

Value Addition of Wild Madan Tree (*Garcinia fusca* Pierre) in Sisaket, Thailand

Ratchanee Siriyan^{1*}, Auttapon Rukkaphan¹, Tawatchai Nimkingrat¹, Chatchanok Noppornphan² and Songpol Somsri³

¹Sisaket Horticultural Research Center, Nong Phai, Muang, Sisaket 33000, Thailand

²National Project Management Unit, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand

³Department of Agriculture, Chatuchak, Bangkok, 10900 Thailand

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Wild madan tree is a native fruit tree commonly found along the river banks in Sisaket, Thailand. The wooden stick from tree stem has been traditionally used as a chicken skewer since over 50 years. The community earns about 1.5 million baht per year from the madan skewer production. This enterprise generates a lot of peeled wild madan bark as a by-product. The present investigation was aimed at assessing whether natural dyes can be extracted from wild madan tree (used traditionally as chicken skewer) bark. Employing four mordants to intensify the colour of the extract, it was concluded that dyeing three times with dye from fresh bark resulted in highest percentage (68) of satisfaction. Thus, using wild madan tree bark for dyeing cotton cloth would provide additional incentive to farmers for conserving this nature fruit tree.

Key Words: Chicken skewer, *Garcinia fusca*, Mordants, Natural dye, Wild madan

Introduction

Wild madan (*Garcinia fusca* Pierre) belongs to the Clusiaceae, the same family with mangosteen. In Thailand, it is commonly found growing in wild along the rivers, streams and swamps in dry evergreen forests (Subhadrabandhu, 2001; Shu *et al.*, 2007). The young leaf can be used in many traditional dishes like sour soup whereas the fruit can be used in chili paste. The local people in Sisaket have discovered a unique way of using the wild madan stem. The wooden stick from wild madan stem are used as a skewer for grilled chicken, called “Kai Yang Mai Madan”. Whilst grilling the chicken, stick exudes fluid which imparts special flavour to grilled chicken which consumers prefer (Sthapit *et al.*, 2013). About 1,000 tons of madan sticks are consumed every day. The bark has to be peeled from the wild madan stem for making skewer. This results in the by-products of plenty of peeled wild madan bark that was wasted traditionally.

A plant usually contains a mixture of natural dyes. This mixture is often extracted and used to dye textiles. Recent environmental awareness has created an interest in the products made from natural dyes. Natural dyes are considered eco-friendly as these are renewable, biodegradable, are skin friendly and also provide health benefits to the wearer (Saxena and Raja, 2014). Natural dyes produce very uncommon, soothing and soft shades as compared to synthetic dyes (Samanta and Konar,

2011). The natural dye extract from *Garcinia* bark (*G. dulcis*) has been reported (Nakpathom *et al.*, 2012). The present study was aimed at producing natural dye from the extract of wild madan bark and exploring the function of mordants in the dyeing process. Four mordants were used to intensify the colour of the extract for dyeing cotton cloth. Mordants play a very important role in imparting colour to the cotton cloth. The wild madan extracted was stabilized by all mordants used. The colour fastness to washing and rubbing was tested with dyed cotton cloth for different duration. Cotton cloth dyed three times showed very good colour fastness. The satisfaction evaluation of dyed cotton cloth was evaluated with fifty samples. This study thus aimed at exploring new avenues for enhancing the income and job opportunity for the community.

Materials and Methods

Extraction of Dyes

Plant parts from various *Garcinia* spp. were used for the extraction of dyes. Leaves were used from “Cha muang” (*G. cowa*), mangosteen (*G. mangostana*) and wild madan (*G. fusca*). Bark from wild madan and mangosteen husk were used in the experiment. The chopped plant materials were boiled with 3 l of water in a pot for 1 h. One kilogram of each material was used for dye extraction except for madan bark for which only 300 gms were used. The dye thus extracted was filtered to remove the remaining residue and kept till further use

*Author for Correspondence: E-mail: noy_siriyan@hotmail.com

(Nakpathom *et al.*, 2014; Office of Sericulture Research and Development, 2013).

Testing Dyes for Dyeing with Cotton Clothes

The cotton clothes were washed in commercial detergent at room temperature and washed with tap water. Dyeing was performed in an open bath. Salt (5g/l) was added to assist in absorption of the dye. The wet cotton clothes were placed into the dye bath and simmered for 1 h. The clothes were completely submerged in the dye solution during the entire dyeing period (Office of Sericulture Research and Development, 2013).

Mordanting

Mordanting was carried out in the post-stage. Four mordants were used in this experiment. One chemical mordant namely alum (0.5g/l) and three natural mordants were used. Natural mordants were lime water (10g/l) and mud and rice husk ash in the ratio of 1:3. After dyeing, the cotton clothes were submerged in mordants for 15 min followed by washing and drying in the shade (Anonymous, 2014).

Comparison of the Dyes from Fresh and Dried Wild Madan Bark

Experiments were performed with respect to dyeing of cotton clothes with dyes from fresh and dried madan bark one, two or three times for 1 h. Fresh and dried madan bark dyes were prepared using 300 gms of bark with 3 l of water as described above. Mordant used in this study was lime water.

Colour Fastness Testing

Colour fastness to washing and rubbing were tested. The dyed cotton clothes were washed and rubbed manually with detergent (5g/l) and rinsed with tap water. The testing was repeated five times. The colour change of the dyed cotton clothes was assessed using a rating scale of 1=very poor, 2=poor, 3=fair, 4=good and 5=very good (Nakpathom *et al.*, 2012).

Evaluation of Satisfaction

Dyeing cotton clothes with dye extracted from fresh and dried wild madan bark one, two or three times was used for satisfaction evaluation. The experiment was performed in Ise subdistrict. Fifty villagers comprising 27 males and 23 females were chosen as evaluators. The satisfaction was evaluated by satisfaction rating scale ranging from 1 (very dissatisfied), 2 (somewhat dissatisfied), 3 (neither satisfied nor dissatisfied), 4

(somewhat satisfied) to 5 (satisfied). The rating scale was calculated on per cent bars.

Results and Discussion

Dyeing and Mordanting

It is evident from the results that dye extracted from various *Garcinia fusca* produced different dye solution colours; greenish yellow from “*Cha Muang*” leaves, brown from wild madan leaves, brownish yellow from wild madan bark, red brown from mangosteen leaves and dark brown from mangosteen husk. Dyeing of cotton clothes with these natural dyes yielded different colour shades (Fig. 1). Mordants played a very important role in imparting colour to the cotton cloth. The different mordants and different ratios gave varying shades. Results showed that natural dyes extracted were stabilized by all mordants.

Comparison of Dyes Extracted from Fresh and Dried Wild Madan Bark

The result indicated that dye extracted from fresh and dried wild madan bark imparted brown colour. The dye extracted from fresh bark gave darker colour than that extracted from the dried bark. Dyeing for different durations yielded different colour shades. Dyeing cotton cloth three times resulted in darker shade than dyeing one or two times. (Fig. 2).

Colour Fastness

Colour fastness to washing and rubbing of the dyed cotton cloth for different duration had different fastness properties (Fig. 3). Dyeing with dye from fresh wild madan bark showed better fastness properties. Dyeing for one time with dye from fresh and dried wild madan bark showed mostly poor rating between 1 and 2 scale. Repeat dyeing for three times with dye from fresh and dried wild madan showed good to very good rating between 4-5 scale.

Evaluation of Satisfaction

Satisfaction testing of dyed cotton cloth with dye from fresh and dried wild madan bark is shown in Figure 4. The greater satisfaction was from repeated dyeing using fresh wild madan bark three times and two times. They gave the satisfaction percentage were 68% and 46%, respectively. The highest satisfaction percentage from using dried wild madan bark was 42. The results also indicated that repeat dyeing was more popular.

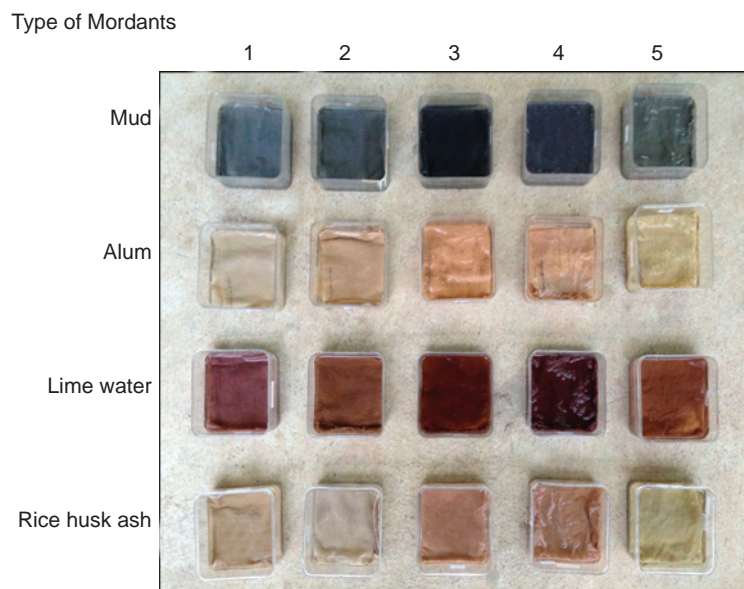


Fig. 1. Comparison of cotton cloth dyed with dyes extracted from various *Garcinia* spp. (1 to 5) using different mordants; 1 = "Cha Muang" leaves, 2 = Wild madan leaves, 3 = Wild madan bark, 4 = Mangosteen leaves, 5 = Mangosteen husk





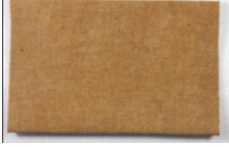
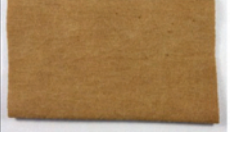
Frequency of dyeing	Dyeing with extract from fresh wild madan bark	Dyeing with extract from dried wild madan bark
Once		
Two times		
Three times		

Fig. 2. Comparison of cotton clothes dyed with extracts from fresh and dried wild madan bark

Based on the results of present study, four on-site trainings, on dyeing process of cotton cloth with wild madan dyes, were conducted for the people in Ise subdistrict, Sisaket province. The idea for such a study was stimulated when site coordinator and farmers visited Kiriwong community in Thailand and used similar techniques in locally available materials.

Conclusion

There is an increasing interest in the application of natural dyes following environmental awareness and

public concern about increasing pollution. The study concluded that dyeing of cotton clothes with dyes from wild madan bark yielded brown and brownish yellow colour depending on the mordant used. Mordants cotton fiber help absorb the dye give better, brighter and more permanent colours to the cloth. Many chemicals used as mordants are very poisonous. The most common mordants are alum, copper sulfate, potassium dichromate (VI), iron (II), sulfate and tannins. Often two mordants are mixed together for the best results.













Frequency of dyeing	Dyeing from fresh wild madan bark			Dyeing from dried wild madan bark		
	Before washing	After washing	Rating scale	Before washing	After washing	Rating scale
Once			2			1-2
Two times			4-5			2-3
Three times			5			4

Fig. 3. Comparative colour fastness to washing and rubbing of dyed cotton cloth

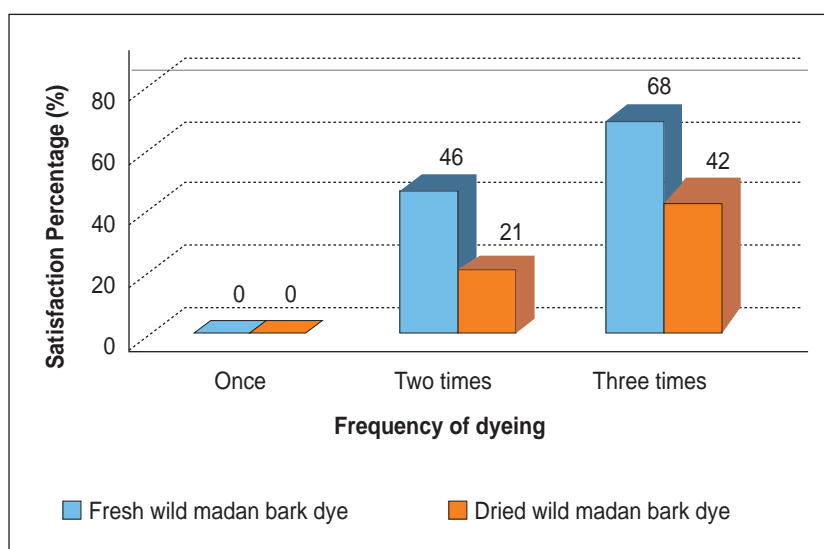


Fig. 4. Comparative satisfaction percentage (%) of dyeing cotton cloth with dyes extracted from fresh and dried wild madan bark

Colour fastness to washing and rubbing of the dyed cotton clothes was mostly good. This is the first report of dyeing cotton cloth with dyes extracted from wild madan bark. Training and setting up of women groups similar to Kiriwong village as small business enterprises might generate income and encourage the community for conservation of wild madan trees along river banks and cultivation around the fence of fields.

Acknowledgment

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References

- Anonymous (2014) *Natural dyeing*. http://www.ist.cmu.ac.th/cotton/naturalColor_Human.php?subnav=3 Accessed 1 Apr 2014.
- Office of Sericulture Research and Development (2013) *Silk dyeing with natural dyes*. http://www.qsds.go.th/osrd_new/inside_page.php?pageid=19 Accessed 15 Nov 2013
- Shu TH, L Xiwen, L Jie and PF Stevens (2007) *Garcinia L.*, sp. *Flora of China* 13: 40–47.
- Subhadrabandhu S (2001) *Under-Utilized Tropical Fruits of Thailand*. Food and Agriculture Organization of the United Nation, Regional Office for Asia and the Pacific, Bangkok, Thailand, 70 p.
- Sthapit B, H Lamers and VR Rao (2013) *Custodian farmers of agricultural biodiversity: Selected profiles from South and*

- South East Asia*. Proceedings of the workshop on “Custodial farmers of agricultural biodiversity”, 11-12 February 2013, New Delhi, India.
- Nakpathom M, B Somboon, N Narumol and S Pinmanee (2012) *Natural dyeing of hemp yarns*. RMUT International Conference: Textiles & Fashion 2012, 3-4 July, 2012, Bangkok, Thailand.
- Saxena S and ASM Raja (2014) Natural dyes: Sources, chemistry, application and sustainable issues. In: Muthu SS (ed). *Roadmap to Sustainable Textiles and Clothing*. Springer Science, Singapore, pp 37-79.
- Samanta AK and A Konar (2011) Dyeing of textiles with natural dyes. In: Kumbasar EA (ed) *Natural Dyes*. Croatia, Intech, China, pp 29-56.