ADVANCES IN BIORESEARCH
Volume 3, Issue 1, March 2012: 43 - 53
ISSN 0976-4585

Website: www.soeagra.com/abr.htm

Original Article

Biodiversity and Conservation of Some Dye Yielding Plants for Justification of its Economic status in the Local areas of Lateritic Zone of West Bengal, India

Pijush Kanti Das and Amal Kumar Mondal*
Plant Taxonomy, Biosystematics and Molecular Taxonomy Laboratory, Department of Botany and Forestry, Vidyasagar University, Midnapore-721102, West Bengal, India.
* Corres. Author: amalcaebotvu@gmail.com; amalcae_botvu@yahoo.co.in; pijushdas.dye@gmail.com

ABSTRACT
A survey has been done on the folk use of dye yielding plants and also its medicinal value. We have identified dye yielding plants like Woodfordia furticosa Kurz (Lythraceae), Morinda citrifolia Linn. (Rubiaceae), Clitoria ternatea Linn. (Fabaceae), Butea monosperma Taub. (Fabaceae), Butea superba Roxb. Ex Willd. (Fabaceae), Carthamus tinctorius L. (Compositae), Ventilago denticulata Willd. (Rhamnaceae), Cordia dichotoma Forst. (Boraginaceae), Nyctanthes arbor-tristis Linn (Oleaceae), Tectona grandis Linn.f (Verbenaceae) which are distributed in the lateritic zone of West Bengal. The dyeing parts of the plants are used by the local ethnic communities for various domestic purposes. These particular dye yielding plants have different medicinal and economic values. It has also been known that the natural dyes are not harmful and eco-friendly. However , it is a matter of concern that the indigenous knowledge of extraction, processing and practice of using and the proper utilization of natural dyes has now diminished due to easy availability of economically cheaper synthetic dyes. It is extremely essential that proper documentation and measures of conservation be undertaken for to preserve these natural dye yielding plants otherwise we are bound to lose valuable information in nature forever. The study reveals that these economically important dye-yielding plants need to be conserved for biodiversity as well as traditional ethnic knowledge.
Key words: *Ethnic communities, traditional knowledge, biodiversity conservation, natural dyes, synthetic dyes*

INTRODUCTION

In the human civilization plants are used not only for the basic needs of life such as food, fiber, fuel, cloths and shelter but also as sources of natural dyes for dying cloths, design and painting. A spectrum of beautiful natural colours ranging from yellow to black exists in the above sources. These colours are exhibited by various organic and inorganic molecules and their mixture is due to the absorption of light in the visible region of 400-800 nm [1]. The ubiquitous green pigment chlorophyll helping to capture sun's energy and convert it to chemical energy, to the beautiful vibrant colors of the flowers and fruits to attract insects or animals either for pollination or for the purpose of seed dispersal [2]. The dyeing process was practiced during the Indus river valley civilization at Mohenjodaro and Harappa (3500 BC), former Egyptian, and China period [3]. Moldenke (I.C) reports that an orange or yellow impermanent dye is made from corolla-tubes of *Nyctanthes arbor-tristis* Linn. for Buddhist robes in Sri Lanka [4]. Ancient times in India, traditionally 'Holi' was played with flowers petals or with natural colors obtained from different plant parts [5]. Different plant parts like 'Seuli'; 'Palash' were widely used for these purposes. That time of 'Holi' festivals were safe too because the natural dyes was not harmful for the human body, but recent times a few cheaper chemical dyes are commonly used broadly in the market as alternative of natural dyes creates different hazards like skin allergic, respiratory, kidney and liver diseases. Research has shown that the natural dyes are quite safe and environment friendly [6]. In the lateritic zone of West Bengal there are many dye yielding plants species used by the tribal communities like Santals, Lodhas, Mundas and other local communities like Chitrakar, Mahatos etc. for coloring food, printing cloths, making 'Patchitra' and mats etc.[7]. The aim of the present investigation that the economically also medicinally natural dye yielding plants at least 10 angiosperms (Fig. 1, 2a, 2b, 3, 4a, 4b, 5a, 5b, 6, 7a, 7b, 8a, 8b, 9, 10a, 10b) as a sources of natural dye used traditionally by the ethnic communities and also prompt them to conserve the natural dye yielding plants in the state.

MATERIALS AND METHODS

The preliminary survey was made in different lateritic zone and rural areas of the West Bengal during January 2006 to September 2011. The places of surveying zone of the district are (1) Pingla [22°16'1" N latitude and 87°37'36" E longitude] (2) Sabang [22°8'15" N Latitude and 87°38'5" E Longitude] (3) Amlachati [22º22'36" N latitude and 87º02'33" E longitude] (4) Jhargram [22º26'59" N latitude and 87º00'4" E longitude] (5) Kankrajhore forest [22º42'13" N latitude and 86º36'24" E longitude]. The tribal people belief that diseases and death are caused by certain spirits of supernatural powers. These beliefs have a great influence on their attitude and psychology about the ailments. Knowledge of their medicine will, within certain limits, show their knowledge of nature and how they use this knowledge. There are many Santals, if any at all who have "medicine" for their only means of subsistence. The prevailing diseases of the tribal people are biliousness, fever, colic, hepatic disease, diarrhoea, dysentery, influenza, malaria fever ulcer, skin disease and others. Some of these disease, such as hepatic and skin disease etc. are possible due to consumption of country liquor like rice bear, mahua (*Madhuca longifolia* (Koenig) Mac Bride) liquor and others and want of proper sanitation. The treatment of various diseases in most cases involves the application of herbal drugs [8] . In the disease of continuous fever the bark of the *Bonga sarjom* (*Ventilago denticulata* Willd.) tree soak in water and give to drink morning and evening .In the sore cavity (*Ras bat ghao*) they used the bark of the Saparom (*Nyctanthes arbor-tristis* Linn) tree and grinding this , then cook in pure mustard oil and then apply to the cavity. Traditional knowledge and various ethnobotanical information were recorded in this study to collect the plant specimens and discuss the matter with the help of attaching persons of making natural dye. Collected plant specimens are deposited in the Botany department herbarium of Vidyasagar University. The Present paper deals with the sources of natural dye yielding plants and collects the original knowledge on dye preparation by the local ethnic communities in the lateritic zone of West Bengal, India.

Fig. 1-Plant with dye yielding parts-flower -*Woodfordia fruticosa* Kurz Syn. *W. floribunda* Salisb.
Fig. 2a- *Morinda citrifolia* Linn. Syn. *M. bracteata* Roxb.
Fig. 2b- Dye yielding parts-root of *Morinda citrifolia* Linn.

Fig. 3-Plant with dye yielding parts-flower -*Clitoria ternatea* Linn.
Fig. 4a- *Butea monosperma* Taub.
Fig. 4b-Dye yielding parts-flower of *Butea monosperma* Taub.
Fig. 5a- Plant (climber) *Butea superba* Roxb.
Fig. 5b-Dye yielding parts-flower of *Butea superba* Roxb.

Fig. 6- Plant with dye yielding parts- flower- *Carthamus tinctorius* L.

Fig. 7a- Plant (woody climber) *Ventilago denticulate* Willd. Syn. *V. maderaspatana* auct.

Fig. 7b- Dye yielding parts-stem bark of *Ventilago denticulate* Willd.

Fig. 8a -Plant of *Cordia dichotoma* Forst. Syn. *Cordia myxa* Sensu Cl.; *C. lowriana* Brandis.

Fig. 8b- Dye yielding parts-leaves of *Cordia dichotoma* Forst. and colour produced-brownish black.
Fig. 9- Plant with dye yielding parts- flower's corolla tube- *Nyctanthes arbor-tristis* Linn.
Fig. 10a - Plant of *Tectona grandis* Linn.f
Fig.10b- Dye yielding parts- leaves of *Tectona grandis* Linn.f and colour produced-deep orange.

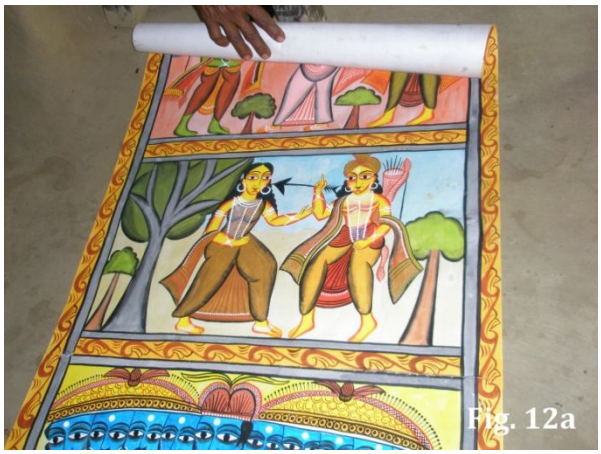

Fig. 11- The famous marshland mat.
Fig. 12a-Traditional 'Patachitra' made by natural dye.
Fig.12b- Different types of Traditional 'Patachitra'.

RESULTS AND DISCUSSION

Normally rural people use natural dye for their own requirements and economic purposes like colouring foods, printing cloths-mats (Fig.11), preparing cosmetics, making 'Patchitra' (Fig. 12a, 12b) and cultural decoration etc. The rural and tribal people of the district are extensively uses some method for extraction of natural dye from plants. Mostly the rural folk dye the yarn by heating chopped leaves, bark, wood or flowers or fruits of the plant in water. This traditional method of dying is extremely crude [9]. Different parts of the plant contain colouring pigment like 'nyctathin' in *Nyctanthes arbor-tristis* Linn., 'ventilagin' in *Ventilago denticulata* Willd. etc. which is used for colouring in different purposes.

Table-1: Some dye yielding medicinal plants of lateritic zone of West Bengal .

Sl. No.	Plant name	Family	Local name	Plant description	Fl. & Fr.	Status	Dyeing parts & uses	Folk medicine
1.	*Woodfordia furticosa* Kurz	Lythraceae	Dhawai-ba, Ichak-ba (Lo. *), Patakalu (San. *), Dhatki (Ben*).	Shrubs; leaves opposite, distichous, linear, lanceolate, acuminat; flowers tubular, scarlet red, axillary cymes; calyx red; fruits capsules ellipsoid, membranous; seeds brown smooth.	Jan.-June	Wild, Common open dry mixed forests.	Flowers yield a brick red dye which is used for colouring rope materials, cloths etc.	Ethnic communities give flower decoction with honey against seminal weakness, calyx boiled in ghee applied to boils.
2.	*Morinda citrifolia* Linn.	Rubiaceae	Chaili (Lo. & Sa.), al. ach, surangi (Ben.).	Small sized tree; leaves opposite, rarely trinately, verticillate, broadly elliptic; flowers in dense ovoid heads, white; fruit of many drupes coalescent into a freshly globose or ovoid head. Seed ovoid or reniform.	Feb.-May	Wild, infrequent.	Roots yield a dark red dye known as Al dye. The morindone pigment present in the dye , which used for colouring cotton cloth & other printing materials.	Roots used as cathartic; applied on rheumatic pain. Santals use root decoction for washing septic wounds.
3.	*Clitoria ternatea* Linn.	Fabaceae	Aparajita (Ben.)	A perennial twining herb; stem slender, ovate or oblong, obtuse, sub coriaceous; leaves pinnately; flowers showey, solitary, axillary, light blue, bractoles large; stamens diadelphous; pods linear, flat, sparingly hairy.	July-Dec.	Common in garden, on hedges, in waste places. Sometimes cultivated	Flower yields the blue dye. The dye used for printing 'Patchitra'.	Roots used by the tribals to cause abortion and also useful in burning sensation, leprosy, decoction used to remove dry cough. Whole plant used in snake poison.
4.	*Butea monosperma* Taub.	Fabaceae	Palas-baha (Lo. & Sa.), Palas (Ben.).	Medium sized tree; stem with irregular branching; leaves large, 3-foliolate, leaflets coriaceous, pubescent beneath; flowers in a dense fascicles, recemose,	Feb.-July	Common in mixed forests; frequent.	Flowersyield a brilliant yellowish orange dye, which is used for colouring the clothes and other decorative purposes.	Lodhas used flower paste to pregnant woman in strong diarrhoea and apply the paste externally on inflammation of testicles. Bark and seeds also

				orange coloured , calyx velvety black, stamens diadelphous; fruits pods, long, seeds oval, compressed & velvety brown.				used in snakebite.
5.	*Butea superba* Roxb. Ex Willd.	Fabaceae	Laramurup (Lo.), Narimurup (Sa.), Latpalash, Latapalash (Ben.)	Large climbers; leaves pinnately compound; flowers in fascicles on racemes, orange scarlet; fruits long pods, seeds compressed.	Feb-June	Wild, infrequent.	Flowers yield deep yellowish orange dye used for colouring cotton cloth.	Decoction of stem bark applied to children for inducing sleep; stem bark juice used as an antiseptic. Flower used as diuretic & astringent.
6.	*Carthamus tinctorius* L.	Compositae	Karrah (Sa.), Kusum (Ben.)	Erect annual herbs; branches puberulous, white; leaves oblong or oblong lanceolate; flowers terminal, orange-yellow; involucral bracts many-seriate, constricted above base; white below constricted portions, green above it with yellow spines, exceeding heads; florets usually bisexual, tubes slender; anthers with sagittate base; fruits 4-angled, obovoid achenes; pappus absent .	Feb.-Apr.	Commonly cultivated, also found as escapes from cultivated.	Flowers yield a reddish yellow dye, colouring matter carthamin present in this dye, which is used for colouring butter, liquors & candles; also employed in cosmetic industry in the production of rouge.	Flower used as laxative, sedative and stimulant; hot infusion, diaphoretic, in jaundice; also useful in cold infusion.
7.	*Ventilago denticulata* Willd.	Rhamnaceae	Bangasarjo-m, Sangasarjo-m (Lo.), Nadnaru (Sa.), Raktapita (Ben.)	Extensively branched, woody climber with hanging branches and dark gray bark; leaves alternate, simple, oblong-lanceolate; flowers pale green, axillary & terminal recemes, petals much smaller than sepals; fruits nuts like, yellowish,	Oct.-June	Wild, infrequent	Stem & root bark source of red dye 'ventilagin' which is used for colouring mordanted cotton, wool and tasar silk.	Root bark paste applied as cure for wounds, eye disease**.** Santals give stem bark decoction with paste of *Piper nigrum* Linn. (Black pepper) to treat stomach ulcer, stem bark paste also applied

				supported by the peristant calyx, wing linear oblong .				to all body pain.
8.	*Cordia dichotoma* Forst.	Boraginaceae	Hemrum (Lo.), Buch (Sa.), Bahubara, Bahanari (Ben.)	A medium sized tree; leaves simple, alternate, elliptic oblong; flowers white, fragrant, small in lax terminal or axillary cymes; fruits drupes, ripening form yellowish, viscus; seeds white embedded in glutinous pulp.	June-May	Common in dry forest, wild, becoming rare.	Leaves yield a brownish black dye, used for colouring and decorating purposes.	Ethic communities use leaf decoction with common salt to cure cold & cough; also applied in ulcers and headache. Whole plant useful in snake-bite.
9.	*Nyctanthes arbor-tristis* Linn.	Oleaceae	Saparom, Chirata (Lo. & Sa.), Seuli, Sephali (Ben.)	A small sized tree; branches numerous, spreading in all direction; leaves opposite, leaf blade ovate or oblong; flowers white, in axillary & terminal peduncles, tube cylindric, orange coloured, pleasanting fragrant, opeaning in sunset; fruits capsules, flat, broad at apex, 2-valved seeds 1 per cell, compressed.	Sep.-Dec.	Common in garden, planted in forest areas.	Flowers tube contains an orange colluring matter 'nyctathin', which is used for colouring silk; also useful in printing purposes.	Santals give fried leaves to cure influenza. Fresh leaf juice given with honey in chronic fever.
10.	*Tectona grandis* Linn.f	Verbenaceae	Sagoan (Lo.) Segun (Ben.)	Large deciduous tree; branchlets 4-angled; leaves large, opposite,simple, obovate-elliptic, stellately yellowish; flowers numerous in large terminal panicles of cymes, white, tomentose, calyx peristant, bladder like; fruits drupes with a thick spongy covering; seeds bony.	July-Jan.	Common in forest areas, planted.	The ethnic people crushed the leaves and obtained the deep orange dye, which is used in the making 'Patchitra'; also suitable for dying silk & wool.	Leaves useful in skin diseases, leprosy, cooling, diabetes, and bronchitis. Seed paste applied to cure ringworm.

Lo. *-Lodha, San. *-Santal, Ben*-Bengali

Dye yielding plants , unlike synthetic dyes may contain more than one chemical constituent, each exhibit a different colour and properties [10]. Few fibers such as silk and wool can be dyed normally by being dipped in the dye but others like cotton require a mordant. Light fastness characteristic of dyes is influenced by the mordating method [11]. Mordant makes the dyes colorfast; commonly uses some mordant are alum, iron, tin and blue vitriol etc. The state of West Bengal preserves a rich source of dye yielding and medicinal plants which are used by the local people or especially the tribal communities like Santals, Lodhas, Mundas and Oraons etc. for not only dyeing but also treatment of various human diseases like diarrhoea, piles, itches, skin disease, strungury, chronic ulcers, diabetes and many more common as well as serious diseases [12-16]. The present investigation has been recorded the details about the 10 angiospermic plants for dye yielding purposes and also have their folklore medicinal values which are enumerated in Table-1.

CONCLUSION

Looking at the growth of natural products the world over, there is tremendous growth potential and it is lagging far behind its potential. West Bengal is a storehouse of economically important plants and dye-yielding plants for justified its diverse flora. The dyeing process from natural dyes having number of advantages and disadvantages over synthetic dyes. Few advantages are- 1. The natural dyes are free from carcinogenic azo compounds. 2. It is easily available in the nature & used as antioxidant easily 3. Natural dyes are more ecofrindly than synthetic dyes. The synthetic dyes cause pollution, environmental hazards etc. and few disadvantages are 1. The natural dying process laborious and time consuming. 2. Natural dyes, which obtained from plants are dependent on growing season for actual colours. 3. Few fiber such as cotton cannot coloured normally without mordant.

Although the natural dyes have few disadvantages but in recent time's environmental point of view that the traditional natural dyes might be an alternative pathway to developed ecofrindly products. Proper collection, documentation and protection should be needed of natural dye yielding plants like *Woodfordia furticosa* Kurz, *Morinda citrifolia* Linn., *Butea superba* Roxb. Ex Willd. *Ventilago denticulata* Willd. etc. are presently less available in this areas otherwise we are suppose to lose our indigenous knowledge system.

ACKNOWLEDGEMENTS

The authors are thankful to the local & tribal communities of the lateritic zone of West Bengal for gathering knowledge about natural dyes. The authors acknowledge the advice and help by Sri Tushar Kanti Das, Forest Ranger, Silviculture south division, Jhargram, West Bengal for going through this manuscript.

REFERENCES

1. Chengaiah, B., Rao, K. M., Kumar, K. M., Alagusundaram, M. and Chetty, C. M., Medicinal importance of natural dyes a review. (2010). International Journal of Pharm Tech Research, 2(1): 144-154.
2. Das, P.K., Mondal, A.K. and Mondal (Parui), S. (2011). Antibacterial activity of some selected dye yielding plants in Eastern India. Afr. J. Plant science, 5(9): 510-520.
3. Siva, R. (2007).Status of natural dyes and dye-yielding plants in India. Curr. Sci., 92(7): 916-924.
4. Panigrahi, G. and Murti, S.K. Flora Bilaspur district, M. P (1989-1999). Bot. Sur. of India, 1-2, India, Kolkata.
5. Dubey, A. (March -2007). Splash the colours of holi, naturally!. Sci. Rep., 44 (3): 9-13.
6. Mohanta, D and Tiwari, S. C. (2005). Natural dye yielding plants indigenous knowledge on dye preparation in Arunachal Pradesh, Northeast India. Curr. Sci., 88 (9): 1474-1480.
7. Das, P. K. and Mondal, A. K. (2008). Some natural dye yielding plants of Paschim Medinipur district, West Bengal, India. Env. & Eco., 26, (4C): 2304-2307.
8. Pal, D. C. and Jain, S. K. (1998). Tribal medicine. Naya prokash. Kolkata,
9. Purohit, A., Mallick, S., Nayak, A., Das, N. B., Nanda, B. and Sahoo, S. (2007). Developing multiple natural dyes from flower parts of gulmohur. Curr. Sci., 92(12): 1681-1682.
10. Wanyama, P. A. G., Kiremire, B. T., Ogwok, P. and Murumu, J. S. (2010). Characterization of colour from some dye yielding plants in Uganda. Afr. J. Pure Appl. Chem., 4(10): 233-239.
11. Samanta A. K and Agarwal P. (2009). Application of natural dyes on textiles. Indian J. Fibre Text. Res., 34: 384-399.
12. Chatterjee, A. and Pakrashi, S.C.(1991-2001). The Treatise on Indian medicinal plants, Nat. Inst. Sci. Comm., 1- 6, CSIR, New Delhi, India.

13. Ambasta, S. P., Ramachandran, K., Kashyapa, K. and Chand, R. (1986). The useful plants of India. Coun. Sci. and Indust. Res., New Delhi, India.
14. Paria, N. D. Editor. (2005). Medicinal plants resources of south West Bengal., Res. Wing, Direc. For., Govt. West Bengal, Kolkata. India.
15. Chopra, R. N., Nayar, S. L. and Chopra I. C. (1956). Glossary of Indian Medicinal Plants. CSIR, New Delhi, (With supplement to Glossary of Indian Medicinal Plants, 1968).
16. Anonymous. (1994-1996). Indian medicinal plants, 1-5. Arya Vaidya sala. Orient Longman Ltd., Hyderabad.