, such as eri silk yarn. Like synthetic dyes, natural dyes can be applied to textiles at any stage, whether fibre, yarn, or fabric. Mordants are used in the dyeing process as they enhance the fastness properties of the dye and create an affinity for textile fibres. Various colour variations can be achieved from the same dyestuff by applying different metallic mordants. In addition to being eco-friendly, natural dyes are visually appealing and harmonise with nature. The beautiful colours derived from plant-based dyes exhibit significant variations based on the specific plant sources and parts used. This investigation identified 45 dye-yielding plant species across 30 families from various regions of Assam, showcasing the rich traditional knowledge of dyeing among 13 communities in the area. Among these, the Garo community reported using eight plant species for dyeing. Sutradhar et al. (2015) documented 39 species of plants yielding natural dyes from 26 families in Tripura. Gaur (2007) reported on 106 dye-yielding plants from 63 families from Uttarakhand Himalaya, His

Table 1. Dye-yielding plants used by different communities of Assam

Community	Scientific name	Vernacular name	Parts used
Khamti	<i>Ceariscoides campanulata</i>	Bihmona	Whole plant
	<i>Sapindus mukorossi</i>	Monichal	Steam bark
	<i>Artocarpus heterophyllus</i>	Jackfruit	Steam, bark and roots
	<i>Garcinia cowa</i>	Teportenga	Roots
Mising	<i>Terminalia chebula</i>	Khilikha	Fruits
	<i>Ziziphus jujuba</i>	Bogori	Steam bark
	<i>Thea assamica</i>	Tea	Leaf
	<i>Syzygium cumini</i>	Jamuk	Steam bark
	<i>Areca catechu</i>	Tamul	Seed/peel
	<i>Calamus viminalis</i>	Betguti	Seed/fruit
Deori	<i>Anthocephalus cadamba</i>	Pungos (roghugos)/RaghuKadam	Steam/bark
	<i>Citrus auerantifolia</i>	Bortenga	Fruit peel
	<i>Syzygium cumini</i>	Jamun	Steam bark
Thengalkachari	<i>Artocarpus hetrophyllus</i>	Jackfruit	Steam bark
	<i>Dillenia indica</i>	Owtenga	Steam bark
Sonowalkachari	<i>Oryza sativa</i>	Dhankher	Straw/stem
	<i>Citrus aurantifolia</i>	Bortenga	Seed
Tiwa	<i>Musa velutina</i>	Kolakhar	Dried stem
	<i>Spondius mangifera</i>	Amora	Dried stem
	<i>Aegle marmelos</i>	Bel	Fruit
	<i>Camellia sinensis</i>	Tea	Leaf
	<i>Ficus benghalensis</i>	Aahot	Bark
	<i>Acanthus sp.</i>	Niligos	Leaf
	<i>Curcuma longa</i>	Halodhi	Rhizome
Karbi	<i>Basella rubra</i>	Puroi	Seed
	<i>Hibiscus rosasinensis</i>	JobaPhul	Flower
	<i>Embllica officinalis</i>	Aamlokhi	Bark
	<i>Nyctanthes arbor-tristis</i>	Sewali	Flower
	<i>Diospyros melanoxylon</i>	Kendu	Seed/fruit
	<i>Allium cepa</i>	Onion	Peel of rhizome
	<i>Trewia nudiflora</i>	Bhelow	Seed/fruit
	<i>Mesua ferrea</i>	Nahar	Seed/fruit
Bodo	<i>Terminalia chebula</i>	Khilikha	Fruit
	<i>Tectona grandis</i>	Sagoon	Steam, bark and leaf
	<i>Ageratum conyzoides</i>	Gundhuabon	Flower
	<i>Lawsonia inermis</i>	Jetuka	Leaf
	<i>Sapindus mukorossi</i>	Monichal	Fruits
	<i>Camellia sinensis</i>	Tea	Leaf

Community	Scientific name	Vernacular name	Parts used
Garo	<i>Terminalia chebula</i>	Khilikha	Seed/fruit
	<i>Eclipta alba</i>	Kehraj	Leaves
	<i>Baccouriaremi flora</i>	Leteku	Leaf
	<i>Rubia cordifolia</i>	Manjistha	Whole plant
	<i>Acanthus</i> sp.	Indigograss	Whole plant
	<i>Artocarpus hetrophyllus</i>	Jackfruits	Steam/bark/wood
	<i>Indigofera tinctoria</i>	Indigo	Whole plant
	<i>Curcuma longa</i>	Halodhi	Rhizome
Rabha	<i>Punica granatum</i>	Dalim/Pomegranate	Fruit peel
	<i>Tagetes patula</i>	Narzi/GendhaPhul	Flower
	<i>Artocarpus hetrophyllus</i>	Jackfruit	Steam/bark/wood
	<i>Terminalia chebula</i>	Khilikha	Seed/fruit
Motok	<i>Citrus aurantifolia</i>	Rababtenga	Fruit peel
	<i>Oryza sativa</i>	Dhankher	Straw/stem
	<i>Musa velutima</i>	Vimkolorkoldil	Plant
	<i>Terminalia chebula</i>	Khilikha	Seed/fruit
	<i>Spondius mangifera</i>	Amora	Fruit/bark
	<i>Mangifera indica</i>	Mango	Bark
Moran	<i>Artocarpus lacucha</i>	Bohot	Fruit
	<i>Citrus reticulatus</i>	Orange	Fruit peel
	<i>Corchorus capsularis</i>	Juteplant	Whole plant
Ahom	<i>Malestoma malabathricum</i>	FutuKola	Fruits/flower
	<i>Bixa oriellina</i>	SendurGos/Annanto	Seed
	<i>Argemona mexicana</i>	SonaliGos/KuhumGos/	Seed
	<i>Impatiens roylei</i>	Demderuka	Flower

extensive survey revealed that most dye resources belong to dicotyledons, along with four monocot plants, three gymnosperms, and three lichens. Kar and Borthakur (2007) investigated 47 species of dye-yielding plants prevalent among five communities in Assam, namely Assamese, Bodo, Karbi, Mising, and Deori. Mahanta et al. (2005) recorded 37 species of dye-yielding plants from five districts of Arunachal Pradesh, classified into 26 families. The Fabaceae family has the highest number of species (six), followed by Moraceae and Euphorbiaceae (four each) and Juglandaceae (two species), while the remaining 21 families each

contain one species. Borgohain et al. (2018) studied natural dyes and textiles as cultural markers among the Tai Phake of upper Assam in North-East India. They found that colour combinations and costumes signify male age differences and marital status among females. The study observed that dyeing with various colours, including black, violet, purple, and green, has been largely replaced by synthetic dyes, except for yellow dye, derived from the bark of *Garcinia xanthochymus*. Furthermore, this cultural practice is now primarily maintained by the older women of the tribe. Therefore, studying natural dyes presents significant potential for

small-scale industrial applications.

Conclusion

The present study on natural dye-yielding plants in Assam highlights the rich traditional culture among local communities. However, this unique Indigenous knowledge and practice of dye production is dwindling among the younger generation, primarily due to the availability of low-cost synthetic dyes, evolving attitudes, and rapidly changing lifestyles. It has been observed that the traditional methods of preparing natural dyes are mainly preserved by a few older individuals, with limited efforts to conserve and promote this invaluable heritage aspect. Natural dyes derived from plant sources are biodegradable, non-toxic, and environmentally friendly. They have diverse applications, including chromotherapy, which relies heavily on natural colouring agents.

In contrast, synthetic dyes contain harmful chemicals that can lead to allergic reactions and other health risks. Consequently, dyes used in textiles, food, beverages, perfumes, lotions, and medicines must meet essential safety standards, including non-toxic, hypoallergenic, biodegradable, and eco-friendly. It is crucial to document and conserve this invaluable traditional knowledge; otherwise, we risk losing vital information about utilising the natural resources in our surroundings. A systematic and scientific approach toward the extraction, processing, and application of natural dyes, along with strategies for their conservation, will not only enhance local economies but also benefit the ethnic communities of Assam and promote future bioprospecting of eco-friendly products.

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