



ISSN: 0975-833X

RESEARCH ARTICLE

PLANTS USED AS NATURAL DYE BY THE ORANG ULU ETHNICS IN ASAP KOYAN BELAGA SARAWAK, MALAYSIA

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ARTICLE INFO

Article History:

Received 24th May, 2015

Received in revised form

10th June, 2015

Accepted 29th July, 2015

Published online 31st August, 2015

Key words:

Ethnobotany, Natural dyes,
Orang Ulu, Asap Koyan Belaga Sarawak,
Malaysia, Colours, Plant species.

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Citation: Noraini Rosli, Zahora Ismail and Philip Lepun, 2015. "Plants used as natural dye by the Orang ulu ethnics in Asap Koyan Belaga Sarawak, Malaysia", *International Journal of Current Research*, 7, (8), 19770-19775.

INTRODUCTION

Plants are the source of various useful products including natural dye. The roots, flowers, seeds, stem, bark, fruit bark and leaves of plants or the whole plant, molluscs, lichens, rocks and soils are used for producing natural dye. Natural dyes were the basic ingredients for producing cosmetics until the 19th century (Harmancioglu, 1955). Mati and Boer (2010) identified 13 species that were used for producing natural dye by the Balaki tribe in Kurdistan, Iraq. In the regions of Turkey where handicrafts such as carpet and rug weaving are common, 123 plants species belonging to 50 families were identified which were used as a source of natural dyes (Doğan et al., 2003). MacFoy (2004) has documented the common plants that produce natural dye in Sierra Leone. But with the advent of synthetic dye in 1856 by William Henry Perkin and the synthetic production of alizarin in 1868 by Graeke and Leiberman, production of natural dyes have been declined (Algan 1976).

Moreover, by the unsustainable harvest of wild plants for timber and medicine, deforestation to create more farm land, invasion of alien species and sometimes war have caused threat to the survival of dying species (Dudley 2001; MacFoy 1992; Wilson 1988). The erosion of natural dyeing culture and indigenous knowledge on dyeing by harvesting and processing and surviving of dyeing plants has become a threat to the natural dyeing industry (Mati and Boer 2010).

The Orang Ulu Ethnics

Orang Ulu is not a legal term and no such racial group exist or listed in the Malaysian Constitution. The term was popularised by a minority association known as 'Orang Ulu National Association' (OUNA) that was formed in 1969. The Orang Ulu are made up of a few tribes namely the Kenyah, Kayan, Klemantan, Kelabit, the Lun Bawang, Penan, Kajang, Kejaman, Punan, Ukit, as well as a few minor tribes in the interior. Orang Ulu, means the 'up-river dwellers' that mainly living in Central Borneo, which accounts for 5.5% of the population. The Penan, Kayan and Kenyah, live in the middle and upper reaches of and the Kelabit and Lun Bawang live in

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the highlands (STF, 2015; Vtaide, 2011). The Orang Ulu typically lives in longhouses elaborately decorated with murals and woodcarvings. They can also be identified by their unique music such as distinctive sounds from their sapes, a plucked boat-shaped lute, formerly with two strings, nowadays usually with four strings. A vast majority of the Orang Ulu tribes are Christians but old traditional religions are still practiced in some areas.

Use of natural dye by the Orang Ulu Ethnics

Orang Ulu are indigenous people of Malaysia who use various plant parts for producing natural dye. They obtain their dyeing materials mostly from wild fruits. They extract dye from the verities of plant resources. It's their cultural practice to make the body and face with different natural dyes. Each colour has specific meaning according to the culture of Orang Ulu. They usually use black natural dye for colouring their teeth. For this purpose, wood - tar from variety of colouring plant of species are used (Lemmens and Wuljarni-Soejipto 1992).

Orang Ulu decorate their bodies with tattoos which are made from mixture of soot and dammar. The patterns of tattoos symbolize bravery or enhance beauty. It varies from tribe to tribe and in some cases, depends on individual's social standing (Parrott 1973). Adorning body with different colours among the Orang Ulu ethnic members is a part of their social life. The tattoos bear the significant story of individual's life experiences; symbolizes grandeur and representing status in their society. The Orang Ulu, particularly the Kenyah women of aristocratic status is finely tattooed on their arms, fingers, feet, and thighs. Designs are first incised on wooden block and printed on the skin to be finely pricked with needle and dye (Eliot 1999).

The most descriptive body tattoos are found in Kayan tribe. They put tattoos of 'dog' in fingers which represent a certain degree of veneration among Kenyah tribes. Women tattoos with combination of red, white and black dyes. Different shapes such as lines, dots, curves, and sometimes sketches are drawn on the face, chest and back (Junaidi Payne 1992). The Kayan women believe that the tattoos are the torches of the next life and without this they will remain in complete darkness in the next life (Eliot 1999). They also use dye for dyeing handicrafts and textiles (Junaidi Payne *et al.*, 1992). The objective of this study was to identify plants used as natural dyes by the Orang Ulu ethnics in Asap Koyan Belaga, Sarawak, Malaysia. Through this research study, we gain better insight on these communities and their indigenous knowledge, for cultural heritage preservation which has been undocumented for hundreds of years and to sustaining the knowledge is the most concern matter which represent their unique culture and identity through their indigenous knowledge and their creation.

MATERIALS AND METHODS

Study Site

In this study, field work was carried out at Asap Koyan Belaga, Kapit Sarawak Malaysia. Belaga is the capital of the Belaga District, covering an area of 19, 403.2 sq kilometres in the Kapit Division of Sarawak in the East of Malaysia. It is situated to the upper reaches of the Rajang River; 120 kilometres northeast of Kapit; about 100 kilometres from the South China Sea coast near Bintulu (Fig. 1).

Field data collection

Key informant interviews were carried out individually in the home and dye plant growing areas of Orang Ulu ethnics in Asap Koyan Belaga.

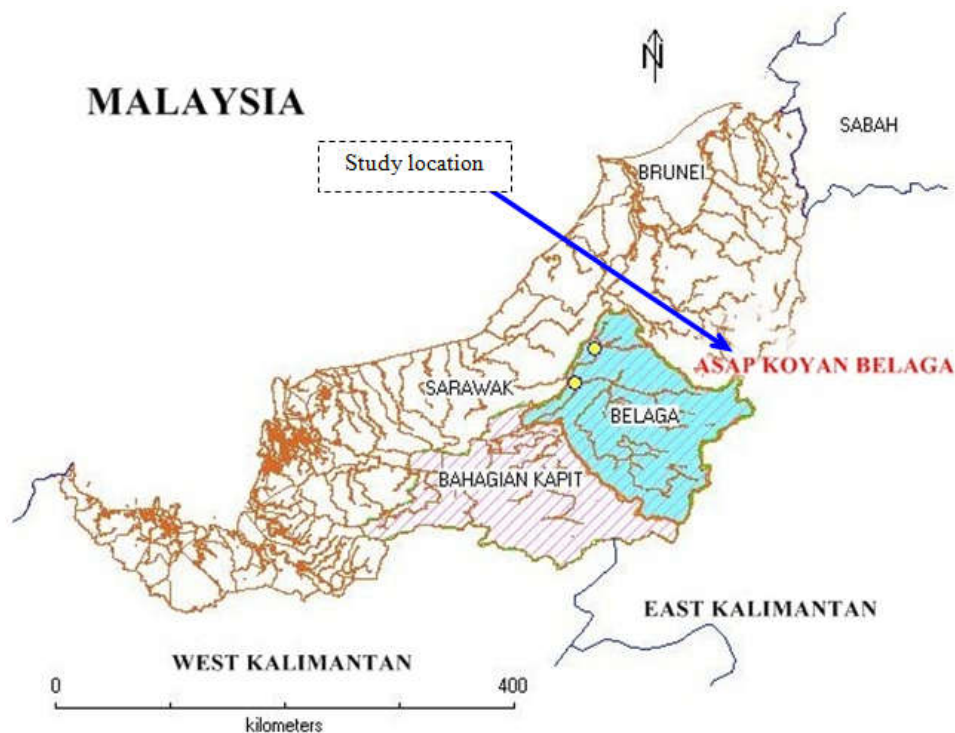


Figure 1. Location of the study area

Age of key informants ranges from 27 to 120 years. All the information was compiled by the direct interview as well as rapid appraisal method using semi-structured questionnaires. Transect survey was carried out in and around the dye plant growing area to validate all the information that were obtained from the key informant interviews.

Plant samples that were used by the Orang Ulu ethnics for natural dye production were collected through asking the ethnics, registered during the ethnobotanical field survey. Plants samples were brought to the Herbarium, Department of Forestry Science, Universiti Putra Malaysia Bintulu Sarawak Campus for taxonomic identification. The voucher specimen was stored in the herbarium. The local name of the plants, the plant parts used for dye production and obtained colours from extraction were determined by collecting information from the Orang Ulu Ethnics. All taxa in species, genus, and family levels were written in alphabetical order.

RESULTS AND DISCUSSION

From this study it was identified that that there were 51 species from 30 families used by the Orang Ulu ethnics as dye source in the Asap Koyan Belaga region found and recorded (Table 1).

The family Euphorbiaceae and Palmaceae has the largest number of taxa in the region with 5 species, followed by Leguminosae with 4 species, Rubiaceae, Guttiferae and Moraceae with 3 species, Anacardiaceae, Rhizophoraceae, and Melastomaceae with 2 species (Figure 2). The rest of the 21 families represented by only one species are Acanthaceae, Balsaminaceae, Bixaceae, Convolvulaceae, Dipterocarpaceae, Fagaceae, Dipterocarpaceae, Fagaceae, Graminae, Lythraceae, Malvaceae, Menispermaceae, Meliaceae, Myrtaceae, Oleaceae, Pandanaceae, Piperaceae, Sapindaceae, Solanaceae, Simaboraceae, Theaceae, Verbenaceae, and Zingiberaceae.

Table 1. Dye plant used by the Orang Ulu ethnics

No.	Botanical name	Plant family	Common/Local Name	Plant part	Colour
1	<i>Anacardium occidentale</i> L.	Anacardiaceae	Jambu Irong	Bark, Fruit	Black
2	<i>Anthocephalus chinensis</i> (Lam.) A. Rich. Ex Walp.	Rubiaceae	Selimpuh	Root	Yellow
3	<i>Archagelisia flava</i> (L.) Merr.	Menispermaceae	Mengkunyit	Heartwood	Yellow
4	<i>Areca catechu</i> L.	Palmaceae	Pinang	Heartwood	Red
5	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Nangka	Fruit	Orange
6	<i>Artocarpus integer</i> (Thunb.) Merr.	Moraceae	Cempedak	Woody stem	Orange
7	<i>Baccaurea javanica</i> (Blume) Mull. Arg	Euphorbiaceae	Setambun	Bark	Black
8	<i>Baccaurea motleyana</i> (Müll. Arg.) Müll. Arg.	Euphorbiaceae	Rambai	Fruit skin	Black
9	<i>Bixa orellana</i> L.	Bixaceae	Kesumba	Fruit	Yellow
10	<i>Bruguiera gymnorhiza</i> (L.) Lamk.	Rhizophoraceae	Putut	Bark	Black
11	<i>Ceriops decandra</i> (Griff.) Ding Hou.	Rhizophoraceae	Landing-landing	Bark, Leaf	Black
12	<i>Clitoria ternatea</i> L.	Leguminosae	Bunga biru	Fruit stalk	Purple
13	<i>Cocos nucifera</i> L.	Palmaceae	Kelapa	Flower	Black
14	<i>Curcuma domestica</i> Valetton	Zingiberaceae	Kunyit	Fruit	Yellow
15	<i>Daemonorops didymophylla</i> Becc.	Palmaceae	Udat	Fruit	Red
16	<i>Daemonorops micracantha</i> (Griff.) Becc.	Palmaceae	Wi jerenang	Fruit	Red
17	<i>Daemonorops sabut</i> Becc.	Palmaceae	Wi Lepoh	Fruit	Red
18	<i>Eurycoma longifolia</i> Jack	Simaboraceae	Tongkat Ali	Leaf	Black
19	<i>Excoecaria indica</i> (Willd.) Müll. Arg.	Euphorbiaceae	Buta-buta	Leaf	Green
20	<i>Flemingia macrophylla</i> (Willd.) Kuntze	Leguminosae	Serangan Jantan	Fruit	Purple
21	<i>Garcinia atroviridis</i> Griff. ex T. Anderson	Guttiferae	Asam gelugor	Fruit skin	Brown
22	<i>Garcinia dulcis</i> (Roxb.) Kurz	Guttiferae	Mundu	Fruit	Brown
23	<i>Garcinia mangostana</i> L.	Guttiferae	Manggis	Fruit	Purple
24	<i>Glochidion superbum</i> Baill. Ex Müll. Arg.	Euphorbiaceae	Tebangau	Leaf	Red
25	<i>Gordonias cortechinii</i> King.	Theaceae	Pagar anak	Fruit skin	Red
26	<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Bunga raya	Flower	Red
27	<i>Impatiens balsama</i> L.	Balsaminaceae	Bunga tabo	Leaf	Red
28	<i>Indigofera suffruticosa</i> Mill.	Leguminosae	Tarom	Aboveground	Purple
29	<i>Ipomoea batatas</i> (L.) Lam.	Convolvulaceae	Keledek	Fruit skin	Blue
30	<i>Lansium domesticum</i> Corr.	Meliaceae	Langsat	Leaf	Black
31	<i>Lawsonia inermis</i> L.	Lythraceae	Inai	Leaf	Red
32	<i>Lithocarpus cratophora</i> Fischer	Fagaceae	Mempening	Heartwood	Blue
33	<i>Macaranga tanarius</i> (L.) Mull. Arg.	Euphorbiaceae	Mahang putih	Leaf	Black
34	<i>Maclura cochinchinensis</i> (Lour.) Corner	Moraceae	Kederang	Bark	Yellow
35	<i>Mangifera indica</i> L.	Anacardiaceae	Mangga	Flower	Yellow
36	<i>Melastoma sanguineum</i> Sims.	Melastomaceae	Red melastome	Flower	Purple
37	<i>Melastoma malabathricum</i> L.	Melastomaceae	Senduduk	Root bark	Purple
38	<i>Morinda citrifolia</i> L.	Rubiaceae	Mengkudu	Shoot, Leaf	Red
39	<i>Nephelium lappaceum</i> L.	Sapindaceae	Rambutan	Leaf	Black
40	<i>Nicotiana tabacum</i> L.	Solanaceae	Tembakau	Flower	Red
41	<i>Nyctanthes arbor-tristis</i> L.	Oleaceae	Seri gading	Leaf	Yellow
42	<i>Pandanus odoratissimus</i> auct.	Pandanaceae	Pandan	Leaf	Green
43	<i>Peristrophe tinctoria</i> Nees.	Acanthaceae	Noja	Stem, Leaf	Purple
44	<i>Piper betle</i> L.	Piperaceae	Sireh	Shoot	Red
45	<i>Psidium guajava</i>	Myrtaceae	Jambu batu	Leaf, Bark	Red
46	<i>Pterocarpus indicus</i> Willd.	Leguminosae	Narra	Leaf, Bark	Red
47	<i>Saccharum officinarum</i> L.	Graminae	Tebu	Leaf	Black
48	<i>Shorea javanica</i> Koord. et Valetton	Dipterocarpaceae	Meranti putih	Stem	Black
49	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Jambolan	Bark	Brown
50	<i>Tectona grandis</i> L.	Verbenaceae	Jati	Bark, Root, Leaf	Red
51	<i>Uncaria gambir</i> (Hunter) Roxb.	Rubiaceae	Gambir	Leaf	Black

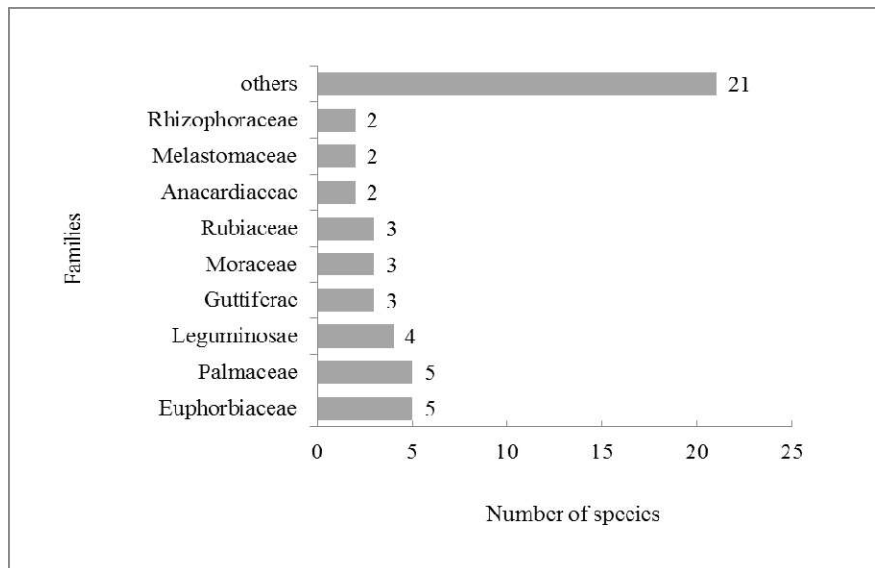


Figure 2. The number of species according to families

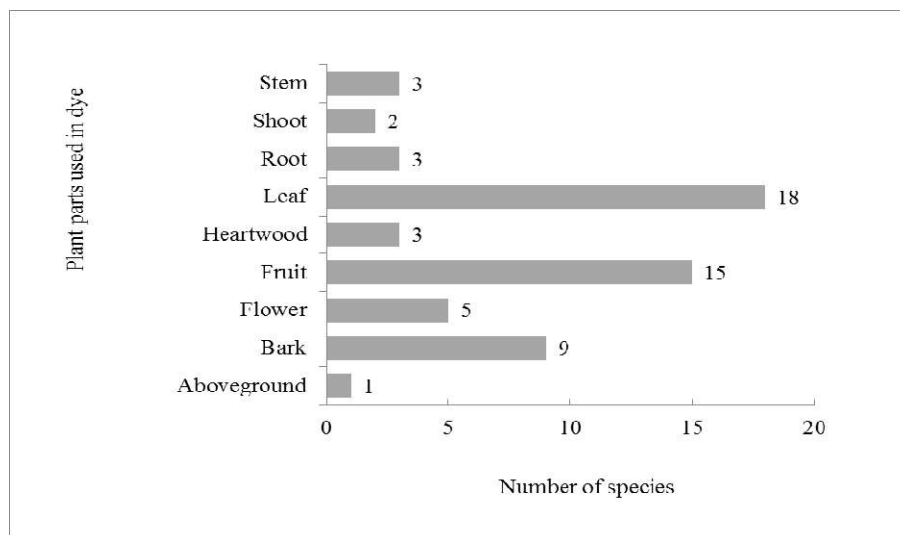


Figure 3. Plant parts used in dye extraction and their distribution according to the number of species

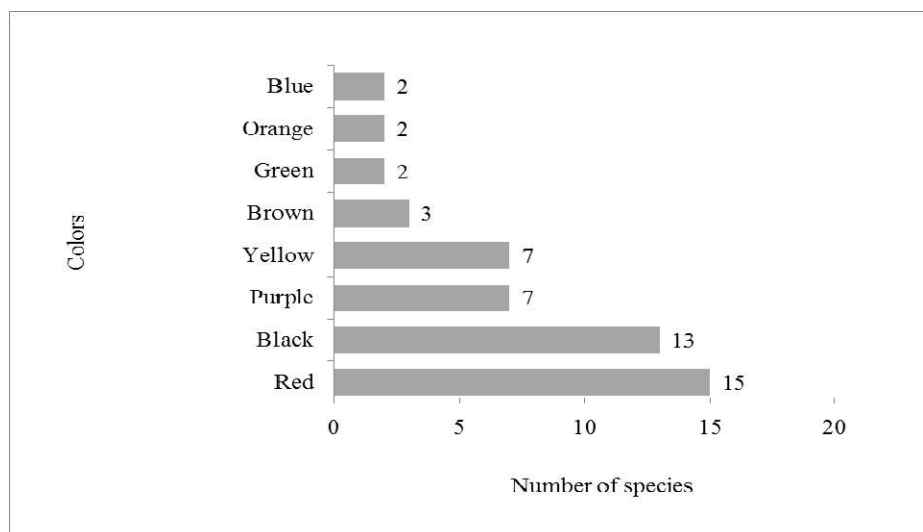


Figure 4. The colours obtained from dye plants and their distributions according to the number of species

As a result of our investigation, it was identified that just one part or combination of more than one part or all aboveground parts of the plants were used as dye substances by the Orang Ulu ethnics. For example, leaves of 18 species, fruit of 15 species, bark of 9 species, flower of 5 species, stem, root and heartwood of three species, and shoot of two species are used as dye substances in the region (Figure 3). All aboveground plant parts of *Indigofera suffruticosa* which is locally known as Tarom was used as dye substance.

According to the present study, the Orang Ulu ethnics used the fruit of *Arecha catechu*, *Bixa orellana*, *Baccaurea motylena*, *Curcuma domestica*, *Daemonorops micracanta*, *Daemonorops didymophylla*, *Daemonorops sabut* Beccari, *Flemingia macrophylla*, *Garcinia mangostana*, *Garcinia atrovides*, *Garcinia dulcis*, *Gordonia scothecanii* and *Lansium domesticum* for producing dyes. They used flower of *Clitoria ternatea*, *Melastoma malabathricum*, *Melastoma sanguiem* and *Nyctanthesarbor-tristis*. Heartwood of *Artocarpus heteropyllus* and *Artocarpus integer*, woody stem of *Archagelisia flava*, leaf of *Eurycoma longifolia*, *Excoecaria indica*, *Glochidion superbum*, *Ipomea batatas*, *Macaranga tanarius*, *Pandanus odoratissimus*, *Piper betle*, and bark of *Baccaurea javanica*, *Bruguiera gymnorhiza*, *Mangifera indica*, and *Syzigium cuminii* for dye extraction. Root of *Morinda citrifolia* were important part for colour extraction. Other plants parts such as shoot and leaf of *Nephelium*, twig and leaf of *Peristrophe bivalves*, wood of *Peristrophe indicus*, leaf and bark of *Psidium guajava*, dregs of *Saccharum officinarum*, stem of *Shorea javanica* and resinous from leaf of *Uncaria gambir* were used for colour extraction.

Dyes extracted from these plant parts have more subtle or pastel colours compared to the vibrant feature obtained from commercial or synthetic dyes. The selection of mature and fresh raw dye materials contributes to the purity and quality of dyes during colour extraction and processing. Raw material sources are colour dependent in relation to maturity and source condition. Healthy plant parts ensure better and more desirable colours (Lipphan, 1983). Since the second part of the 19th century, artificial dyes were preferred to natural dyes. However, it was found that with artificial dyes the colour of handicrafts changes over time, and the value of handicraft deteriorate while they exposed to light, washing, and friction. On the contrary, when handicrafts are dyed with natural dyes, the bright colour will endure for a long time and the dyes are not harmful to the environment (Baytop, 1984). For these reasons, the importance of natural dyes is increasing from day to day.

According to our study, from the investigated plants 8 different colours are gained. Some of these colours can be obtained from one plant, or different colours can be produced from different parts of the same plant. Dregs flowers, fruit skin, fruit stalk, leaves, roots, resinous, the outer and inner bark of trees, and heartwood of some species were used to produce these dyes. It was also observed that, lighter colours were derived from leaves and fruits while darker colours were derived from bark and roots. It is seen that the natural dyes obtained from these plants include three main colours: yellow, red, and blue. Ugur (1988) and Mairet (1948) reported that other colours can be

produced from one plant, or from combination of the parts of different plants. These findings reported by the authors were supported by the results of our investigation. In our investigation, in the Asap Koyan Belaga regions where natural dyeing is still alive, it was identified that the colours obtained from the number of species are as follows: red from 15 species, black from 13 species, purple and yellow brown from 7 species, brown from 3 species, and blue, orange and green from two species (Figure 4). The results clearly show that the production of same colour from different plants, like red obtained from 15 different plant species, illustrates how Asap Koyan Belaga region has a rich potential from the natural dye plants point of view.

There are different tribes inhabiting in the Asap Koyan Belaga region, possesses indigenous knowledge of dye extraction utilizing the plant resources and the extraction process and utilization varies with tribes. Since the plant parts being the main source of raw materials for dye extraction, local floral diversity has an influence on the variety of colour the tribes produce. The variety of natural dye - yielding plant sources with their varying derived colours dictates the dyes to be extracted (Davis *et al.*, 1995). The Orang Ulu ethnics are also aware about the natural dye process as an environment friendly technology. They are employed traditionally by the ethnic community for extracting dyes utilizing their indigenous extraction techniques.

With the emergence of modern dyeing technologies, the natural dye weaving techniques adopted by the Orang Ulu ethnics was not affected in terms of authenticity and originality. Moreover, the Orang Ulu ethnics have earned social recognition due to creativity and artistry traced in their finished products in Asap Koyan Belaga region. From time immemorial till present natural dye extraction and utilization has not only become their social and economic foundation but also boosting their cultural integrity and dignity.

Plants used for colouring purposes by the Orang Ulu ethnics will be an important part of Malaysian flora. We hope that this work will help the researchers and people who are interested in plant-originated natural dyes. Private companies or businesses could be established for the propagation of plants used for dyes. Also new employment facilities will be provided through promoting this indigenous knowledge and more cultivation and conservation of natural dye plants.

Conclusion

From the present study, the most of the species belonging to Euphorbiaceae and Palmae family are used by the Orang Ulu ethnics for natural dye extraction. Red and black are the dominant colours that extract from different plant parts. People of the Orang Ulu ethnics use the dye for many purposes including colouring handicrafts, blacken teeth, tattooing and many more in their cultural and social life. The major source of their raw materials is coming from the primary forest, secondary forest, and plants ground in their home garden. Although, different types of dye plants still available in the Asap Koyan Belaga regions, but, due to extensive logging activity and exploitation of forest resources the colouring plants

are now under threat. Rapid development in the area has caused extensive raw material depletion and the resources. Managing these resources sustainably should provide unique opportunities for modern society to learn about traditional ethno botany from local communities. Further, conservation of sufficient areas of colour producing plants could provide opportunities for the younger generation to assimilate indigenous knowledge which may otherwise be lost due to conversion of forested areas by development and other land uses. Government of Malaysia particularly Sarawak State Government should take proper management and forest conservation initiatives to preserve this indigenous knowledge of Orang Ulu and sustain their economy and cultural heritage.

Acknowledgement

The authors would like to extend their appreciation to the community of ASAP Koyan Belaga Sarawak Malaysia for information they shared.

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