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Plant Species used for Dyeing Eri-Silk and their Conservation by the Bhoi Women of Meghalaya, India

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ABSTRACT

Natural dyes are coloured substances derived mainly from plant sources like fruits, leaves, bark, roots, fungi and lichens. Eri-culture and traditional handloom weaving is a popular practice amongst the women of the Bhoi sub-tribe of Meghalaya. The uniqueness of the eri-silk produced by this community is that it is organic. The locally produced silk thread known as '*Ksai Ryndia*'is creamy white and needs dyeing to give its colour. The objective of the study is to document the plant species used by the women weavers of Ri-Bhoi District, Meghalaya for dyeing Eri-silk. Twenty six plant species have been reported to be used by the Bhoi women weavers for dyeing the eri-silk thread. These plants are mainly used for the preparation of dyes and as mordant. Different plant parts like leaves, bark, fruits, stem and even the peels are used for extracting different colours. The women folk have taken initiatives to conserve the wild plant species used for dyeing by domesticating them in their home gardens. This reflects the rich knowledge the community has on the use of natural dyes and their environmental consciousness as these are safe and eco-friendly.

Key Words: Weaving, Dye, Mordant, Tradition, Attire.

INTRODUCTION

Natural dyes are coloured substance of plant or animal origin. The majority of natural dyes are from plant sources like fruits, leaves, bark, roots, fungi and lichens, while a few are also obtained from minerals, insects and animals. Earliest evidence for the use of natural dyes dates back to more than 5000 years, with Madder (*Rubia cordifolia*) dyed cloth found in the Indus river valley at Mohenjodaro (Mahanta and Tiwari 2005). In the natural dyeing process, mordants are considered as integral part; where pre-treatment or post-treatment with them increase the uptake of the dye by the fibre (Gulrajani 2001). At present there is an increase interest in natural dyes as they are environment friendly and can be used safely because of their non-toxic, non-carcinogenic and biodegradable nature (Bhuyan 2003, Nidhi and Nitan 2014).

'Eri silk' is the product of the domesticated silkworm, obtained from the cocoon of the worm *Samia cynthia ricini Boisd.,* found in North East India and some parts of China and Japan. The name is derived from the Assamese word 'era' which means castor as the silkworm feeds on castor plants (*Ricinus communis*). In the Khasi Hills of Meghalaya it is known as 'ksai ryndia' which is mainly used for weaving of the traditional shawl 'jain ryndia'.Creamy white colour originally, the silk thread is then dyed to different colours before weaving. The silk is highly valued not only within the state but outside the state as well. It is mainly used in making traditional or cultural attires but presently it has gain a place in the fashion society, where fashionable clothing for men and women are made from the silk.

Ri-Bhoi District is one of the main regions of Meghalaya where eri-culture and handloom weaving is still practiced. It has a long tradition and is part of the culture and heritage of the community. In fact, all the materials involved in the process are sourced from the

district itself.The Bhoi women weavers play a significant role in retaining this age old traditional practice because they are the ones who are involved in all the steps in the sericulture value chain- starting from rearing of silk worms to spinning and reeling of silk to yarn production and dyeing and finally to weaving. The uniqueness of the eri-silk produced by this community is that it is organic and the dyes used for colouring the thread are obtained from natural products.

India is endowed with a wealth of natural flora and many studies have documented on the use of dyes extracted from plants for dyeing clothes, food item, medicines by the tribal communities (Ghosh and Das 2007, Kar and Borthakur 2008, Nidhi and Nitan 2014). Meghalaya, despite having this unique indigenous knowledge and rich source of flora as natural dyes, so far there is no documentation on the plants used and the methods of dyeing. The aim of the present study is therefore to document the plant species used as natural dyes for dyeing eri-silk, practiced by the women of Raid Nongtluh, Ri-Bhoi District Meghalaya.

STUDY AREA

The study was conducted at Raid Nongtluh, Ri-Bhoi District, Meghalaya, India. In a traditional governance system, the Syiemship administered by the Syiem or the chief is the highest authority. Under the Syiemship, there exist different Raids which encompass many villages under it. The Raid is under the administration of the Sordar or Myntri. The people inhabiting Raid Nongtluh belong to the Bhoi sub-tribe where agriculture is their primary occupation but they also practice rearing of silkworm, weaving and dying and handicraft making.

MATERIALS AND METHODS

Field visits were made, during 2019, to two selected Ryndia weaving villages namely, Diwon and Umden, located in the study area. Information on the names of plants used, their habit, sources/habitat, and the process of dyeing was collected through interviews and discussions with experienced weavers and dyers as done in ethhnobotanical studies (Jain1989). The survey was conducted following the method of Jain and Rao (1977) where the plant specimens were collected and identified with the help of a taxonomist from North-Eastern Hill University, Shillong and by consulting books *viz.,* flora of Nongpoh (Joseph1982), forest flora of Meghalaya (Haridassan and Rao1985-1987) and flora of Assam (Kanjilal et al. 1934-1940) and the website www.theplantlist.org. The dyers were thoroughly interviewed on the plant parts used, and the colour produced from each plant specimen or plant parts. All information were recorded properly and enumerated herewith.

RESULT AND DISCUSSION

The Bhoi women weavers have been traditionally engaged in the extraction, processing and preparation of natural dyes from various domesticated and wild plants found in the area. At present these dyes are not being commercially exploited but are used by women at their household level or at the community level as Self Help Groups (SHGs) involved in weaving of different traditional attires. Altogether 26 plant species belonging to 20 families are being used in the dyeing process (Table 1) which is a similar result to those reported by Krishnamurthy et al. (2002) from Eastern Ghats and Tiwari and Bharat (2008) from Achanakmar-Amarkantak Biosphere reserve but more than those reported from Manipur (Akimpou et al. 2005) and West Bengal (Das and Mondal 2012) and less than those reported from Assam (Kar and Borthakur 2008), Arunachal Pradesh (Mahanta and Tiwari 2005) and Tripura (Sutradhar et al. 2015). The highest represented family is Malvaceae, represented by three species, Euphorbiaceae by two whereas the rest by one species each.

In the dyeing process, some plants are used as mordant to give different shades and to facilitate the bonding of the dye to the fibre and also for improving wash fastness. From among the 26 plant species used,19 plant species are used only for extraction of dyes, 4 are used as mordant only, 2 are used as both dye and mordant and one plant species is used for improving wash fastness.

Dyes of different colours are obtained from the leaves, bark, stem, flowers, fruits, skin, seeds and rhizome of various plants (Table 1). Leaves are mostly used for the extraction of dyes (10 plant species), followed by fruits (4 plant species) and bark (3 plant species) contrary to the findings of Tiwari and Bharat (2008) who found that bark is mostly used. Scientific studies found that the plant materials contain secondary metabolites like flavanoids (yellow and brown), Iso-quinoline (yellow), Chromene (orange yellow), Napthoquines (brown and purple grey), Anthraquinones (red), Benzophyrones (purple and black), indigoids (blue) and tannins (Gokhale et al. 2004).Some plants give more than one colour depending upon the plant parts used. The shade of the colour depends upon the ratio of plant materials

Table 1: Dye yielding plants used by Bhoi women for dyeing Eri-silk

Sl. No.	Botanical name	Family	Vernacular name	Habit	Parts used	Uses	Source/habitat
1	*Allium cepa* L.	Liliaceae	Piat	herb	skin	Dye extraction (light green)	household
2	*Amaranthus* sp	Amaranthaceae	Syntu latumar	shrub	flowers	Dye extraction (dark grey)	home garden
3	*Antidesma khasianum* Hk.f	Euphorbiaceae	Soh syrlei	tree	leaves	Dye extraction (chocolate brown)	wild
4	*Ardisia paniculata* Roxb.	Myrsinaceae	Soh ksain masi	shrub	fruits	Dye extraction (dark grey)	wild, home garden
5	*Areca catechu* L.	Arecaceae	Kwoi im	tree	skin	Dye extraction (yellow)	household
6	*Bixa orellana* L.	Bixaceae	Anonto	tree	seeds	Dye extraction (yellowish grey)	plantation
7	*Callicarpa aeborea* Roxb.	Verbenaceae	Lakhiet	tree	leaves	Dye extraction (orange)	wild
8	*Camellia sinensis* (L.) Kuntze	Theaceae	Slasha	shrub	leaves	Mordant	plantation
9	*Casaeria* sp.	Flacourtiaceae	Dien stong	tree	bark, leaves	Dye extraction (yellow)	wild
10	*Citrus medica* L.	Rutaceae	Soh jew	shrub	fruits	Wash fastness	home garden
11	*Curcuma longa* L.	Zingiberaceae	Shyrmit	herb	rhizome	Dye extraction (yellow, orange, dark green)	home garden
12	*Hibiscus acetosella* Welw. ex Hiern	Malvaceae	Jyrsong	shrub	leaves, fruits	Dye extraction (red), mordant	home garden
13	*Hibiscus rosa-sinensis* L.	Malvaceae	Syntu jain	shrub	flowers	Dye extraction (light grey)	plantation
14	*Hibiscus sabdariffa* L.	Malvaceae	Jyrsong bam	shrub	leaves, fruits	Dye extraction (red), mordant	home garden
15	*Lysionotus serratus* D.Don	Gesneriaceae	Sla nuli	herb	leaves	Dye extraction (black)	wild, home garden
16	*Mikania micrantha* Kunth	Asteraceae	Kynbat japan	climber	leaves	Dye extraction (black)	wild
17	*Morinda angustifolia* Roxb.	Rubiaceae	Dieng rnong	shrub	roots	Mordant	wild, plantation
18	*Morus indica* Thunb.	Moraceae	Soh langdkhur	shrub	fruits	Dye extraction (dark grey)	plantation
19	*Musa* sp.	Musaceae	Ladu	shrub	stem	Dye extraction (black)	wild, plantation
20	*Oroxylum indicum*	Bignoniaceae	Waitlam Pyrthat	Tree	bark	Dye extraction (black, dark green)	wild, plantation
21	*Phyllanthus emblica*	Euphorbiaceae	Soh myrlein	tree	bark	Dye extraction (black, chocolate brown)	wild, plantation
22	*Psidium guajava* L.	Myrtaceae	Soh pien asem	shrub	leaves	Dye extraction (grey)	plantation
23	*Pueraria thunbergiana* (Sieb. et Zucc) Benth	Fabaceae	Ler jyrmei	climber	leaves	Dye extraction (black)	wild
24	*Sterculia* sp.	Sterculiaceae	Soh Khu	tree	leaves	Mordant	wild, plantation
25	*Tectona grandis* L. f	Lamiaceae	Dieng rong	tree	apical leaves	Dye extraction (chocolate brown)	wild, plantation
26	*Vitex pinnata* L.	Verbenaceae	Soh tung	Tree	leaves	Mordant	wild

in the mixture, the mordant and the minerals used in a dye bath. Common colours extracted are black, brown, green, orange, red and yellow along with their different shades. Black colour is yielded by maximum number of plants (6 Nos.). Plants like *Phyllanthus emblica, Oroxylum indicum, Allium cepa* and *Curcuma longa* yielded more than one colour. *Curcuma longa* is the plant that produces maximum of three colours viz., dark green, yellow and orange colour. The dyers used their own customary approach to extract and process the natural dye where lac and iron ore are also used in addition to plant materials. Lac dye being an acidic dye can be directly dyed on protein fibres such as wool and silk. Introducing metal ions in the fibre can increase the affinity towards mordant dyes (Gulrajani 2001).

The plants used in the process of dyeing are obtained from four sources viz., from the wild, plantations, home gardens and from different households. Out of

Figure 1. a. preparation of dye from bark; b. preparation of dye from leaves; c. dyed silk threads of different colours; d. Bhoi woman involved in weaving of a khasi traditional shawl.

the 26 plant species recorded, fourteen species are collected from the wild and ten are collected either from plantations or home gardens. It was observed that eight of the fourteen wild dye yielding plant species have been domesticated by these people in their plantations or home gardens. The skin of *Allium cepa* and *Areca catechu* are collected from different households. It was also found that these plant species are either specific to the region or are introduced for various purposes. The plants which are specific to the region and found in the wild are *Antidesma khasianum*, *Ardisia paniculata, Callicarpa aeborea, Casaeria* sp*, Lysionotus serratus*, *Mikania micrantha*, *Morinda angustifolia*, *Oroxylum indicum, Phyllanthus emblica, Pueraria thunbergiana*, *Sterculia* sp., wild *Musa* sp. and *Vitex pinnata*. Species such as *Curcuma longa*, *Hibiscus sabdariffa*, *Morus indica*, *Musa* sp., and *Psidium guajava* are being cultivated by the people since time immemorial.

The traditional knowledge possessed by the people of the region on the use of plants as natural dye has not only raised awareness about traditional importance and values of these plants but has also helped in conservation of biodiversity and environment. The people have started valuing the plants through sustainable harvesting and even preserve their habitat. In order to reduce pressure on the forest and for those plants with low population, the women folk have taken the initiative to conserve them by domesticating in their home gardens or plantations. Extraction of dyes from the skin of *Allium cepa* and *Areca catechu* which are common household wastes helped to reduce waste in the environment. A study by Valenzuela-Zapata et al. (2011) revealed that wild plants associated with a particular culture or traditional use by the indigenous communities showed a decrease in their wild population. For the conservation of this valuable knowledge and for biodiversity protection some communities have taken initiatives such as market development for products that use plant-based dye and domestication of rare plant species (Fan et al. 2018).

CONCLUSION

The study elucidates the rich knowledge the Bhoi community has, particularly women, on the use of natural dyes obtained from plants for dyeing clothes. It also depicts the increasing environmental related consciousness amongst the community to popularize the use of natural dyes as these are safe and eco-friendly. Further, efforts to conserve these vital natural resources are taken into consideration through domestication of these plants in home gardens and plantations. However, during the study it was also observed that the traditional knowledge of natural dye preparation is now confined only to a small pocket of villages in the study area. At present efforts are being made by the women along with the support of the government to popularize and train the youths in the weaving of 'jain ryndia' and its dyeing using natural dyes.

More efforts are needed to document the methods of extraction and preparation of natural dyes. It is time that steps are taken towards documenting these treasures of indigenous knowledge systems; otherwise we are bound to lose vital information on the utilization of natural resources around us. Detailed studies and scientific investigations are needed to assess the quality of the dye, the availability of natural dye-yielding resources and the propagation of the species which are in great demand. Systematic approaches with scientific inputs are required in conserving the indigenous knowledge. At the same time, awareness about implementation of protocol under the biodiversity act and proper mechanism for access and benefit sharing as per CBD should be in place so that the local people will continue to get their share of the benefit incurred, should in future the dyes get commercially exploited.

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REFERENCES

Akimpou, G.; Rongmei, K. and Yadava, P.S. 2005. Traditional dye yielding plants of Manipur, North East India. Indian Journal of Traditional Knowledge 4(1): 33-38.

Bhuyan, R. 2003. Extration of natural colourants from roots of *Morinda angustifolia* Roxb., their identification and studies of dyeing characteristic on wool. Indian Journal of Chemical Technology 10:131-136.

Das, P.K. and Mondal, A.K. 2012. 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. Advances in Bioresearch 3(1): 43-53.

Fan, Y.; Zhao, Y.; Liu, A.; Hamilton, A.; Wang, C.; Li, L.; Yang, Y. and Yang, L. 2018. Indigenous knowledge of dye-yielding plants among Bai communities in Dali, Northwest Yunnan, China. Journal of Ethnobiology and Ethnomedicine 14:74.

Ghosh, C. and Das, A.P. 2007. Use of dye yielding plants by the tribal Tea Garden workers in Terai and Hills of Darjiling. Pleione 1: 19-22.

Gokhale, S.B.; Tatiya, A.U.; Bakliwal, S.R. and Fursule, R.A. 2004. Natural dye yielding plants in India. Natural Product Radiance 3(4): 228-234.

Gulrajani, M.L. 2001. Present status of natural dyes. Indian Journal of Fibre & Textile Research 26: 191-201.

Haridasan, K. and Rao, R.R. 1985-1987. Forest Flora of Meghalaya, volume I and II, Bishen Singh and Mahandrapal Singh, Dehradun, India.

Jain, S.K. 1989. Methods and Approaches in Ethnobotany. Society of Ethnobotanist, Lucknow. 192 pages.

Jain, S.K. and Rao, R.R. 1977. A Handbook of Field and Herbarium Methods. Today & Tomorrow's Printers and Publishers, New Delhi. 157 pages.

Joseph, J. 1982. Flora of Nongpoh and Vicinity. Forest Department, Government of Meghalaya, Shillong. 376 pages.

Kanjilal, U.N.; Kanjilal, P.C.; Das, A. and De, R.N. 1934-1940. Flora of Assam, volume I to V, Government Press, Shillong.

Kar, A. and Borthakur, S. K. 2008. Dye yielding plants of Assam for dyeing handloom textile products. Indian Journal of Traditional Knowledge 7(1): 166-171.

Krishnamurthy, K.V.; Siva, R. and Senthil K.T. 2002. Natural dye yielding plants of Shervaroy Hills of Eastern Ghats. pages 151-153, In: Proceedings of the National Seminar on Conservation of Eastern Ghats. Environment Protection Training and Research Institute, Hyderabad, 24-26 March 2002.

Mahanta, D. and Tiwari, S.C. 2005. Natural dye-yielding plants and indigenous knowledge on dye preparation in Arunachal Pradesh, Northeast India. Current Science 88(9): 1474-1480.

Nidhi, J. and Nitan, K.K. 2014. Herbal Dye Yielding Plants of District Kathua, Jammu and Kashmir State, India. International Research Journal of Biological Sciences 3(12): 73-79.

Sutradhar, B.; Deb, D.; Majumdar, K. and Datta, B.K. 2015. Traditional dye yielding plants of Tripura, Northeast India. Biodiversitas 16 (2): 121-127.

Tiwari, S.C. and Bharat, A. 2008. Natural dye-yielding plants and indigenous knowledge of dye preparation in Achanakmar-Amarkantak Biosphere Reserve, Central India. Natural Product Radiance 7(1):82-87.

Valenzuela-Zapata, A.G.; Lopez-Muraira, I. and Gaytán, M.S. 2011. Traditional Knowledge, *Agave Inaequidens* (Koch) Conservation, and the Charro Lariat Artisans of San Miguel Cuyutlán, Mexico. Ethnobiology Letters 2:72-80.

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