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Short Communication: Traditional dye yielding plants of Tripura, Northeast India

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Abstract. *Sutradhar B, Deb D, Majumdar K, Datta BK. 2015. Traditional dye yielding plants of Tripura, Northeast India. Biodiversitas 16: 121-127.* This present paper deals with the survey of traditional dye yielding plants, their ethnobotanical usage and cultural practices by the different ethnic communities of Tripura. Field investigation was carried out in different villages and adjacent forest pockets in South and West district of the State. The ethnobotanical information was collected based on semi-structured questioner, personal interviews and group discussion among the major ethnic communities of Tripura. The study reports a checklist of 39 species of dye yielding plants belonging to 35 genera and 26 families documented along with their vernacular name, habit, parts use. The active coloring agents were also listed for each plant based on earlier reports. Natural dye yielding plants have immense significance in the socio-economic and socio-cultural life of indigenous ethnic people and if we promote these products in a managed way then efforts towards preservation of traditional knowledge and local biodiversity will be more fruitfully achieved.

Keywords: Dye yielding plants, indigenous knowledge, natural products, Tripura

INTRODUCTION

The relation between man and plants originated with the prehistoric human civilization with early human Neanderthals to modern human civilization. The plants are used not only for maintaining the basic life sustaining needs like food, fuel, shelter, but also for making clothes and natural dye to fabric clothes (Das and Mondol 2012). Natural dyes occupy an important place in human culture and dye yielding plants were probably discovered early through human curiosity, use, reuse and trials (Canon and Cannon 2003; Dogan et al. 2008).

The first report of natural dye extraction from plant sources dates back to around 2600 BC in China. The Indus valley civilization at Mahenjo-Daro and Harappa (3500 BC) traces of dyeing garments with natural madder (Siva 2007). According to Dogan et al 2008, the use of natural dye stuff in by Phoenicians, Hebrews and Venetians was also started from the beginning of 13th century (Dogan et al. 2008). Later the technology passed across regions and cultures like Greeks, Romans, old world Africans, Mexicans and was also evident in Peru (TRMIC 1991; Dogan et al. 2008). According to Zohary and Hopf (1994), dye yielding plants have been cultivated in southwest Asia since ancient times and earliest persisting indication of textile dyeing comes from an over 5,000-year-old piece of cloth dyed with natural madder (*Rubia cordifolia*) discovered at Mohenjo-Daro (Singh 2002; Mahanta and Tiwari 2005; Das and Mondol 2012). Natural dyes are colorants derived from plants, invertebrates or minerals, while majority of natural dyes are extracted from vegetable or plant sources like roots, berries, bark, leaves, wood and other biological sources such as fungi and lichens.

The use of natural dyes has been declining since the discovery of synthetic dyes (Singh 2002). However, many studies have found that synthetic dyes are harmful to human health as well as environment (Kwok et al. 1999; Singh and Singh 2002; Cristea et al. 2003; Mahanta and Tiwari 2005; Seker et al. 2006). Natural dyes are environment and skin friendly; for example, turmeric, the brightest of naturally occurring yellow dye is a powerful antiseptic and revitalizes the skin, while indigo yields a cooling sensation. Hence, there exist a significant justification for the application and promotion of natural dyes as they are harmless both for human and environment (Hartl and Vogl 2003; Kumar and Sinha 2004; Kim and Park 2007). The present study is a comprehensive account of dye yielding plants of Tripura and gathers information on traditional knowledge system of extraction and use of natural dyes by the local ethnic people. Consequently, the study is an attempt to overcome the paucity of documentation of dye plants and to create baseline information on the natural sources of plant based dye.

The significant research on ethnobotany has created a mass awareness among the scientists in India during the last two decades (Rashid 2013). A number of publications have come from different regions of India including the north eastern states related to the traditional health care practices, wild edible plants, ethnoveterinary plants and fiber plants (Borthakur 1976; Tiwary et al. 1978, 1979; Bhattacharjee et al. 1980; Baruah and Sharma 1984; Mahanta and Tiwari 2005; Sawian et al. 2007; Jamir 2008; Kar and Borthakur 2007). In north eastern states some

pioneer workers have made a brief note on dye plants (Akimpou et al. 2005; Kar and Borthakur 2007). Ethnobotanically Tripura has quiet lagged behind rest of India (Deb et al. 2012). However, few workers have made a concise note on traditional ethno medicine and wild edible plants (Deb 1968; Singh 1997; Majumdar and Datta 2007; Das 2009; Roy 2010; Sen et al. 2011, Deb et al 2012). But, none of the workers have made a detailed note of customary dye yielding plants of Tripura used by the ethnic peoples of the state and therefore this is the first such study.

Materials and Methods

Study area

Tripura is one of the seven states in the north eastern part of India with a geographical area of 10, 491 sq Km. It is located in the south west extreme corner of the north eastern region, between 22° 57' to 24° 33' N latitude and 97° 10' to 92° 20' E longitude (Figure 1). The state is situated between river valley of Myanmar and Bangladesh on the north, west, south and southeast; in the east it has a common boundary with states of Assam and Mizoram. Tripura is a land locked state and its geographical limits touch both national and international boundary lines. International boundary with Bangladesh measures 839 km. Its national boundary with Assam and Mizoram measures 53 km and 109 km respectively. The average minimum temperature is 15°C and maximum temperature is 34°C. The average annual rain fall in the state is 2024.4 mm.

The major part of the State is covered by dense forests in which various ethnic groups live close to the forest and are largely dependent on the wild biological resources for their livelihood. The ethnic groups inhabiting different areas of the state have indigenous knowledge systems and have evolved methods for utilizing the vast plant resources available. Floral diversity is the main source of raw materials being used traditionally by the indigenous people of Tripura state as food supplements and for fodder, fibers, construction, handicrafts, beverages, coloring agents (dyes) and more importantly in health care practices. Their knowledge in utilizing these resources is characteristic and differs from community to community.

Field survey

Field investigations were conducted during the year 2013-2014 as per well planned schedule and rich pocket of tribal areas were visited for documentation of dye yielding plants. Survey was done by standard procedure (Jain and Rao 1977), through a questionnaire and group discussion with the community heads, old people, women and also village local market (Rao and Hazra 1994). The specimens were collected from the adjacent forest area with the help of local informant. The plant specimens were made into herbarium following the standard herbarium techniques. Herbarium specimens were identified with the help of Flora of Tripura State (Deb 1983). The reference specimens were deposited in the herbarium of Department of Botany, Tripura University, India.

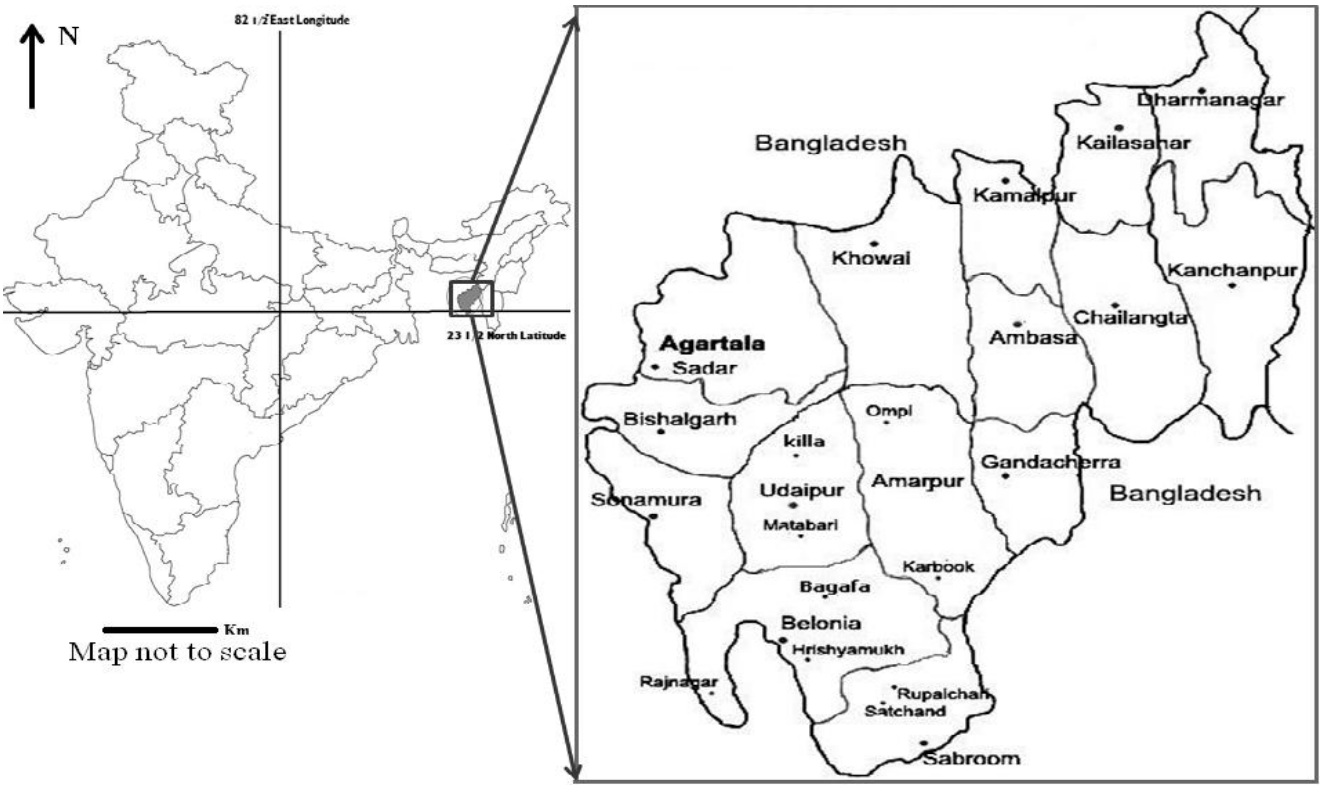

Figure 1. Study site in the State of Tripura, India

Table 1. Traditional dye yielding plants of Tripura, India

Scientific name	Family	Local name	Part used	Dye color	Dye uses for	Active coloring agent
*Adhatoda vasica (*L) Nees.	Acanthaceae	Basak	Leaves	Yellow	Cotton	Adhatodic acid, carotein, lutolin, quercetin (Singh et al. 2011)
*Alpinia galanga (*L) Willd.	Zingiberaceae	Telbanok juknai sam (Kok)	Root stalk	Yellowish green	Cotton, wool	Galangin (Chudiwal et al. 2010)
Areca catechu Linn.	Arecaceae	Supari, Gua	Seed	Red color	Cotton	Gallotannic acid (Amudhan et al. 2012)
Basella alba Linn.	Basellaceae	Muifrai (Kok)	Fruit	Violet	Silk and cotton, food coloring	Gomphrenin-I (Kumar et al. 2013)
Bauhinia variegata Linn.	Fabaceae	Kanchan (Beng)	Petal	Light pink	Cotton	Anthocyanin (Jash et al. 2014)
Bauhinia purpurea Linn.	Fabaceae	Goondilata (Kok)	Petal	Pink	Cotton and silk	Chalcone, butein (Gokhle et al. 2004)
Bixa orellana Linn.	Bixaceae	Powassi	Seed	Orange/ Red	Wool and cotton	Bixin, orellin, beta-carotene (Siva 2007)
*Butea monosperma (*Lam.) Taub.	Fabaceae	Jong-obi (Kok)	Petal	Orange	Orange dye, which is used for coloring the clothes and other decorative purposes	Butein, butin, isobutrin, coreopsin, isocoreopsin (Sindhia and Bairwa 2010)
Camellia sinensis Linn.	Theaceae	Cha	Leaves	Black	Fishing net, cotton, rope	Phenolic compound, flavonoids (Reto et al. 2007)
Celosia argentea Linn.	Amaranthaceae	Sweet murga	Flower	Red color	Wool and cotton	Betalains pigment (Patel et al. 2010)
Clerodendrum philippinum Schau.	Verbenaceae	Not known	Leaves	Green	Silk and cotton	Phenolic compound (Tiwary and Bharat 2008; Venkatanarasimman et al. 2012)
Clitoria ternatea Linn.	Fabaceae	Aparajita (Beng)	Flower	Blue	Wool, cotton, silk	Anthocyanin pigment ternatin (Kazuma et al. 2003)
Curcuma domestica Valeton.	Zingiberaceae	Haldi	Rhizome	Yellow	Wool, silk and cotton and also a food colorant	Curcuminoids, curcumin (Revathy et al. 2011)
Curcuma zedoaria Roxb.	Zingiberaceae	Halka	Rhizome	Yellow	For the production of Abir powder used in Holi	Curcumin, arabins and albuminoids (Hamdi et al. 2014)
Cuscuta reflexa Roxb.	Convolvulaceae	Jirai (Kokborok)	Whole plant	Yellow	Silk and cotton	Cuscutin, quercetin, coumarin (Ramya et al. 2010)
Diospyros peregrina Gürke.	Ebenaceae	Makur (Kok)	Fruit	Black	Fishing net, cotton	Triterpenes, B-sitosterol, betulin, gallic acid (Sinha and Bansal 2008)
Duranta repens Linn.	Verbenaceae	Ban mehendi	Leaves/ Seed	Green/ Orange	Silk, cotton and for palm staining of girls	Durantosides, c-alkylated flavonoids (Ahmed et al. 2009)
Eclipta prostrata Linn.	Asteraceae	Manathingsabup hang (Kok)	Leaves	Black	Hair blackening and cotton	Phenols, coumarins, flavones (Lee et al. 2008)
Hibiscus rosa sinensis Linn.	Malvaceae	Jaba	Flower petal	Red	Wool and cotton	Anthocyanidins, isoflavanol, flavone (Kumar and Singh 2012)
Indigofera tinctoria Linn.	Fabaceae	Nil	Green crop	Blue	Silk, wool cotton	Indigotin (Saraswathi et al. 2012)
Erythrina variegate Roxb.	Fabaceae	Mandar (Beng)	Flower	Red	Wool and cotton	Anthocyanin and betalains pigment (Subhashini et al. 2011)

Lawsonia inermis Linn.	Lythraceae	Mehendi	Leaves	Yellow red	The dye obtained from macerated or powdered leaves stains skin. Leaves also used for coloring skins, Leather, silk and wool..	Lawsone (Musa and Gasmelseed 2012)
*Mallotus philippensis (*Lam.) Muell. Arg.	Euphorbiaceae	Khurchub (Kok)	Seed	Red	Silk, cotton, wool	Rottlerin, isorottlerin (Sharma and Varma 2011)
Melastoma malabathricum Linn.	Melastomataceae	Phutki, Ban padam	Stem/ Seed	Red/ Black	Cotton and wool	Not known
Melia azedarach Linn.	Meliaceae	Ghora neem	Leaves	Blue	Cotton	Catechin, quercetin (Sen and Batra 2012)
Morinda tinctoria Roxb.	Rubiaceae	Haldiruk (Kok)	Root	Red	The dye is used for coloring cotton cloth & other printing materials.	Morindone (Shanthi et al. 2012)
Musa acuminata Colla	Musaceae	Thailic (Kok)	Pseudostem	Black	The sap is used for coloring traditional attire	Not known
Nyctanthes arbor-tristis Linn.	Nyctanthaceae	Hengra (Kok)	Flower tube	Orange	The dye is used for coloring silk; also useful in printing purposes.	Nyctanthin, carotenoids (Sah and Verma 2012)
Parkia javanica Merr.	Fabaceae	Kuki Tetai	Fruit peel	Brown/ Black	Silk and cotton	Carotenoids, flavonoids (Chanu et al. 2012)
Phyllanthus emblica Linn.	Phyllanthaceae	Amla (Kok/ Beng)	Bark/ fruit	Black	Cotton, rope, silk	Flavonoids,kaempferol, ellagic acid and gallic acid (Habib-ur-Rehman et al. 2007)
Piper betle Linn.	Piperaceae	Fatwi (Kok)	Leaves	Red brown	Cotton	Piperitol, piperbetol, eugenol, piperol (Pradhan et al. 2013)
Psidium guajava Linn.	Myrtaceae	Gayam	Fruit	Yellow red	Silk and cotton	Guajanoic acid,carotenoids, lectins, leucocyanidin (Kamath et al. 2008)
Rubia cordifolia Linn.	Rubiaceae	Manjistha (Beng)	Fruit	Red	Wool, cotton and silk	Manjistin, Purpurin (Siddiqui et al. 2011)
Solanum nigrum Linn.	Solanaceae	Rummunta (Halam)	Fruit	Brown black	Cotton	Gallic acid, catechin, caffeic acid, epicatechin, rutin, and niringenin (Gogoi and Islam 2012)
*Strobilanthes cusia (*Nees) O. Kuntze.	Acanthaceae	Not known	Leaves/ young buds	Black & blue	Silk and cotton	Lupeol, betulin, lupenone, indigo, indirubin (Li et al. 1993)
Tectona grandis (Linn. f)	Lamiaceae	Segun	Young leaves	Red	Silk, cotton, wool	Tectoleafquinone (Khera and Bhargava 2013)
*Terminalia arjuna (*Roxb.) White & Arn.	Combretaceae	Arjun	Fruit	Brown	Wool and cotton	Arjunic acid (Burapadaja and Bunchoo 1995)
Terminalia belerica Roxb.	Combretaceae	Bahera	Fruit	Black	Silk and cotton	Chebulaginic acid, gallic acid, ellagic acid (Meena et al. 2010)
Terminalia chebula Retz.	Combretaceae	Bakhla (Kok)	Fruit	Black	Cotton	Chebulinic acid (Lee et al. 2006)

Results and Discussion

The study elucidated the 39 dye yielding plants of Tripura which were traditionally used by the tribal of Tripura. Among these plants, many were common to all communities, and their uses were also almost same. The documented natural dye yielding plants with their vernacular name, part used, dye color, specific uses and coloring agent are listed in Table 1.

The listed plant species belong to 3 families of monocotyledons (12% species) and 23 families of dicotyledons (88% species). Among the monocotyledons, Zingiberaceae is represented by 3 species while Musaceae and Arecaceae are represented by single species each. Among dicotyledons, 7 species (18%) are Fabaceae; 3 species (8%) Combretaceae followed by Acanthaceae, Rubiaceae and Verbenaceae with 2 species (5%) each. Dyes were produced from different parts of the plants i.e. underground parts (root 5%, rhizome 5%), stem (4%), bark (3%), leaf (26%), flower (21%), fruit (26%), seeds (13%) or even whole plant (5%). More than 2 plant parts were used in7% species of documented plants.

The important dyes extracted from roots or rhizome include *Alpinia galanga (*L) Willd., *Curcuma domestica* Valeton., *Curcuma zedoaria* Roxb., *Morinda tinctoria* Roxb. Hort. Beng. Stem and bark is the important source of the species *Melastoma malabathricum* Linn., *Phyllanthus emblica* Linn. etc. Floral dyes includes *Bauhinia variegata* Linn., *Bauhinia purpurea* Linn., *Butea monosperma, Celosia argentea* Linn., *Clitoria ternatea* Linn., *Hibiscus rosa sinensis* Linn., *Erythrina stricta* Roxb., *Nyctanthes arbor-tristis* Linn. etc. Commonly used fruit dyes are obtained from *Basella alba* Linn., *Diospyros peregrina* Gürke., *Parkia javanica* Merr., *Rubia cordifolia* Linn., *Solanum nigrum* Linn., *Terminalia belerica* Roxb., *Terminalia chebula* Retz., *Terminalia citrina* (Gaertn.) Roxb but in some cases tender fruits of *Psidium guajava* Linn. is used for black coour. The leaf dyes are extracted from *Adhatoda vasica (*L) Nees., *Camellia sinensis* Linn., *Clerodendrum philippinum* Schau., *Duranta repens* Linn., *Eclipta prostrata* Linn., *Lawsonia inermis* Linn., *Melia azedarach* Linn., *Piper betle* Linn., *Strobilanthes cusia (*Nees) O. Kuntze., *Tectona grandis* (Linn. f) etc. Whole plant is used in case of *Cuscuta reflexa* Roxb. Green crop of *Indigofera tinctoria* Linn. is used while sap of pseudostem is used for *Musa acuminata* Colla.

Dyes extracted from the various plant parts are weak in nature and their permanency varies from plant to plant and traditional techniques of preparation. Use of multiple plants parts in a particular ratio may increase the longevity of dye. Sometimes special techniques viz. heat and cold treatment may increase dye stability. The selection of plants also depends on the color choice, product type and purpose. This present study recorded 14 different colors from 12 different plant parts, where black color was yielded by maximum number (26%) of plants. The ethnic communities used their own customary approach to extract and process the natural dye.

Ethnic communities used the dye yielding plants for various day to day activities like coloring food and clothes, making cosmetics and fashion jewelries. The dyes are colored compound capable of being fixed to fabrics which do not washout with soap and water or fade on exposure to light. For dyeing purposes, either fresh extract or paste form were best suited for the communities. Present record of 38 species was very high compared to 10 species reported from West Bengal (Das and Mondol 2012) and 15 species from Manipur (Akimpou 2005) and less than the documentation of 47 species from Assam (Kar and Borthakur 2007). However, documentation of 37 species from Arunachal Pradesh and 33 species from Central India (Tiwari and Bharat 2008) was quite similar to the present study. Thus, the study presents the potential resources of dye plants which have immense scope and small-scale industrial prospects. But the indigenous knowledge of processing and using the natural dyes from plants has to be valued and at the same time has to be upgraded or value added to incorporate with modern product generation.

In conclusion, the indigenous knowledge of extraction, processing and practice of using natural dyes has declined to a great extent among the new generation due to easy availability of cheap synthetic dyes and modern attitude and life style. It has been observed that the traditional knowledge of dye making is now practiced by older people only. Unfortunately, there is lack of fruitful attempts to promote and conserve this immense treasure of traditional knowledge. Typically, most commercial synthetic dyes are attractive in color and are easy and cheap to processes. But, material collection for preparation of natural dye is closely dependent on resource availability, seasons and proper traditional knowledge. Due to lack of precise technical knowledge on the extraction and dyeing procedure, the natural dyes could not compete with commercially successful synthetic dyes. The natural dyes obtained from plant sources are biodegradable and non-toxic. Indigenous traditional knowledge on dye yielding plants is very essential for community based development, future bio prospecting and eco-friendly products.

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