STUDY ON SUSTAINABLE USES OF COLORANT FROM PLANT RESOURCES OF ETHNIC MINORITIES IN VIETNAM

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL OF HUMAN SCIENCES – OSAKA UNIVERSITY IN PANTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTORS OF HUMAN SCIENCES

OSAKA UNIVERSITY

2016

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ACKNOWLEDGEMENTS

In the process of the research for the thesis a number of people supported to me, and I would like to express my sincere gratitude to them by recording their names in this acknowledge as well.

First of all, I would like to thank to my advisors Yoshinori Sumimura, the Global Collaboration Center (GLOCOL) and Professor Ninh Khac Ban, Vietnam Academy of Science and Technology (VAST), who support and encourage me in finishing dissertation. Special thanks to professors in Glocol for teaching and guiding in anthropology methodology which is the new subject to me.

In fieldworks at mountainous areas, all the people and community representatives received my visits and kindly shared their knowledge and experiences of natural dyes in Vietnam. I would like to express my humble appreciation especially to local people.

I would like to grateful to Professor Hirata Kazumasa and Applied Environmental Biology Lab, Graduate School of Pharmaceutical Sciences (Osaka University) for support to me in testing toxicity colorants for food.

My special thanks are due to Professor Masao Kashinaga in Minpaku (National Museum of Ethnology) for warm encouragement, considerate support and sharing knowledge in Thai Studies in Vietnam.

In Japan, I am indebted to students at Human sciences Graduated School, Glocol staffs, Ms. Aoki Megumu for their helping.

In addition, I express warm thanks to NGUYEN Phuong Thao and the Department of Ethnobotany, IEBR, Hanoi, for sharing the knowledge and images of colorant plants, deep gratitude to staffs at Natural Conservation Department (Vietnam National Museum of Nature, VNMN) for assitance and encouragement in my process of research of thesis.

I express warm thanks to Elizabeth K. Humphrey and Prof. Peter Matthews (Minpaku) for editing assistance in writing scientific articles.

Lastly, but not least, I thank to my parents and my family for their strong support, and transmitting the love in scientific research to me.

Osaka, Februaly 2017

Ngoc Anh LUU-DAM

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CHAPTER I – **INTRODUCTION**

Research into natural colorants in Vietnam is not a relatively new field, having originated in the 1990s. However, these past works generally concerned overall surveys evaluating colorant resources in Vietnam; hence, there has been no systematic or comprehensive research into the composition of colorant plants, traditional implementation methods, or other related social factors. In regard to their actual needs, the Vietnamese must import 80% of the dyes used in their food and in other industries from abroad. On the other hand, Vietnam is a tropical country, located in Southeast Asia, with high biodiversity, and it ranks 16th in the world in regard to levels of endemism and species diversity (National Strategy for Biodiversity Conservation in Vietnam from 2010 to 2020). Vietnamese flora is estimated to consist of over 12,000 vascular plants, which includes over 4,000 medial plants, 300 oil-producing plants, and 200 colorant plants. ([1]).

Moreover, Vietnam is also a country with considerable ethnic diversity, with over 50 ethnic groups residing in the area. Eight languages groups also exist within the country's ethnic communities. The ethnic minorities live across the country, with a higher density in the northern mountainous region (30 groups), followed by the central–western highland region (14 groups), and the southern region (nine groups). Their lives depend greatly on forest resources, which they use for food, clothing, and as housing supplies. As a result of their long period of residence in their respective regions, they have accumulated a considerable local-knowledge system concerning the use of botany to fulfill the most basic needs.

In line with modernization and industrialization trends, Vietnam has changed dramatically since the Renovation Policy of 1986, shifting the country from a subsidy–centralized economy to a multiple–merchandized one. Modernization and industrialization has helped many industries to develop more rapidly, and this has had considerable effects on all social elements. The lives of ethnic communities have also been improved, with more education, medical access, and cultural facilities available.

[1] Cư, L. D. and Hợi T. M.1995, *Các cây nhuộm màu phổ biến ở Việt nam*. Tuyển tập công trình nghiên cứu: 46–58, Viện STTNSV. Nxb. Khoa học & Kỹ thuật.

These new changes and innovations have helped ethnic groups in highlands to focus less on labor, and they can now participate in social activities, or even work in government agencies, actively contributing to the modernization and development of their nation. However, under the influence of modernization, many traditional customs and social identities have been changed significantly, and will soon be forgotten entirely. The convenient availability of products in the markets means that the number of people who remember how to extract and use natural colorants is dwindling, and activities such as making traditional clothing, dyed fabric and food, and the planting of cotton trees are disappearing.

In previous times, in the area between the Mã river and the Sốp Cộp district (Sơn La province), villages of Thai people engaging in sericulture, silk weaving, and lac dyeing for weaving Khuyt and Pieu were common, but these beautiful scenes have all but vanished in recent years. The practice of raising lac insects has been lost for over a decade and using sericulture to weave silk is now only remembered by the elderly of these villages; hence, the youth today do not know how to engage in these activities. Silk weaving and lac dyeing are famous for being jobs for Thai women, which is an indication of these women's ingenuity and resourcefulness and, more importantly, it shows that the activities were part of an extremely unique and special ethnic identity. It is a great pity to lose these intangible cultural heritages, and researchers who focus on native knowledge, and especially those who, like myself, are interested in natural colorants, are becoming disappointed and concerned with these developments.

I began to research natural colorants in 2007, when I was working in the Ethnobotanical Department of the Institute of Ecology and Biological Resources in the Vietnam Academy of Science and Technology. Initially, I only focused on objects such as plants that are used to obtain food dye, which are commonly used in the traditional dishes of many minorities in Vietnam during the Tet festival (e.g., five-colored sticky rice and black Vietnam square cake). In minority cultures, the colors not only help to improve the appeal of the food and its preservation time, but they also carry many deep symbolic meanings. When the Dao people throw a house-warming party, red sticky rice is always served, as this symbolizes a wish that the family members enjoy long lives. Additionally, the Dao people believe that a good outcome in the dyeing process means that every member in family will have good health.

After deeper research of their cultures and traditions, particularly in relation to local knowledge on natural-colorant usage, I discovered that the people not only master the dyeing of food but also of fabric, as they possess very efficient and unique ways of combining natural colorants. Vietnam, as a land with over 50 different ethnic communities, has been enriched by this valuable local knowledge and the abundance of natural plant-colorant resources. In addition, many concepts relating to world-views and unique social customs are expressed through the coloring of food and fabric. This has intrigued me and motivated me to conduct research into how minority communities can be assisted in regard to maintaining their traditional usage of colorant plants and, even more importantly, how their traditional knowledge can be preserved. Furthermore, I became interested in researching how natural factors such as deforestation and climate change have affected these activities and how social factors from inside the minorities' communities and external factors have affected their knowledge system in regard to natural-colorant usage. Why are they discontinuing their dyeing tradition and what difficulties do they face when they attempt to practice these traditional activities? for all of the above reasons, I wrote the dissertation: STUDY ON VIETNAMESE ETHNIC MINORITIES' SUSTAINABLE USE OF COLORANTS SOURCED FROM PLANTS.

1. Research objects

Natural colorant plants and indigenous knowledge concerning their use, as well as different factors that affect the sustainability of these practices.

2. Research purposes

- Indigenous knowledge on using plants to color fabric and food in Vietnam is abundant and unique, but it is being rapidly forgotten as a result of the impacts of industrialization and the decline of biodiversity decline. Hence, we have a duty to preserve them.

- Vietnam imports 80% of the pigments used to dye food, textiles, and cosmetics. Hence, we must reconsider the value of plant resources and their usage.

- This research will help to evaluate related factors concerning the sustainable use of natural colorant resources in Vietnam.

3. Dissertation purpose

- To systematically clarify the distinguished, valuable, and unique indigenous knowledge of ethnic minorities in Vietnam in relation to colorant plants, and document the information through surveys and interviews.
- To analyze obstacles to sustainable use and the development of natural plant-dyeing culture using the KAP (knowledge, attitude, and practice) method.
- To determine factors related to the sustainability of natural resources and knowledge relating to the use of natural colorant plants by Vietnamese ethnic minorities.

4. Research Methodologies

In this paper, I would like to combine anthropological and ethnobotanical methods to explore Vietnamese tribes' local knowledge concerning the use of natural colorant plants. This combination can help to comprehensively organize information on the local usage of natural colorant plants from both natural and social perspectives. From a botanical point of view, different plant compositions will be examined in terms of the ethnic minorities' usage of them. Additionally, from the anthropological perspective, many factors related to local knowledge will be researched and evaluated. Furthermore, the meanings behind the use of multiple colors in clothes and traditional dishes will also be documented, along with many natural and social factors that impact the ethnic groups' customs relating to the colorant plants and their usage. These will not only give us an overview of the many variations in the Vietnamese dyeing culture, but will also provide valuable information concerning existing biodiversity and intangible cultural heritage, as well as the many risks that these communities are currently facing.

Moreover, I also include findings concerning how ethnic people's opinions of the use of colorants have changed. To obtain this information, I applied the KAP method in research on the Black Thai community in order to determine the knowledge of, attitudes towards, and implementation of colorant plants in Son La Province.

5. Dissertation structure

- Chapter 1: INTRODUCTION

In this chapter, I overview the objectives, purposes, methodologies, and structure of the dissertation.

- Chapter 2: OVERALL HISTORY OF THE USE OF NATURAL COLORANTS WORLDWIDE AND PREVIOUS RESEARCH INTO COLORANT USE IN VIETNAM

In this chapter, I review previous research concerning the use of natural colorants, both in Vietnam and worldwide, in order to clarify possible issues that may relate to their use.

- Chapter 3: RESEARCH METHODOLOGIES

In this chapter, I explain the interdisciplinary methodologies, fieldwork, and scientific analyses applied, as well as the KAP method.

- Chapter 4: LOCAL KNOWLEDGE OF A SELECTION OF ETHNIC MINORITY GROUPS IN REGARD TO USING NATURAL COLORANT PLANTS TO COLOR FOOD AND FABRIC

In this chapter, I describe the actual situation of the local knowledge of ethnic minorities based on the result of my fieldwork.

- Chapter 5: CHANGING USES OF COLORANT PLANTS IN BLACK THAI COMMUNITIES

In this chapter, I focus on two Black Thai communities and analyze the contrast between their knowledge of, attitude towards, and practice of dyeing using colorant plants in order to clarify factors that have influenced the sustainability of colorant usage.

- Chapter 6: FACTORS RELATING TO THE CHANGING USE OF NATURAL COLORANTS

In this chapter, by comparing the results of the KAP study performed on two different Black Thai communities, which have different natural conditions, climates, and history, I discuss significant subjective and objective factors relating to the usage of colorants.

- Chapter 7: VALUE OF NATURAL COLORANTS IN VIETNAMESE SOCIETY

In this chapter, I discuss key values that have significance in relation to the process of modernization: the objectification of culture, convenience, nature and art, and safety.

- Chapter 8: DISCUSSION AND CONCLUSION

In this chapter, I discuss future research possibilities and the limitations of this study.

I. HISTORY OF THE USE OF NATURAL COLORANTS AROUND THE WORLD

1.1 History of exploitation and research into the use of colorants around the world

By simply looking through a window on a bright fall day, it is easy to see that nature possesses innumerable colors from which humans can derive inspiration and attempt to simulate in their everyday products. Colors have become an indispensable part of human life.

Colorants were first discovered and used over 3,000 years ago (Downham A. & Collins P., 2000) and, throughout history, civilizations have accumulated various knowledge and experiences of colorants. Academics continue to study colors in order to determine the reasons why they have had such an immense impact on human life, as well as to discover new ingredients and more efficient methods of using natural colorants. (Rita, 1971)

Archaeological research shows that there is a long and impressive history of natural-colorant usage. Many of the colorants discovered in ancient times are still widely used today. The dyeing of fabrics with natural colorants began in ancient times; the earliest evidence of the use of natural colorants was found in China, in material dated to 2,600 BC (Cardon D., 2007). Similarly, chemical tests on red fabric samples found in the tomb of the Egyptian pharaoh Tutankhamun confirmed the presence of alizarin, a colorant derived from the madder tree. In another example, Alexander the Great, some years later, mentioned finding a purple cape in the royal treasury when he invaded Susa, the capital of Persia (an event that occurred in 541 BC). Additionally, according to Jewish records, kermes (extracted from red oak aphids) was used to dye linen red and, similarly, colorants such as woad, madder, weld, Brazil wood, indigo, and purple were known in the fourth century AD (Ethel M. Mairet ,1916).

The Europeans have used red colorants since the Middle Ages. These colorants were mostly derived from the core of sappan wood (*Caesalpinia sappan*) (Fuke, 1985), which is a species that originated from the tropical regions of Asia (India, Malaysia,

and Sri Lanka). Low quantities of sappanwood were exported to Europe during the Middle Ages. This kind of colorant has a magnificently red color, similar to burning coal, and it was called bresil or brasil by Portuguese traders. According to a study by Record and Hess, in 1321 the Portuguese discovered and exploited a large amount of another species, dyewood trees (*Caesalpinia echinata*). The vast land in which they found such an abundance of dyeing timbers was called Terra de Brasil, and later Brazil, after it was discovered that many brazilwoods grew there. Brazil may be the only country named after a plant. (Canon 1994)

In approximately the 1500s the Spaniards discovered another leguminous tree called logwood (*Haematoxylum campechianum*). This tree is native to Central America, particularly Mexico, and parts of North and South America. They especially grow in Yucatan, Mexico, and have a reddish color, similar to the color of sappanwood. At the end of the 1500s, the Spaniards began to export large volumes of valuable logwood cores from Yucatan.

Figure 1. Structural formula of Brazilin and Brazilein

Until 1507, dye plants were cultivated in France, Holland and Germany as part of those countries' dyeing industry.

In addition to the plants mentioned above, Egyptian women have used henna (*Lawsonia inermis* L.) to dye their hair since 2,500 BC (Mary Hancock, 1997). Concurrently, saffron is recorded in the Bible as a dyeing substance.

Indigo dye derived from woad (*Isatic tinctoria*) was originally used by Britonic warriors in Palestine, where wild woads grew in abundance. (Balfour J., 2006)

The most famous expensive pigment and the most frequently mentioned throughout history is Tyrian purple. Tyrian purple was extracted from the spikes of shellfish in the Mediterranean Sea and was used to dye linen (Decelles, 1949). According to ancient texts, the Greeks named the citizens of a nearby city “Phoenicians” (later, Phoinikes), and this may have been a result of the trade of their famous purple dye. It took approximately 8,000 shellfish to produce one gram of this pigment; therefore, its price per gram was higher than gold, and it was used exclusively to dye the fabrics of the royals or wealthy aristocrats of ancient times. The Phoenicians continued producing the pigment until the seventh century, when Egyptian invaders destroyed the workshops in Levant. Tyrian purple was a valuable pigment in ancient times. Its chemical structural formula is 6,6′-dibromoindigo (Figure 2), which was discovered in 1909. This compound has not yet been produced synthetically for commercial purposes.

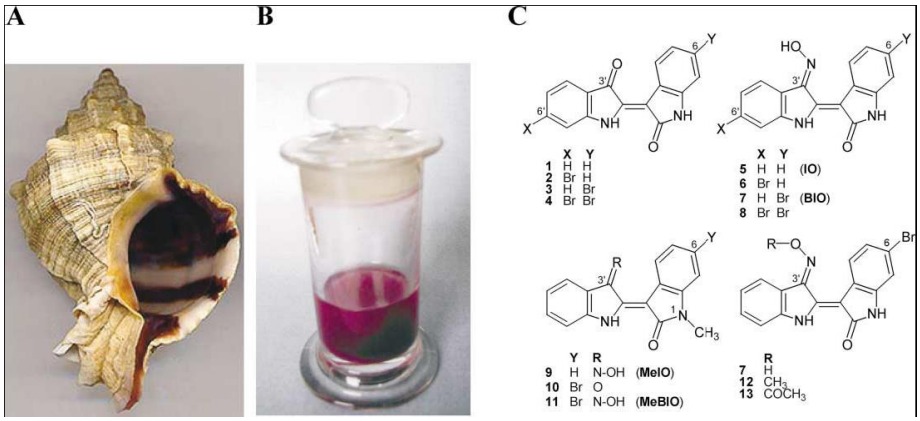


Figure 2. Tyrian purple from shell fish

Along with the trend of extracting colorants from plants, in the 15th century dyes from insects like cochineals and kermes became very popular.

Figure 3. Colors sourced from cochineals

Along with dyeing clothing, on religious holidays and during wars ancient people would dye the skin of their animals. They believed that the colors would create magical powers, protect them from evil spirits, and help them win.

Dyes may have been discovered accidentally, but their use has become an indispensable part of human tradition. It is difficult to imagine the modern world without dyes. The art of dying spread widely as human civilization developed.

Today, dyeing has become a specialized and complex field of science. Currently, many dyes can be made synthetically. This means a great improvement in their outstanding characteristics and applicability; however, many dyeing craftsmen still use natural colorants widely (natural colorants are sourced from plants, animals, and minerals).

On the other hand, many artisans who sell their products on the market believe that the use of natural colorants will not continue much longer. They give two reasons for this belief: quality and economy. The peak of the use of dyeing plants occurred in the early 19th century. With the "debut" of the first synthetic dye, mauveine, in 1856, along with the appearance of basic violet colorant and the first synthetic aniline dyes for silk, plant-based colorants began to become unpopular by the end of the century. In an attempt to synthesize artificial quinine from coal tar as a means of treating malaria, William Perkin, an 18-year-old chemistry major, created a solution that, instead of possessing a dark residue, had a beautiful and unusual color. Incidentally, Perkin had created the world's first aniline dye, which is now known as mauve. This dye has many advantages in regard to its stability and intensity, while all of the colorants and paints made from roots, leaves, insects, and the purple colorant made from krill share the common characteristics of the difficulty in predicting their color intensity and that they easily fade during washing (fastness). Perkin's discovery showed that it was possible to develop a range of synthetic colorants, and this revolutionized the field of colorants and fashion. Alizarin substances extracted from Rubia tinctorum L., which were used as red dye, were first synthesized in 1896 in Germany (von Wiesner, 1927); this was soon followed by indigo, which has been synthesized in large quantities since 1897. In a short time, colorants from plants were completely replaced by synthetic colors, which were cheaper and easier to processing. In fact, the only natural color that remained in use until 1900 was indigo (*Indigofera tinctoria*). In 1905, Adolf von Baeyer (the

scientist who created the formula for aspirin) won the Nobel Prize in Chemistry for his discovery of the molecular structure of indigo, and he developed a synthetic manufacturing process for this colorant. Natural colors were almost completely replaced by synthetic colorants, and this ended the long, glorious history of natural colorants.

However, scientists later discovered the limitations of many synthetic colorants. First, some natural colorants could not be successfully synthesized through chemical methods. Second, it was cheaper to obtain natural colorants, especially plant-based dyes (particularly species such as sappanwood, logwood, *Bixa ocellana*, and *Indigofera tinctoria*). Furthermore, and most importantly, many synthetic colorants can cause skin allergies (to fabric colorants) or other serious diseases such as cancer and cardiovascular or gastrointestinal diseases (food colorants).

Consequently, the value of natural colorants (safe, abundant, cheap) was recognized and appreciated and, in the 1960s, the study of uses of natural colorants was restored and promoted in many countries.

1.2 Forms of natural colorants and mordant

Dyeing is a process of using colorants. The colorants are retained in material through their natural fastening properties (mechanical maintenance or adsorption)

Natural colorants are obtained from animal or plant sources without processing.

Natural colorants can be divided into three categories: those extracted from plants, animals, and minerals.

* Mordant: an element that supports the interaction between the colorants and the fabric, allowing the colorant to be adsorbed. The tools for dyeing must be made of non-reactive material, such as stainless steel or celadon. Not all colorants require mordant. There are two forms of natural dye: substantive and adjective. The most common mordant is alum (often used with cream of tartar, which helps to create a brighter color and accelerates the dyeing process); iron (or brass, to create a green color or to darken colors); tin (often used with cream of tartar, and applied to create red, orange, yellow, or to brighten colors); and copper sulfate (to create green or to darken colors). In general, there are three forms of mordant: 1) metallic mordant: metallic salts sourced from aluminum, chlromium, iron, copper, and tin are most

common; 2) Tannin: often used in dyeing fabrics; 3) oil-based mordant: mostly used to create Turkey red from madder. The main structural form of oil-based mordant is a complex form linked with alum. This is also the main form of mordant used in Turkey's carpet industry.

* Natural colorants from plants

Most natural colorants and dyes are obtained from plants. Plant-based colorants provide various colors such as red, yellow, green, black, and brown. Most parts of the plant, like the roots, leaves, bark, fruit, wood, seeds, and flowers provide colorants.

* Natural colorants from animals and insects

In 1518, the Spanish discovered that the native Mexicans used cochineal "seeds" as a colorant. They later found that the colorant was not sourced from a kind of seed but actually a crimson-colored scale insect. These insects thrive on nopal and cholla in Guatemala, and this colorant as used throughout Mexico. It has been estimated that approximately 70,000 dry cochineal scale insects are required to make one pound of colorant and one acre of nopal yields approximately 200–300 pounds of colorant from cochineal insects. Colorant made from cochineal insects is more valuable than that of madder (Figure 3).

The cochineal is a source of anthraquinone that creates a bright red colorant, and this is mostly used to dye fabrics. Many shades of red can be created from cochineal, such as the shade produced by the females (or its eggs, according to some documents) of a species of the parasitic insects that live on cholla of the genus Opuntia and Nopalea cacti, especially Nopalea cochenillifera, a species native to Central and South America. The most famous cochineal colorant is obtained from the females of the Dactylopius coccus Costa species. The majority of the female insects are harvested manually when they are sexually mature. They are then preserved in a dry, airy place before the color is extracted with hot water. The chemical nature of the original cochineal colorant is carminic acid, which has a pH of 7 and the ability to react with metal to create a complex that has a bright red color; the final product is called carmine. The color ranges from purple to yellow depending on the ratio of carminic acid and aluminum. Both silk and wool can be dyed using crimson scale insects, and tin or alum are used as mordant.

Colorants obtained from animals mostly consist of:

1. Armenian red: obtained from the coccid insect Porphyrophyra hamelii, found on the roots of alkaline grass in the wet regions of Azerbaijan and Armenia

2. Kerme: extracted from lilcis, a parasitic aphid that lives on oak trees.

3. Dutch cochineal: extracted from the Porphyrophora Polonica insect, whose main habitat is the roots of *Scleranthus perennis*, a species of plant native to Central and Western Europe.

4. Red dye cochineal (lac dyes): the main ingredient in this dye is laccaic acid obtained from Laccifera lacca, which can be found on *Schleichera*, *Mauretania*, *Zizyphus*, and *Butea monosperma* in India, China, and Malaysia. This dye was traditionally used by the Chinese to dye jades. Lac was used in India for several centuries, obtained from an insect species found in the western part of the country. The female insects cling to twigs, where they quickly produce a thick, red plastic layer of ooze. This is used to dye Persian rugs dark red. In 1796, red lac was exported to the UK and, several years later, to the US, where it was widely used as a result of its low cost and high-yield.

** Colorants made from lichens and mushrooms*

Lichens and mushrooms are a popular source of colorants in Europe as well as in many other parts of the world. Lichens are mostly used to dye material purple or violet. During the Middle Ages, it was difficult and costly to collect the species of snail that yielded these colors, so lichens were used instead. With an abundant supply of this organism along the coasts, and the fact that it was easily obtained in large quantities and easy to process, it became very popular despite the longer processing time required.

Lichen is a symbiotic form of fungi and algae, and has long been used to dye fabric. The colors extracted from lichens range from orange, yellow, and brown to red, pink, and purple. Colorant made from fungi or lichens is colorful and can withstand laundry treatment and salt water. The most valuable species include: *Cladonia impexa*, *Evernia prunastri*, *Hypogymnia physodes*, *Lobaria pulmonaria*, *Ochrolechia Parella*, *O. tartarea*, *Paramelia omphalodes*, *P. saxatilis*, *Rocella tinctoria*, *Umbilicaria pustulata*, and *Xanthoria parietina*. Colorants derived from lichens are rarely used today. In regard to its chemical nature, most of the colorants belong to the flavonoid class of the

anthocyanin group, but the color and intensity of each colorant is completely different. Lichen can be difficult to extract, but the quality of the dye is worth studying and will bring economic benefits if developed and used appropriately.

Among the fungi used for colorants, some species of the Monascus genus were used for a long time in the Asian regions for dyeing foods such as rice, wine, and soy products, (Jacobson and Wasileski, 1994). The colorants that can be extracted or produced are red. These colorants are produced from fungi including carotenoids, iridoid, flavonoids, and phycobiliprotein.

1.3 The application of natural colorants in daily life

The history of the human use of colorants is quite long. Each ethnic group has had their own unique and various purposes for colorants. In general, natural colorants are used for the following purposes:

a. Colorants for foods and drinks

Experts conducted long-term studies to determine if color plays a decisive role in perceived appeal and taste of food. Three aspects were evaluated: smell, taste, and color; of these, the third factor plays the most important role. "If you do not have the right color, I think you can forget about the other two factors" –Jack Francis, a food researcher at the University of Massachusetts. "If it is not the color you expect, you will not like it." (Adam Burrows, 2009)

For many centuries, people in Southwest Asia have used plant-sourced colorants to color foods. The variety of flora in this region has provided a considerable volume of color, which means that they have many options. Using plants to dye food, especially traditional dishes, has been extremely popular in Southwest Asia, although the number of applicable colorants appears to be very limited. Some colorants are extracted from fresh, abundant ingredients. For instance, yellow is obtained from the roots of *Curcuma longa* L., green from the leaves of *Pandanus amaryllifolius* Roxb., *Dracaena angustifolia* Roxb., and *Sauropus androgynus* (L.) Merr., red from the leaves of *Iresine herbstii* Hook.f. and the fruit of *Capsicum annum* L., and brown from sugar extracted from rattan such as *Arenga pinnata* (Wurmb) Merr., *Borassus sundaicus* Becc., and *Cocos nucifera* L.

The natural food colorants obtained from plants can be divided into four main groups:

- Anthocyanin. Belonging to the flavonoid class, this form of dye is water-soluble and produces orange, red, or blue when dissolved in water. It is normally sourced from fruits and vegetables, and it is common for some types to be multi-colored (with a pH level ranging from four to six). These colorants last longest in acidic conditions, so it is necessary to maintain the concentration's pH level within the acid range.

- Betanin. This concerns a small group of yellow and red dyes that are sensitive to pH, heat, and light. Radish is widely used to extract this colorant (*Beta vulgaris* L.)

- Carotenoid. These yellow, red, and orange colorants are vulnerable to oxidation; they maintain their fastness in food if they are not exposed to air.

- Chlorophyll. The green colorants mentioned above. It is sensitive to acidic conditions and light.

Aside from color, humans are also interested in the taste and appeal of food products made from plants. In this regard, people are often attracted to the color first, then to taste, then to the structure, and finally to nutrition. Synthetic colorants are detrimental for human health. To protect consumers, most countries issue regulations regarding food colorants. The earliest act regarding food coloring was issued in France in 1396 and was related to provisions on the coloring of butter. [Brurrows A. 2009]

However, color additives approved in one country may not be approved in other countries (i.e., transnational consent is not in effect). Color additives sourced from plants are typically considered safer than synthetic additives, although the synthetic kind are also subjected to general controls before being used in food. While chlorophyll is approved as a food and drink additive in the European Union (EU), it is not approved in the United States (Freund et al. 1988). The extract of Gardenia jasminoides Ellis is very popular in Japan and is commonly added to sticky rice, roe, bread, candy, ice cream, noodles, and jam, but this is also not approved in the United States. Annato (*Bixa orellana* L.) and turmeric (*Curcuma longa* L.) are the most widely used plant-based additives in the food-processing industry.

b. Colorants for paint and ink production

Ink was first used in approximately 2,600 BC by the Chinese and Egyptians. However, certain kinds of varnish are still being produced from shellac (a pigment derived from insects).

c. Fabric dye

Fabric dye was first used in 2,600 BC, and this marks the most important milestone in the history of human colorant use. Ancient Egyptian scripts mention that, in 2,360 BC, dye workshops were very common in Egypt and Greece []. The laborers in these workshops worked nonstop for long hours; they were constantly tired and they carried the pungent odor of the dye.

The first instruction concerning dyeing techniques was published in 1188 in England. Brazilwood was first recognized as a dye in 1321 and the first book in Europe about dyeing, titled Mariegola Dell 'Arte de Tentori, was published in 1429 in Italy.

d. Colorants used in other fields (cosmetics, etc.)

Natural colorants are also used in the following areas:

- Cosmetics and makeup: The main products in this field are lipsticks, makeup, and hair dyes. The plants most widely used for the manufacture of cosmetic products include *Bixa ocellana*, *Indigofera tinctoria*, *Strobilanthes cusia*, and *Lawsonia inermis*. Saffron was formerly a popular hair dye in Venice during the 16th century.

- Based on the knowledge of obtaining colorants from plants, many cosmetic companies have manufactured popular natural dye products that possess high economic value. For example: Wella (a German company) has produced many kinds of hair dye from henna (*Lawsonia inermis*), Roman chamomile (*Chamaemelum nobile*), catechu (*Acacia catechu*), and indigo beans (*Indigofera tinctoria*)

- Natural colorants in medicine: as some natural colorants are bioactive, they are used in medicine. However, there is little information concerning this field. Among the natural colorants using in medicine, rutin is widely used (together with Vitamin C) to soften the arteries in order to lower blood pressure. Furthermore, indigotine extract from indigo beans and indigo dye are effective for curing a number of skin diseases. Another widely used colorant in medicine is carotene (a yellow substance obtained from many plants), and this is used to increase vitamin A.

II. USAGE OF NATURAL COLORANTS IN VIETNAM

1. Social background

Vietnamese people have used colorant plants for a long time and, even now, they remain a part of daily life. However, currently, there is no documentation or evidence precisely recording and describing the usage of these plants. Analyzing modern evidence, in the two wars in Vietnam (the resistance against French colonists and the war against America), the symbols of these periods were farmers in brown or black clothes and soldiers in green uniforms. These colors helped them to disguise themselves and hide from their enemies. Everyone wore dark-colored clothes as a means of camouflage to avoid enemy planes. If a shirt was white, it was dyed moss green or a waning-grass brown called "màu phòng không" (literally, air-defense color) (Tình, 2010 [1]) using Trau leaf (*Piper betel*) or Bang leaf (*Terminalia catappa).*

Brown and black were the main colors of the Kinh (Viet) people in northern and southern Vietnam. Shirts were dyed dark brown using tinctorial yam extract, while pants were dyed black (Huyên, 1996 [2]). Unlike the Kinh people, indigo was the traditional color for the clothes of the ethnic minorities in Northwestern Vietnam.

Traditional clothes and colors have been part of festivals and worshipping ceremonies for many years. The King Hung legend mentions chung cake wrapped in La dong leaves (*Phrynium* spp.), as green represents earth, and day cake made of sticky rice, as white represents heaven. Prince Lang Lieu created these two types of cake, which he submitted in a contest to determine the heir to the throne. Thanks to his unique idea, Lang Lieu became the next Viet king. Colorant plants have been a part of the history and development of every ethnic group in Vietnam (Trần Thế Pháp, 1968 [3]).

Modernization brought synthetic colors, which are now favored due to their low price and high endurance. However, natural colors have not entirely disappeared.

[1] Tình, D. T. 2010, *Trang phục thăng long Hà Nội,* 511. Nxb Hà Nội.

[2] Huyên, N. V. 1996, *Góp phần nghiên cứu văn hóa Việt Nam*, tập I: 466, Nxb. Khoa học xã hội.

[3] Pháp, T. T. 1968, *Lĩnh nam chích quái*, bản dịch Lê Hữu Mạc, Nhà sách Khai trí, Sài Gòn.

Artisans still prefer natural colorants for their work because they have the most natural colors and high aesthetic value. There are many reasons why people are turning to natural dyes even though synthetic dyes are more convenient to purchase and use. Each plant provides an amazing diversity of shades. From just one plant you can obtain between five and 15 colors and shades. Furthermore, these colors and shades are subtle and tend to harmonize with one another. The resulting fabrics or fibers consequently become original pieces—it is extremely difficult for anyone to duplicate them exactly (even the dyers themselves). Additionally, there is the question of ecology. As people are becoming more aware of environmental factors, dyers are searching for alternatives. Natural dyes are regarded as more eco-friendly as, unlike their synthetic counterparts, they are all derived from nature. Therefore, colorant plants continue to play an important role in the lifestyles of ethnic minorities.

According to plant-resource experts, Vietnam has great biodiversity in regard to its flora, and it is estimated that over 12,000 species exist in the country. Among these thousands of species, almost 200 are colorant plants (Cư and Hợi 1995). With such an abundance of colorant-plant resources, we can determine colorant plants that have the potential to be used in industry.

The majority of ethnic communities in Northern Vietnam live in mountainous areas and their daily lives depends on forest resources. The H'Mong group, which often inhabit areas that are between 1,000 meters and over 2,000 meters above sea level, gather in boundary lands where there are many rugged mountains. This lifestyle explains the group's dependence on forest resources for medicine, wood, food, dye, and their lack of knowledge of home gardening. The Dao group occupies lower areas, from above 700 meters. The H'Mong are good at planting cardamom and hemp in the forest, and the Dao are experts in herb cultivation. The Dao collect medicinal plants to replant in the forest or their forest gardens and use them for a peculiar remedy: herbal bathing.

The Viet-Muong and Tay-Thai groups reside on low hills and in valleys of vast rice fields and on relatively flat lands. These groups are specialists in farming and home gardening. Their agricultural techniques have been proven to be effective and the result can be seen in many fields in northwestern regions such as Muong Thanh, Muong Lo, and Muong Tac. The Viet-Muong and Tay-Thai have gardens around their

houses and throughout their villages where they grow an array of vegetables, fruits, and multipurpose colorant plants. As a result of their multi-generational history of practicing this lifestyle, these communities have accumulated knowledge and experience in regard to using plants for medicine, dye, and wood to satisfy their minimum daily needs concerning food, clothing, and shelter.

2. Usages

Today, ethnic minorities mainly use colorant plants for food coloring and garment, textile, and tool dyeing.

In Vietnamese ethnic-minority communities, women perform the dyeing and they maintain this knowledge within their families and communities. Dyeing is undertaken during sunny days after harvesting and when the women have leisure time. A mother will teach her daughter how to dye approximately three or four years before her child's wedding day. For new year festivals and special occasions, women and their daughters usually make colorful cakes and sticky rice for family or community rituals. As a result, the mother bequeaths her dyeing experience to her daughter, i.e., from one generation to the next. Men might have knowledge of colorant plants, but only women know how to dye and create colors.

Textile dyeing

Textile dyeing has historically been the most common use for colorant plants and many ethnic groups have maintained this practice. The species used for dyeing clothing depends on each group's living habit and conditions. The King people utilize *Dioscorea* spp. for dyeing clothes, fabric, and fishing nets brown. To dye cloth, silk, and female trousers and dresses black, Soi leaves (*Sapium discolor*) are used. In daily life, ethnic people still wear traditional costumes; however, the King people no longer use plants for dyeing clothes and this valuable knowledge is disappearing with the group's elderly.

Natural colors in food coloring

All Vietnamese ethnicities practice food coloring for particular dishes. For some ethnic minorities, multi-colored food—two-, five-, or seven-colored sticky rice—is an integral part of their culture. The most common dyeing practice involves using the husk of the membrane of the Gac fruit seed (*Momordica cochinchinensis*) and the leaves of the cam plant (*Peristrophe bivalvis*) to make red sticky rice for holidays. It is obvious

that ethnic minorities' knowledge and experiences in regard to colorant-plant usage are not fully understood and are worth researching.

Fingernail, toenail, and tooth dyeing

According to published documents, many years ago certain Vietnamese peoples used Mong leaf (*Lawsonia inermis*) and Sim tree resin (*Rhodomyrtus tomentosa*) to dye their fingernails and toenails, as well as for blackening their teeth. These practices have long been discontinued. In 1862, Western cultures entered and became widespread in Vietnam and this form of dyeing became less popular. Particularly in the 1930s, many people scraped their dyed teeth clean, revealing white, but smeared, teeth. These people wanted to be viewed as pioneers of social reform, renewal, and the women's-rights movement. Consequently, tooth dyeing has begun to disappear. Today, little research or documents can be found concerning the process.

Goods and tool dyeing

In regard to dyeing goods and tools, some Vietnamese ethnic groups use the *Dioscorea spp.* species to dye fishing and hoof-lift nets, which increases their strength. The high tannin level in Chinese yams makes the fishing nets more durable in underwater environments. Dyeing the nets also means that they blend with their surroundings. In Lao Cai, Tay-Nung people utilize the red cam plant (*Khau deng,* in the Tay's language) to make red-colored chopsticks. Generally, Vietnam's ethnic groups have longstanding and exuberant colorant-plant practices and experiences.

Paper painting, involving natural ingredients such as grass and plants, was also a traditional activity pursued by ethnic minorities. Usually, these paintings were used for worship or rituals. The Dao and Nung people of the Muong Khuong district of Lao Cai Province are excellent at creating colors from plants. The Nung group can create a wide range of colors—the seven rainbow colors and more—by combining three kinds of cham (*Indigofera* spp.), turmeric (*Curcuma longa*), and ash water (Sơn 1997)[1].

3. Status of Colorant-plant Research in Vietnam

Since 2000, the Department of Ethnobotany of the Institute of Ecology and Biological Resources has been surveying and researching the experiences of ethnic groups in regard to the usage of colorant plants in food. The department is particularly

[1] Sơn,T. H. 1997, *Văn hóa dân gian Lào Cai*, 24-37. Nxb. Văn hóa dân tộc.

analyzing the practices of ethnic minorities—such as the Tay, Nung, Dao, and H'Mong—in northern provinces, namely Lao Cai, Son La, Hoa Binh, Ha Giang, and Dien Bien. The results have illustrated the diverse and unique uses of food-coloring plants.

With these achievements and the Global Environment Facility's sponsorship, the Department of Ethnobotany successfully launched a food-coloring-plant preservation project in the Muong Khuong communes of Lao Cai Province. The first step of this project, which concerned giving instruction on the use of three colorant plants for dyeing food, concluded with the development of growing, caring, and harvesting techniques, as well as the color-extraction procedure for cam (*Peristrophe bivalvis*), cham meo (*Strobilanthes cusia*), and mat mong (*Buddleja officinalis)* plants.

Hoang Thi Linh recorded 16 popular species used for cloth dyeing and coloring (Bechtold and Mussak, 2009: 65–71).

In 2011, Vo Mai Phuong, an expert with the Vietnam Museum of Ethnology, completed a doctorate focusing on Lao costumes and their components and described the process for dyeing with indigo. In addition, the Lao people have knowledge of blending the three primary colors—blue (indigo), yellow (*Gardenia*), red (lac) (Phương, 2011 [1])—to create green, purple, and sapphire blue.

Before the aforementioned studies, there was no research or papers explaining the unique knowledge of ethnic minorities in regard to creating and combining colors for dyeing food and garments. Vo Mai Phuong's paper records and describes the experiences and cultural practices concerning dyeing of the ethnic minority groups in northern Vietnam, particularly noting festivals, weddings, and new year celebrations.

1 Phương, V. M. 2011 *Trang phục của người Lào ở Tây Bắc Việt Nam*. Luận án tiến sỹ, 66—67. Viện Khoa học xã hội Việt Nam.

CHAPTER III - **METHODOLOGIES**

In this research, I would like to combine a unique anthropological method with ethnobotanical methods in order to study the indigenous knowledge of minority communities in Vietnam relating to the utilization of dye plants. This combination can facilitate a comprehensive systematization of indigenous knowledge relating to the use of native plants in both natural and social fields. The species' compositions are identified, along with the process of use of the dye plants. In addition, factors affecting local knowledge are studied and evaluated, and the meaning expressed through the various colorings used in costumes and traditional dishes are documented. These factors impact common practices relating to the use of dye plants by ethnic minority groups. This combination will also help us to gain an overview of the cultural identity of each dye in Vietnam, the value of biodiversity and the existent intangible culture, and the threats that the communities are facing.

1. FIELD RESEARCH

PREVIOUS FIELDWORK

In my previous work, I focused on investigation and the collection of the knowledge and experience of ethnic minorities in regard to the use of colorant plants.

Between 2008 and 2012, I conducted several field trips in mountainous areas in Northern Vietnam, such as the Son La, Lao Cai, Hoa Binh, and Cao Bang provinces. In each province, I chose a dominant ethnic group to research in regard to their experience and utilization of dye plants; examples of such groups include: the Thai people of Son La Province; the Black Mong and the Red Dao of Sapa, Lao Cai province; and the Tai-Nung of the Lang Son and Cao Bang provinces

Interviews and field investigations were undertaken in twelve mountainous hamlets and villages, and were conducted with the following peoples:

Tay-Nung people: Den hamlet (Sapa commune, Lao Cai Province); Lung Quang hamlet (Thong Nong commune, Cao Bang Province).

Giay people: Lau hamlet (Sapa commune, Lao Cai Province)

H'Mong, Dao people: Khoang hamlet (Muong Khuong commune, Lao Cai Province); Ranh and Du hamlets (Da Bac commune, Hoa Binh Province).

Thai people: Black Thai in the Bo, Nhop, Bia and Bang hamlets (Thuan Chau commune, Son La Province); Phang-3 hamlets (Muong Phang commune, Dien Bien Province); White Thai in Na Muoi hamlet (Moc Chau commune, Son La Province).

FIELDWORK CONDUCTED IN 2013–2014

In 2013–2014, I focused on the Black Thai ethnic groups in Son La (the dominant ethnic group in the northwestern region of Vietnam, and the second largest of all minority groups in Vietnam) and documented the northwestern area of the country. I then focused further research concerning fabrics dyed using traditional knowledge as well as shifts in the people's perceptions of the dye as a result of social and economic factors. Semi-structured interviews were conducted in the Thuan Chau and Sop Cop districts of Son La province. In these areas, I selected households using a particular criterion (as specified in Chapter 5) and conducted interviews with subjects that were then classified by age and gender. There is a high percentage of Thai people in these districts; however, they differ in terms of natural, conditional, and geographic location, so there are certainly inherent differences between the groups.

Furthermore, in order to collect more data on natural dyes I conducted investigations in the highlands of central Vietnam concerning the dye plants used by the Ma and M'nong groups.

1. Social Science Methodologies

KAP surveys.

KAP surveys are focused evaluations that measure changes in human knowledge, attitudes, and practices in response to specific interventions. As they are highly focused and limited in scope, KAP studies require fewer resources and tend to be more cost effective than other social research methods. Further details on this process are given in Chapter 5.

2. Ethnobotanical Methodologies

2.1 Interviews

Semi-structured interviews were conducted at the study sites. The interviews consisted of the following questions adapted from Martin (2001). The questions are related to dye plants and dyeing techniques.

1. What plants in your hamlet have been traditionally used for dyeing products and coloring food?
2. What members of your household and community use dye plants?
3. What season/time of the year do you use dye plants?
4. How are each of these dye plants collected?
5. Where do dye plants grow in your community and its surrounding areas?
6. How are dye plants processed in preparation for coloring food and clothing?

Key informants were identified on the basis of semi-structured interviews and they assisted us on transect walks through the surrounding mountains and fields to collect documented dye plants for samples and voucher specimens. Picture cards featuring images of dye plants were also shown to informants to determine local knowledge of such plants.

2.2 Botany methodology

The next step was to identify the scientific name for the plants, using descriptions based on morphological characters. All collected specimens of the dye plants were housed in the herbarium of the Institute of Ecology and Biological Resources and their scientific names were determined by taxonomists from the Institute of Ecology and Biological Resources. The samples are currently being preserved in the Hanoi Herbarium of the Institute of Ecology and Biological Resources.

Thus, after performing a traditional anthropological survey through participatory observation, plants were listed by their local names only; however, they were then combined with physical examples, which meant the scientific names of the samples could be determined. This information is significant as it documents the species used by the minorities and can function as a base for applying industrial techniques.

3. Chemistry Methodology

Extraction Method 1 (using boiling water)

i. Weigh 2.0 g of homogenized material (record the actual weight)

ii. Transfer the material to a 300 mL Erlenmeyer flask
iii. Add 70 mL of distilled water
iv. Heat at 105°C in a water bath for one hour
v. Cool at ambient temperature
vi. Filter through filter paper (No. 5B)
vii. Transfer filtrate to a 100-mL volumetric flask and adjust the volume with distilled water
viii. Transfer two 25 mL aliquots to 50-mL plastic centrifuge tubes
ix. Lyophilize
x. Dissolve the residue in tubes with a small amount of distilled water
xi. Combine the extract solutions and transfer to one 50-mL screw thread glass vial for which the mass has already been weighed
xii. Lyophilize
xiii. Weigh the vial containing the dried extract

Extract cont. (%) = 2 × (value of xiii step (mg))/(material actual weight (mg)) ×100

1-1. Extraction Method 2 (With 50% ethanol)
i. Weigh 2.0 g of the homogenized material (record the actual weight)
ii. Transfer the material to a 200-mL stoppered Erlenmeyer flask
iii. Add 70 mL of 50% ethanol in distilled water (w/w)
iv. Leave for approximately 24 hours at ambient temperature (occasionally shake it by hand)
v. Filter through filter paper (No. 5B)
vi. Transfer filtrate to a 100-mL volumetric flask and adjust the volume with 50% ethanol
vii. Transfer 25 mL of the extract to a 100-mL round-bottom flask for which the mass has been weighed previously
viii. Remove the solvent *in vacuo* using an evaporator
ix. After the solvent has decreased to less than 2 mL (but has not dried up), add 25 mL of the extract to the flask and dry it up *in vacuo*
x. Dry in a desiccator with silica gel for one hour
xi. Weigh the round-bottom flask containing the dried extract

Extract cont. (%) = 2 × (value of xi step (mg))/(material actual weight (mg)) ×100

1-2. Caco-2 maintain
i. Aspirate the medium using an aspirator
ii. Wash cell with PBS containing 0.2 mM EDTA
iii. Aspirate PBS using an aspirator
iv. Add 3 mL of trypsin solution to the dish and incubate 5–10 min. at 37°C
v. Add 7 mL of the medium to suppress trypsin activity
vi. Collect the cell in a 50-mL centrifugal tube.
vii. Centrifuge at 800 rpm for five min.

viii. Aspirate the medium
ix. Add 10 mL of fresh medium and suspend the cell
x. Transfer the cell-suspension medium to a dish
(Final conc. 1.0 X 10^4 cells/cm^2, = 7.5 X 10^5 cells/75 cm^2)

1-3. Cell toxicity test
i. Aspirate the medium using an aspirator
ii. Wash the cell with PBS containing 0.2 mM EDTA
iii. Aspirate PBS using an aspirator
iv. Add 3 mL of trypsin solution to the dish and incubate for 5–10 min. at 37°C
v. Add 7 mL of the medium to suppress trypsin activity
vi. Collect the cell in a 50-mL centrifugal tube.
vii. 20 □L of suspension is collected.
viii. Mix 20 □L of 0.05% trypan blue/PBS and then count the cells
ix. Centrifuge the remainder at 800 rpm for five min.
x. Aspirate the medium
xi. Add fresh medium to 1.5 X 10^5 cells/mL cell suspension.
xii. Transfer 100 □L of the cell suspension to wells.
xiii. Cultivate for 24 hours in a CO_2 incubator.
xiv. Prepare the test solution dissolved in E-MEM solution.
xv. Aspirate the medium (using an aspirator with a yellow tip)
xvi. Add 100 □L of the test solution to the E-MEM solution
xvii. Incubate for 24 hours.
xviii. Add 20 □L of WST solution to the cell culture
xix. Incubate for one hour.
xx. Measure the absorbance at 490 nm

1-4. Calculating IC50

The series of PBS dilutions (1/2, 1/4, 1/8, 1/16, 1/32) of the extract solution were applied to a cell-toxicity test, as shown in 1-5. The PBS without the sample extract was also applied to the same assay to determine the absorbance at 100% viability. The same dilution series of extract solution was also applied to the same assay without cells because the absorbance of the mixture of the extract solutions, E-MEM, and WST reagents were measured. Each assay was conducted in duplicate. The averages of each duplicate were used. Relative viabilities were determined according to the following equation:

$$\text{Relative viability (\%)} = \frac{A_{490}\ (\text{test})}{A_{490}\ (\text{PBS})} \times 100$$

$$A_{490}\ (\text{test}) = A_{490}\ (\text{Extract + Cell}) - A_{490}\ (\text{Extract without cell})$$

$$A_{490}(\text{PBS}) = A_{490}(\text{PBS+Cell}) - A_{490}(\text{PBS without cell})$$

Relative viabilities were plotted against logarithmic values of the dilution rate of the extract. The curve that fit the plots was calculated based on sigmoid function. IC50 corresponded to the dilution rate (concentration) at 50% viability (Fig. 1). A lower IC50 value means that the chemical's toxicity is higher.

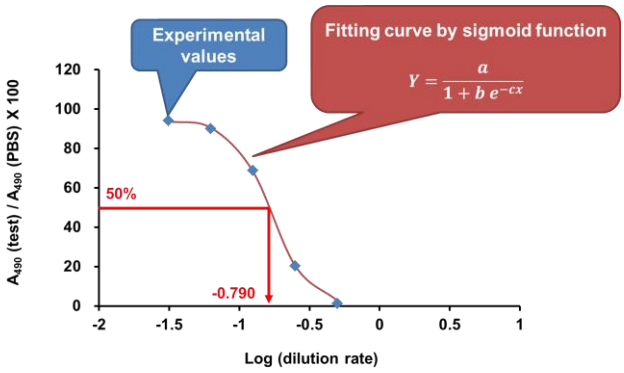


Figure 4. Calculating IC50 values

Finally, IC50 dilution rates were transformed to extract concentration (g/L (extract)), and the ratio of plant material to extract solution (g/L (plant)).

The methodologies used in this study were designed to determine how ethnic minority groups in Vietnam could sustainably use colorant-plant resources in three domains: nature, society, and human. Fieldwork will reveal natural and societal factors that impact ethnic groups and dye resources. The toxicity of the dye resources are reviewed to determine if they are harmful to human health. Indigenous knowledge is valuable; however, substance should be tested using modern techniques before being used on a larger scale.

I. General Statement

The color of the costumes and the food of ethnic people have a sacred meaning and represent the people's wishes or dreams. In the town of Sapa in Lao Cai province, from the sixth to the fifteenth day of the Tet holiday all ethnic minorities participate in the Long Tong festival. This holiday reflects the desire to have a good harvest in the new year. During this festival, the Tay people often dye eggs red, and then hang the eggs from trees (Figure 5), which symbolizes luck. Indigo also has special meaning. To the Dao people, indigo is considered a symbol of health. On the other hand, the H'Mong people consider indigo to symbolize that their women have a high level of skill and, if a woman wears a nice indigo dress, it is easier for her to find a good husband.

Figure 5. Lucky eggs at Lồng Cồng Festival (Tay groups in Sapa, Lao Cai). Photo by author.

The colors used in the preparation of foods also reflect the experiences of many generations. For example, for the Giay and Tay groups black chung cake is an indispensable food during the Tet holiday. They use coal, leaves, or red rice to blacken the cake and to preserve it during the holiday. This knowledge passes from grandparents and parents to the generations that follow.

Women, especially elderly women in villages, dye the foods or textiles. Mothers usually make the colorful foods with their daughters. As a result, the experience and knowledge is passed from mother to daughter. Men might have knowledge of colorant plants, but only women know how to make colors and perform the dyeing process (Mrs. Vi Thi Thanh, 2013).

Natural conditions are an additional factor to rich, unique knowledge and experience in using colorant plants. Through surveys, ethnic groups, such as the Ha Nhi (Bat Xat District in Lao Cai Province), Giay (Lau village, Sapa District), Black Thai (Nhop village, Son La Province), and Dao-quan chet (Phu Tho Province), states that yellow was the most favored color of sticky rice. Yellow represents longevity for the Nung and Giay groups but, for the Tay people, it also symbolizes the moon in the field ritual of the Long Tong festival. However, each ethnic group chooses their own ingredients to color the sticky rice yellow because the availability of these ingredients depends on natural conditions. The H'Mong people live in high mountainous regions, which is the native environment of the Mat Mong plant. These people gather the plant's flowers during March to color their sticky rice or they also dry the plant for later use (Ha Nhi or H'Mong people). The Black Thai people in Son La Province, a region of low hills and valleys, prefer using Phang flowers (*Gmelina arborea*) to color the sticky rice used for Tomb-sweeping Day offerings or when visiting relatives (Mrs. Vi Thi Ha, Nhop hamlet 2012). The Giay people of the Lau village, which is 600 meters above sea level in the Muong Khuong District of Lao Cai Province, cannot obtain Mat Mong flowers; instead, they use turmeric (Mr. Din Chin, Lau hamlet 2007). In another instance, the Black Thai people in the Thuan Chau District have been known to dye sticky rice yellow using *Buddleja* and *Gmelina*. However, a group in the Sop Cop District have not yet learned of this method because these plant species only can be found in higher altitudes (Figure 6 a,b).

Figure 6a: Mat Mong during its blooming season (Buddleja officinalis) which occurs in March. Photo by Thao N.T.P.

Figure 02b: Rice is soaked in Mat Mong extraction to create a yellow dye

For ethnic minorities, colors have miraculous meanings. They contain not only knowledge accumulated from past generations, but also the people's ideas, dreams,

and methods of treating and utilizing natural produce. Their lives and knowledge have a charming hidden beauty, which can further attract anyone who begins to explore it.

II. Details concerning Food

To the ethnic minorities, festivals and rituals must be held in a formal and proper way. On these solemn occasions, delicious dishes are prepared as offerings, which the entire family or community later consumes. Rice cakes and sticky rice are examples of dishes specially made for festivals. A survey recorded that 47 plant species can be used to color food and drink (Appendix 01). The traditional foods and unique experiences of the ethnic people of Tay Bac are detailed below.

Black Thai People of Son La Province

Unlike other minority groups, the custom of coloring sticky rice is quite popular in the daily life of the Thai people of Son La Province. The Thai people's sticky rice generally has only one color, unlike the multicolored sticky rice of the Tay and Giay peoples. Despite just making one-color sticky rice, the Thai people still maintain the knowledge of how to make multicolored sticky rice with red, purple, and yellow colors. Steamed sticky rice is usually white on normal days, and only one other color on special occasions, such as when visiting relatives or tomb sweeping. To color sticky rice yellow, the Thai people prefer to use Mat Mong *(Buddleja officinalis)* and Phang (*Gmelina arborea*) flowers. The Thai people say that in springtime sticky rice colored with Mat Mong or Phang flowers has an attractive scent similar to honey.

To make yellow food using *Buddleja officinalis* (Mật mông/Booc phón) and *Gmelina arborea* (Phặng), which flower from February to March, the flowers are cut and boiled in water for twenty minutes. The yellow liquid is filtered and steamed rice is soaked in the liquid for 10 to 12 hours. After removing the rice from the solution, it is washed with cold water and then cooked. Flowers are cut, dried, and preserved for the entire year.

In summer, for the crop-harvesting festival, which is celebrated after the harvest to show appreciation for the Mother Crop's blessing, the Thai people favor the color purple (colored using cam leaves). In general, the festivals of the ethnic groups of the northwest region, and particularly those of the Thai people, reflect their life circumstances. The festivals celebrated by the Thai people and ethnic groups that

share the same language family, like the Tay and Nung, are related to wet-rice agriculture. They celebrate such festivals by praying for abundant crops and for rain, worshipping the god of water, and by performing other rituals associated with farming activities (Mrs. Xuan, Bia hamlet 2012).

Tay and Nung peoples of Cao Bang Province and Lao Cai Province

For the Tet holiday, the Tay and Nung people often cook "đăm–đeng" sticky rice (Figure 7). The name đăm-đeng means red-black; but this sticky rice can actually be multicolored (Mr. San, Den hamlet 2008).

Figure 7. Nhả ngài cake, colored using Artermisia vulgaris. This is a traditional Tay cake used during the March 3rd festival (slan ma or the Grave-visit Festival) in the province of Cao Bang. Photo by the author.

In March, *Artermisia vulgaris* trees grow new leaves. These young leaves are picked and then boiled in ash water for two to three hours. For good-quality ash, ethnic people use bamboo or the bark of the green gram. Sticky rice is cooked and then crushed with additional *Artermisia* leaves using a stone mortar, which produces a dark green color. The crushed sticky rice is then rolled into ball-shaped cakes and stuffed with green beans or black sesame seeds and sugar (Figure 7). These cakes are made for Tomb-sweeping Day or the third day of the third lunar month.

The Nung people have unique and rich experiences creating and mixing natural food coloring. From the magenta plant, which is used to make purple, the Nung people create the variant colors, dark purple, blue, and glossy-dark green. For the third day of the third lunar month, the Nung people cook yellow sticky rice. For the Tet holiday and the first day of the seventh lunar month (the Nung's Children's Festival), seven-color sticky rice—red, yellow, purple, dark purple, blue, glossy-dark green, and white—is cooked. On the fifteenth day of the seventh lunar month, the Nung people cook sticky

rice with just one or two colors and offer it with eggs. On different celebrations, such as the fifth day of the fifth lunar month; the new crop celebration; Chicken Day, which falls during the eighth lunar month; and Dog Day, which falls during the ninth lunar month, the Nung people cook green sticky rice using ginger leaves (Ms. Vui, Den hamlet 2007).

A unique technique for making blue color using the indigenous knowledge of the Nung people of the Muong Khuong District in Lao Cai Province is as follows: To make blue, like the color found on the neck of a duck, the Nung people add an extraction from the flowers of *Buddleja officinalis* to color rice yellow. They then soak the yellow rice in a purple solution that has been extracted from the fresh leaves of the *Peristrophe bivalvis* and add water with ashes.

Black chung cake is an indispensable part of the Tet holiday for the Tay and Nung peoples of the northwestern area of Vietnam. The Tay and Nung make this cake on the Tet holiday and on the fourteenth day of the seventh lunar month, and it will preserve for one week. On the other hand, the King people make green chung cake for the Tet holiday (Figure 8).

Figure 8. The Giay people's black chung cake, Lao Cai. Photo by Thao N.T.P.

We took pictures of the black chung and gai cakes of the Tay people of Cao Bang Province. However, the Tay people at Cao Bang do not use ashes to create black coloring; instead, they use the leaves of a species belonging to the Gesneriaceae family, *Chirita speciosa* Kurz (Figure 9 a,b). Mong-Dao people in Lao Cai province.

Figure 9a. Chirita speciosa. Photo by Huong BV.

Figure 9b. Black Chung cake is made by the Tay peopl from Cao Bang Province. Photo by author.

For many ethnic groups, including the Dao people, the third day of the third lunar month is Tomb-sweeping Day. The eighth day of the fourth lunar month is the day observed by the Tu Di people, and the twenty-third day of the sixth lunar month is the day for the Pa Di people. On these holidays, people often dedicate sticky rice colored with various colorant plants (Figure 10).

Figure 10. Colorful steamed sticky rice of the Dao people of Lao Cai. Photo by Thao N.T.P.

The Longevity celebration—the third day of the third lunar month—and the Coming of Age ceremony are important festivals for the Dao people. In particular, the number of colors of sticky rice displayed on a tray represents the development and success of the homeowner's offspring (Mrs. May, Chung Chai, hamlet 2011).

The H'Mong people often make five-color—red, yellow, purple, green, and white—sticky rice on holidays, such as the third day of the third lunar month, the fifth day of the fifth lunar month, and the thirteenth day of the seventh lunar month. When building a new house, the H'Mong people cook red-colored sticky rice as an offering to

obtain the earth god's permission. The Giay people make khuc cake on Tomb-sweeping Day; they also make a tower-shaped cake wrapped with sorrel leaves on the fifth day of the fifth lunar month. Only the Giay ethnic group of the Muong Khuong District have been recorded as using sorrel leaves to wrap the tower-shaped cake in a light-yellow crust (Figure 11). On the fourteenth day of the seventh lunar month and during the Tet holiday the Giay people make black chung cake.

Figure 11. Khâu út cake (steamed rice cake), th traditional cake of the Giay people of Muong Khuong Commune, Sapa, Lao Cai. Photo by Tha N.T.P.

Figure 12. The Giáy people of Lầu village's traditiona dishes for the Tet holiday. Photo by Thao N.T.P.

Many Giay people live in the Ban Lau commune, one of three communes in a region of Muong Khuong that is 600 meters above sea level. Mat Mong plants do not grow in this region, so the Giay people use turmeric to color sticky rice yellow.

III. Details concerning Textile

Indigo is the main color used for the clothes of the ethnic groups in the northern region. The shade of indigo depends on each ethnic group and the plants they use.

The indigo color of the clothes of the H'Mong people is uneven, but has a high gloss. The color of the cloth of the Dao people is darker, but it does not fade. The color of the Tay clothes is brighter and has a scent; however, it is not as colorfast as the cloth dyed by the Dao. In fact, the textile-dyeing techniques of each ethnic group are quite similar, but their mordanting techniques are unique (Figure 13).

Figure 13. Shades of indigo textile. Photo by author.

There are generally two basic processes for dyeing clothes and textiles: dyeing and mordanting. All of the ethnic groups use these processes to produce creative textiles.

The most prominent dyeing technique of the northern ethnic minorities is indigo dyeing using the cham meo plant (*Strobilanthes cusia*) or the dau cham plant (*Indigofera tinctoria*). This traditional method is still practiced by the H'Mong, Dao and Tay-Nung communities.

In general, there are three steps to the dyeing process for textiles, including clothes:

Step 1: Prepare the dye by making indigo powder

When harvesting cham trees, people remove the parts of the branch that have leaves, and then put the material into a tank of water for two nights and one day. Occasionally, they use a bamboo pole to stir the water in the tank to accelerate the fermentation of the cham leaves. Then, lime is added to the cham tank and, when the indigo dye has crystallized, pure water is drained from the upper part.

Step 2: Dye the fabric

Cotton is used to create the textile. After this, the dyers soak the textile or fabric in a tank with indigo, occasionally stirring it to obtain an even coloring. During the day the cloth is hung, and during the night it is soaked in the box and beaten with a stick. This process is repeated until the cloth has the desired color. Dyeing fabric is performed on sunny days.

Step 3: Mordanting (for the Tay, Thai, and Muong groups)

To dye textiles indigo, the majority of the Dao and H'Môngg groups only use members of the *Strobilanthes* genus (chàm mèo). When the H'Mong people move their houses in order to find fresh ground for cultivation, they bring this species with them. Conversely, the Tay-Thai groups only use species from the *Indigofera* genus for dyeing. The species found in both of these genera have the same colorant—indigotin; however, due to the different traditions and customs that each group has upheld for generations, their choice of species differs. Despite living near other ethnic groups, each ethnic group uses only their own species. Cases where a group uses the species of another are rare. We have recorded only one such case, in which the Nung people from the town of Mường Khương in the Muong Khuong District in Lao Cai Province) and the Black Thai from Thuan Chau District, Sơn La Province used "chàm mèo" plants to dye fabric indigo.

Some species of plants are regarded as popular colorants and are used by many ethnic minorities (e.g., yam–*Discorea* spp.). Meanwhile, other species are used by a limited number of minority groups.

When comparing the usage of each plant species, we recorded some colorant plants that are used by one ethnic minority group to maintain fabric colors while another ethnic group use them as dyes. For instance, the Tay and Muong people use the brown tuber to dye fabric or wool for fishing nets brown, but it is also used by the Dao and H'Mong groups to maintain indigo-blue in fabric. The Dao and H'Mong groups do not wear brown clothes.

Some ethnic groups of the Tai-Kadai language family perform a third step in the textile-dyeing process: mordanting. Each ethnic group has its own method of fastening the color to the fabric. Two mordant methods have been discovered thus far.

First method: The fabric is recolored with another dye to maintain the color. The Black Thai people of Son La Province dye the fabric with cham leaves first, then dye it again with yam (*Dioscorea cirrhosa*) or móng bò (*Bauhinia variegata)* bark to fasten the color (Mrs. Vi; Mrs. Phúc, Bo hamlet 2011). Dao people in other provinces, such as Lao Cai and Son La, also regularly fasten the color by boiling dyed fabric with other materials. Plants boiled with already-dyed fabric include long yam (*Dioscorea* sp.), glutinous rice,

and tannin plants. This method of color fastening using plants as mordant can be conducted using either low- or high-temperature water.

Second method: Certain plants are added during the dyeing process so that the process of dyeing fabric and fastening the color can occur simultaneously. To maintain the color, the Thai people of Dien Bien and the Dao people of the Sapa district in Lao Cai Province and of the Ta Phin Province add ash water and chili liquor during the dyeing process. The Dao people in the town of Bac Ai in Lang Son Province compost cham leaves with *Lycopodiella cernua* to stop them becoming rotten during the dyeing process.

Normally, Vietnamese ethnic minorities use cham meo (*Strobilanthes cusia*) and dau cham (*Indigofera tinctoria*). According to a survey conducted in the Thuan Chau district of Son La Province, there is another way of using indigo-colorant plants. Besides the two known species, cham meo and dau cham, the Black Thai people in Thuan Chau use *Wrightia laevis* to create indigo. This is a valuable discovery for Vietnam because it was believed that the use of these plants in the northwest region of Vietnam had been forgotten, as it was not mentioned in any previous documents.

In an interview, Mrs. Phuc, a Thai woman from the Bo commune in Son La Province, provided the following indigo-dyeing method:

Based on my experiences, the Black Thai people in Thuan Chau, Son La, use plants in the dyeing process in three different ways:

Main material: There are three species that contain indigo—*Indigofera tinctoria, Wrightia laevis, Strobilanthes cusia*—and these are used individually or, if a sufficient quantity of one cannot be found, they can be mixed.

Additive material (catalyst for fermentation): *Oroxylum indicum, Lycopodiella* spp.

Material used to fasten the color: Normally, *Bauhinia* sp., *Dioscore*a spp. bark, or *Sapium biscolor* leaves are used.

The Black Thai people are unique for using various types of plant to obtain the color indigo. According to the survey, all other ethnic groups use only one species to create indigo. The Tay-Nung people—in Lang Son, Cao Bang, and Lao Cai—only use

Indigofera. The H'Mong-Dao people—in Lao Cai and Hoa Binh—prefer *Strobilanthes cusia.* The special formular applied by the Black Thai people can be explained by the diversity of local plant resources available.

According to Mrs. Phuc (Bo hamlet), weaving and dyeing fabric involves many stages.

Cotton plants are cultivated on terraced fields of corn, and then used to weave fabric. The woven fabric is then boiled with corn or rice. The longer the fabric is boiled, the more resilient and durable it is.

Then, the fabric is dyed with indigo. After 10 to 12 dyes, the standard fabric has a dark-blue color. Once this is achieved, the fabric is then blackened. Brown tuber is ground and then mixed with water, in which the fabric soaks for a day or two. The cloth is then exposed to the sunshine to dry. As a result, the fabric becomes black and tough.

The traditional costumes of the Thai people are black; however, the H'Môn people wear indigo-blue clothes.

The typical practices of the northern mountainous area are dyeing fabric and decorating it with wax or embroidering patterns on it (Figure 14a, b).

Figure 14a. Patterns after dyeing with indigo

Figure 14b. Dao wax patterns

The ethnic groups living in the central Vietnamese highlands use plants to dye clothes, but they only dye individual threads, not an entire piece of cloth. The threads are then used to weave fabric with patterns and, hence, there is no need to use wax to

decorate their clothes. As a result, the textile industry in this region has developed to a technically high level (Figure 15).

Figure 15. Using dyed threads, a loom used by the Ma people in central Vietnam, ĐăkLăk Province. Photo by author.

This region is the site of a unique process for maintaining the color of fabrics. The people here boil the empty shells of shellfishes until they become ash, which is then mixed with colorant plants to dye fabric. This dyeing method is completely different from the method used by other ethnic groups in the northern region of Vietnam.

IV. Other Details

In addition, plants are also used to dye instruments and implements, such as chopsticks. To change the color of chopsticks, they are boiled in water with cam leaves for three to four hours. Then, the chopsticks are dried for two days. To obtain dark colors, they are dyed two or three more times (Figure 16).

Figure 16. The Dao people's method of dyeing chopsticks, Đà Bắc Hòa Bình. Photo by author.

Colorant plants used at weddings

In Marriage Ceremonies (Thai and other groups):

In the Giay community, *xôi trai-gái*—a kind of steamed glutinous rice—has only two colors and black is never used. This is a unique cultural tradition. A newly married couple often cooks *xôi trai-gái* to worship their ancestors and as a treat for their relatives. If, after 20 years, they are still living happily together, they cook this steamed rice again to treat their relatives. Unhappy families never cook this dish again. For weddings of couples where the bride became pregnant before marriage, the steamed glutinous rice may include three colors. If those invited to such weddings (relatives, local people) come and eat this rice, this means that they have forgiven the mistake and are bestowing their best wishes on the couple.

To the Thai people, the union between two families in marriage is established when the bridegroom's family gives the bride's family wedding presents in response to a request issued by the bride's family. However, the bride's family must also prepare a dowry for the bride.

Figure 17. Piêu-scarf for Black Thai women in Thuan Chau district, Son La province. Photo by author

Thai custom states that when married, the bride must bring a large number of woven products as her dowry, including her own clothes and Piêu scarves used as head covers. Piêu blankets and pillows must be offered by the bride to the groom's family (Figure 17). The number of Piêu depends on the number of members in the groom's family; hence, Thai girls begin to learn how to dye fabric and make Piêu at approximately the age of thirteen or fourteen in order to prepare for their weddings.

V. Summary

I would like to summarize the utilization of colorant plants in northwestern Vietnam.

Table 1. Utilization of colorant plants in northwestern Vietnam

Ethnic minority groups	Coloring food	Dyeing fabrics	Dyeing tools, furniture	Cosmetics
Total species	47	18	5	3*
Tày-Nùng groups	37	11	4	0
Dao ethnic group	21	10	2	1
H'Mông groups	16	7	1	1
Giáy groups	24	3	2	0
Mường groups	26	6	3	0
Thái groups (Tai)	28	10	4*	1

*This knowledge has been lost in modern times.

Of 71 identified species, 47 are used to dye foods, 18 are used to dye clothes and fabric, five are used to dye pieces of wood for chopsticks, beds, and cabinets, and three are used for cosmetic purposes, i.e., to dye teeth, fingernails, and toenails. Currently, the techniques of dyeing nails and teeth are mostly unwritten and are transmitted orally. This is particularly true for the H'Mong, Tay, Nung, and Muong groups. In fact, we are currently unable to record this information and it may eventually be lost forever.

In Table 1, it can be seen that the use of colorant plants to dye foods accounts for a large proportion, with a ratio of 47:71. in particular, for festivals and weddings, it is essential for ethnic people to have steamed glutinous rice and other foods dyed with natural colorants from plants. These foods have special symbolic meanings for each ethnic minority. Currently, the Tay-Nung people use the highest number of colorants among the ethnic minority groups. The Tay-Nung also have more knowledge about using and processing colorant plants than any other groups.

From the investigations conducted during our field trips we now have new records on the Tai groups of Thuan Chau District, Son La Province. This minority use *Wrightia laevis* to dye indigo, a very rare custom. Mrs. Luong Thi Phuc, an elder dyer from Bo hamlet in the Thuan Chau District of Son La Province, and also a member of the Black Thai group, provided this information.

DISCUSSION

Modern life, recent progress, and market economy mechanics since the opening of Vietnam have had a large impact on many aspects of the culture and the lives of

ethnic minorities. Gradually, the gap between rural and urban areas has been reduced. Ethnic minorities have experienced changes in their production and activities, which were required in order to adapt to the rapid developments of society. Contrary to previous eras, young girls now are allowed to attend school. Women now have the opportunity to work in government agencies and they have the same rights and power as men.

Industrialization and modernization has also affected family life. Government authorities have constructed roads in villages to ease transportation. Most ethnic people go to the market every day to trade commodities and agricultural products in order to earn money to buy necessities, clothes, and other commodities for their families. Many males from ethnic minorities now wear western-style clothes like the Kinh people in order to feel more comfortable at work and social events. Traditional clothing has become valuable and is used only for special occasions and other rare occasions during the year.

Women in some ethnic minorities, including the Thai and H'Mong, still maintain the custom of wearing traditional clothing; however, these garments are bought from markets. When observing certain rituals, they wear handmade traditional clothes, which are regarded as precious items. They are preserved carefully, are never sold, and become their clothing after their deaths. These clothes are made from natural materials and dyed with colorant plants using traditional methods.

In normal daily life, the youth, influenced by the Kinh people, wear Western-style clothes and buy all they need in the market instead of making their own clothing. As a result, they do not know how to dye fabric or make Piêu scarves. Furthermore, the young people dislike strenuous work and do not want to plant cotton or weave and dye fabric as their ancestors did.

The changes in society and modernization have had a visibly deep influence on the lifestyles of ethnic minorities in northwestern Vietnam. These groups are gradually changing their traditional lives and, in 10 to 15 years, it is unlikely that the art of weaving and dyeing fabric using traditional methods will still exist in the villages of these ethnic minorities in northwest Vietnam.

CHAPTER V - **CHANGING USES OF COLORANT PLANTS IN THE ETHNIC COMMUNITIES OF THE BLACK THAI GROUP**

I. INTRODUCTION

The Tai (Thai) people have settled in Myanmar, India, Southern China, Vietnam, Laos and Thailand. In Vietnam, the Tai people are located mainly in the northwestern and central region. The Tai people are considered to be the most important group in these regions, as they constitute the largest population in the area and have played a major part in the history of Vietnam. (Pattiya, 2000)

Arriving in Northwest Vietnam, especially Son La, it is obvious that the stilt houses of Thai people have a different style of architecture to that of the Kinh people or the other ethnic minorities. In Black Thai villages, the women often dress traditionally, with chignons, wrap skirts, and “ao com” (a form of Thai skirt). At first glance, it seems that the Thai people still maintain their traditional culture in daily life. However, along with the changes in social economic conditions and the politics of the regions in which ethic minority groups live, the feudal administration system (fia-tao) of the Thai people has been abandoned. Today, the villagers can participate in administration activities. Women are equal to men in regard to social, cultural, and political activities, children can attend school, the community’s knowledge and economy have been dramatically modernized, the villagers can buy and use numerous products, and cultural exchanges between different peoples have begun.

Political and economic transformations have also led to changes in the traditional culture of the Thai people. They no longer hold large festivals like “Sen Ban festival” or “Sen Muong festival.” Many traditional Black Thai customs are kept as simple as possible. They buy clothes in the market instead of weaving silk and raising silkworms. Moreover, in the past, when the girls got married, the mother and daughter were required to prepare 20 to 30 hand-made pieu scarves, wrap skirts, and blankets for all members of the groom’s family; however, now they just prepare 10 pieu scarves and buy additional dyed cloths.

Researching the knowledge, attitude, and practice of the Black Thai people of Son La in regard to utilizing colorant plants can clarify the contexts that have physically influenced the sustainability of natural-colorant usage in particular communities.

Among the ethnic minorities living in Northern Vietnam, the Thai rank third in population after the Tay and Muong. The Thai call themselves "Tay," just like the Tay people in Viet Bac, but in this paper I refer to them as "Thai" in order to distinguish these two groups. "Thai" is a Sino-Vietnamese phonetic deformation of "Tay." The Thai and Tay languages have strong similarities, and the two ethnic minorities may well have a common origin. Thai tribal groups have different names depending on their place of settlement: Lu in Dien Bien Phu; Tay Deng, Man Thanh, Tay Muoi, Hang Tong; Tay Khang, Tay Pong in Nghe An and Ha Giang; Tho in Ha bac and Hoa Binh, Lao in the border areas between Vietnam and Laos, etc. The group can also be named after the area in which they live. The Black Tai (Black Thai) are also referred to as Tai Muang Muay or Tai Muong La (Pattiya, 2000). In approximately the fourth century BC, the Thai settled in small groups in North Vietnam, such as the Lu group in Dien Bien Phu. Towards the 11th and 12th centuries they arrived in greater numbers through several different routes, forming two major migratory currents, that of the Thai proper and that of the Tay.

The first current, which included the White and Black Thai – so called because of the color of the women's bodices and shirts – came from the west. Having crossed the Yunna, the White Thai entered Vietnam by following the Red River and settled in the Northwest, occupying the fertile valleys of Dien Bien Province, Phong Tho, and Muong Lay in Lai Chau Province. The Black Thai, who travelled the same path, passed through Lao Cai and Yen Bai provinces to the outskirts of the delta before turning west, where they settled in Nghia Lo and Son La after ousting the Xa and other weaker tribes. For almost 600 years, the Thai resided in what is now the Northwest Autonomous Region, and they have contributed greatly to the development of the Vietnamese nation.

II. OBJECT AND METHODOLOGY

RESEARCH AIM

Employing the KAP (Knowledge, Attitude, and Practice) survey model facilitates presentative studies of a specific population and the collection of information on what is known, believed, and performed in relation to a particular topic.

In my thesis, I applied KAP in structured interviews and semi-structured interviews in order to discern the knowledge, attitudes, and practices of Black Thai people in regard to their use of colorant plants. The following were my main goals in this regard:

1. To evaluate KAP in regard to the utilization of colorant plants in foods, textiles, and the differences between men and women, the old and the young, in regard to their use of colorant plants

2. To define contradictions within the KAP of the Black Thai people in regard to their use of ethnic traditional colorant plants, which is conducted in order to analyze contexts that can effect changes in the usage of colorant plants.

OBJECT, LOCATION, AND TIME OF RESEARCH

The object of this study is to determine the KAP of the Black Thai people in regard to their utilization of traditional colorant plants in Son La Province. The Black Thai account for over 60% of the ethnic minority population in Son La province and they are the only ethnic group native to the Son La and Dien Bien provinces.

Location: Sop Cop and Thuan Chau Districts, Son La Province. In order to compare changes in the KAP of the Black Thai people in regard to their use of traditional colorant plants, we chose to focus on the Sop Cop and Thuan Chau districts, which are in different locations and have contrasting biodiversity and economies[1].

Sop Cop district is located near the Laos-Vietnam border and it has a dry climate. Approximately 49% of the district area is forest, with 71,306 ha of natural forest and 1,350 ha of planted forest located within the district's 148,088 ha area. The area's poor accessibility has a large effect on the economy's development and on daily life; cars can only travel to communes in the dry season (except Sop Cop and Muong Va commune). The main economy is agro-forestry. All of the communes in this district are poor with a high level of poor households (approximately 40.9%)

Thuan Chau District is located in the northwest of Son La Province, and is

[1] According to Hong Luan, Son La Press, March, 25, 2015

accessible by the Highway 6, which links Hanoi, Hoa Binh, Son La, and Dien Bien. Therefore, Thuan Chau is a convenient place for commercial intercourse. There are also many industrial crops of high economic value grown here (456 ha of tea, 1,677 ha of rubber, 2,876 ha of thornapple, and 2,494 ha of coffee). The economy is quite developed, with poor households only constituting 29.41%.

Figure 18. The location of our research in Son La, Northern Vietnam

Hence, we chose Sop Cop district, which is far from center of Son La province (sharing a border with Laos) and Thaun Chau for our study. Sop Cop is easily accessible in regard to transportation and, as the Thuan Chau commune is close to Son La City, and there is a highway from Son La to Dien Bien province.

My KAP research was conducted in March and June, 2013, in Thuan Chau, Son La, and in March and May, 2014, in Thuan Chau and Sop Cop.

The method of research employed was the scale and choice method. In Thuan Chau district, we interviewed 100 people in regard to their KAP of colorant plants. In Sop Cop district, we interviewed 50 people, asking the same questions as in Thuan Chau. The data-collection method was a normalized question list with four main themes

1. General information

2. Knowledge: Knowledge concerning colorant plants and experience of processing and utilizing colorant plants for dyeing cloth, thread, and foods.

3. Attitude: Points of view concerning knowledge and experiences relating to processing colorant plants, their value, the maintenance of that knowledge, and predictions for the future of this tradition.

4. Practice: The practical process for using colorant plants to dye cloth, thread, and foods.

The interviewer interviewed each villager for 90 minutes.

The criteria for choosing interviewees was as follows:

Households where the wife was over 35 years old and had daughters
Households where the wife was over 35 years old and lived with her husband

We interviewed the wife, husband, and daughters in applicable households.

The KAP research concerned four dimensions, comparing two communities and two items, food and clothes, to clarify the related context.

III. RESULTS

3.1 General information about the interviewees

The age, gender, and educational level of the interviewees are mentioned in Table 2.

Table 2. General information concerning interviewees

	Information	Thuan Chau	Sop Cop
Gender	Male Female	43% 57%	30% 70%
Age	F ≥35	58%	60%
	F < 35	42%	40%
Job	Agriculture	80%	90%
	Commerce	10%	2%
	Student	10%	8%
Educational level	Illiterate	25%	20%
	Primary school	45%	65%
	Secondary school	30%	15%
	University	0%	0%

Table 2 also shows the main source of income for each household. In Thuan Chau, agriculture is the main income, involving planting rice, fruit (plums), and industrial crops (tea, coffee, rubber). The income from planting industrial crops and fruit accounts for a large amount of the total income of the households. In Sop Cop, agro-forestry is the main income, involving planting rice and harvesting forest

products. The income from harvesting forest products (medical plants, rattan) accounts for a large amount of the total income of the households.

In Thuan Chau, we interviewed 100 people in order to clarify differences in KAP depending on gender; the results are shown in Table 3

3.2 Aims of the utilization of colorant plants

Colorant plants are used for dyeing clothing and foods instead of for painting faces for festivals or painting pictures.

Table 3. Purposes of colorant-plant utilization by the Black Thai people in Son La

	Clothing (%)	Other (painting, implements)	Food	As makeup for festivals	Do not use
Female	23	0	70	0	7
Male	29	0	71	0	0

From Table 3, we can see that the Black Thai people only use colorant plants for dyeing clothing and foods. Moreover, there are some people who no longer use colorant plants in daily life and the tradition of Thai women dyeing their teeth black is not noted.

3.3 KAP of Black Thai people in regard to utilizing colorant plants

3.3.1. Colorant plants for coloring food

1-A. Knowledge

We asked two questions concerning knowledge of the use of colorant plants for food coloring (sticky rice, cake) and knowledge of the food-coloring process. There are 20 types of colorant plants used for coloring the food and drink of Thai people (Luu Dam Ngoc Anh, 2009), but they usually use just five particular types to obtain different colors

Table 4. Knowledge of food coloring using plants in the Thuan Chau and Sop Cop districts

	Thuan Chau		Sop Cop	
	Male (%)	Female (%)	Male (%)	Female (%)

Q1: Are you familiar with colorant plants used for food coloring?	Y: 100	Y: 100	Y: 71.9 N: 28.1	Y: 86.8 N: 13.2
Q2: Do you know the coloring process for sticky rice?	Y: 7.9 N: 92.1	Y: 45 N: 55	Y: 2 N: 98	Y: 40.4 N: 59.6
		(Y)≥35: 100 (Y)<35: 25.6		(Y)≥35: 100 (Y)<35: 20

Question 1: Are you familiar with colorant plants used for food coloring? List all the colorant plants that you know.

100% of the men and women answered "yes" to this question and could recognize the plants concerned and list their names and usages (Thuan Chau). In Sop Cop, 71.9% of men answered yes and 86.8% of women. Some young people do not use or eat these plants so they have no knowledge of them. The fact that some young people are unfamiliar with these plants constitutes a knowledge crisis. It is possible that basic knowledge on colorant plants will soon disappear entirely. However, it is interesting that in Thuan Chau, all of the people are still familiar with the tradition. This difference is likely due to the different situations and contexts in which these two places are located.

Question 2: Do you know the coloring process for sticky rice?

In Thuan Chau, 7.9% of men and 45% of women answered yes (85% of them were over 35 years old) and the women were able to explain the process in detail. On the other hand, in Sop Cop, just 40.4% of women and 2% of men were familiar with this process. In Thuan Chau, only the older people possess this knowledge. The young do not care and do not wish to learn it. We asked some men why they do have not learned this and they replied: "dyeing foods is women's work, the men merely help them pick the plants" (Lo Van Long, Via village, Thuan Chau) and "I saw my mother and my wife dyeing but I have never done it myself" (Vi Van Thanh, Bo village, Thuan Chau). Therefore, the differences between men and women in regard to dyeing knowledge are caused by the different assignments each gender fulfills in the dyeing process. Men simply pick plants for the women who dye, so only the women know how to dye, and this is bequeathed to their daughters. Sop Cop also has a disparity of knowledge between men and women and between different age groups (Table 4)

1-B. The attitude

Table 5. Results of research into the attitude towards the use of colorant plants for food coloring in Thuan Chau

Gender	Male		Female	
	Yes	No	Yes	No
Do you like eating dishes that have been dyed using leaves?	78.9	21.1	91.7	8.3
Do you like making colored sticky rice and cake for festivals?	0	100	77.8	22.2
Do you think that the food-coloring tradition should be maintained?	62.6	37.4	52.9	47.1
Do you have any trouble maintaining the food-coloring tradition?	5.3	94.7	9.2	90.8

Question 1: Do you like eating dishes that have been dyed using leaves?

91.7% of women like eating colored sticky rice and cake, and 78.9% of men just eat such food for fun but do not find them delicious.

79% of women like making colored sticky rice and cake for festivals and 100% of men answered no to this question. “I just pick plants for my wife” (Vi Van Chat, Dom Cang village, Thuan Chau).

63% of men think that the tradition of food coloring should be maintained because the use of violet sticky rice over white or yellow rice is important on worshipping days, (colored using boc phon or the phặng flower). 53% of women agree with this.

Making color for sticky rice is highly regarded by men as a result of its ritual connotations, which means that men are interested in this work. Making and eating colored food is not conducted as a result of individual preference but for symbolic meanings as part of worship.

Table 6. Results of research into attitude towards the use of colorant plants for food coloring in Sop Cop

	Male		Female	
	Yes	No	Yes	No
Q1: Do you like eating dishes that have been dyed using leaves?	69,1	30,9	80,2	19,8

Q2: Do you like making colored sticky rice and cake for festivals?	0	100	70.0	30
Q3: Do you think that the food-coloring tradition should be maintained?	50.4	49.6	50.1	49.9
Q4: Do you have any trouble maintaining the food-coloring tradition?	0	100	4.9	95.1

In Table 6 we can see a clear gender division in regard to making dishes for festivals, and the people's attitude towards maintaining the tradition is far from a consensus. One of the reasons for their uncertain attitude may concern the difficulty in maintaining the food-coloring tradition. In my interviews, I enquired about the cause of this difficulty, and many men mentioned the shortage of natural colorant plants. On the other hand, 95.1% of women find it difficult to color foods because it takes too much time and the young generation dislike such hard work. Hence, the unsteadiness of their attitude may be influenced by both ecological and socio-economical change.

1-C. The practice

The results of research into the practice of using colorant plants are noted in Table 7

Table 7. The results of research into attitudes towards colorant plants and colored products

	Male		Female	
	Yes (%)	No (%)	Yes (%)	No (%)
Q1: Do you eat sticky rice and cake that have been dyed using leaves?	100	0	95	5
Q2: Do you dye sticky rice and cake to sell it?	0	100	15	85
Q3: Do you eat or make colored sticky rice for festivals, holidays, or weddings?	99	1	100	0
Q4: Do you eat or make colored sticky rice in daily life?	5	95	6	94

100% of men and 95% of women ate colored sticky rice. However, they only use leaves for food coloring on special days such as "Com Moi day," the Tet holiday, and weddings. 99% of men use leaves for food coloring on special days and 5% of them eat colored sticky rice and cake in daily life, the same as the women. We can see that the men adhere more closely to the tradition than women, some of whom do not eat colored rice because of personal preference.

3.3.2. Dye plants for Textile dyeing

2-A. The knowledge

The differences between genders in regard to knowledge of colorant plants for textile dyeing is shown in Table 8 for both Sop Cop and Thuan Chau.

Table 8. Knowledge of textile dyeing with colorant plants

	Thuan Chau				Sop Cop			
	Male		Female		Male		Female	
	Yes	No	Yes	No	Yes	No	Yes	No
Do you know which colorant plants are used for textile dyeing?	67.5	32.5	73.7	26.3	30	70	52	48
Are you familiar with mordant plants?	34	66	30	70	10	90	25.2	74.8
Do you know the plants used to make ash for the textile-dyeing process?	26	74	38	62	0	100	10	90
Do you know how to dye textiles?	15.8	84.2	30	70	0	100	4	96

In Thuan Chau, 73% of women have knowledge of colorant plants for textile dyeing because they must make clothes for their family or for their daughters when they get married. 68% of men know about those plants because they often help their mothers and wives pick the plants. However, only 30% of women know how to dye textiles (93% of these are elderly women); 34% of men possess this knowledge and 42% of women learn this from their mother, and women always maintain this knowledge and teach it to others.

In Sop Cop, 52% of women have knowledge of colorant plants, 25.2% of women are familiar with mordant plants, 4% of women know how to dye textiles, and just 10% know the colorant plants used to make ash for dyeing. The young are not familiar with colorant plants and they rarely see the other villagers use them.

The situation of the disappearing knowledge concerning the colorant plants used for textile dyeing is more severe than the lack of knowledge concerning food dyeing.

2-B. Attitude towards knowledge and experience of dyeing

In Table 9, the results of research into the attitudes of villagers towards knowledge and experience of traditional dyeing are shown.

Table 9. Attitudes in the Thuan Chau district towards dyeing

	Male		Female	
	Yes	No	Yes	No
Do you like wearing clothes that have been dyed using leaves?	57.9	42.1	23.3	76.7
Do you like dyeing in the traditional way?	0	100	5	95
Do you think that it is necessary to wear naturally dyed clothes?	28.9	71.1	35.0	65.0
Do you think that it is necessary to use leaves to dye clothes?	23.7	76.3	30,0	70,0
Do you experience any difficulty dyeing?	97.4	02.6	88.3	11.7
Is there any difference between hand-made dyed clothes and clothes from the market?	92.1	07.9	83.3	16.7
Is the price of hand-made clothes different to that of clothes from the market?	97.4	02.6	90.0	10.0

Surprisingly, 57.9% of men like wearing traditional costumes on special days because they are “nice” and “warm.” Villagers do not like wearing traditional costumes in daily life because they are “inconvenient” and make them “feel embarrassed.” However, the older people are proud of the traditional costumes of Black Thai men and wearing black clothes with a French bonnet is considered nice and luxurious (French colonialism had an effect on the people living in northwest in regard to their perceptions of fashion) On the other hand, the younth want to wear European suits similar to the Kinh people.

23,3% of women wear naturally dyed clothes and Pieu scarves that have been dyed using cham leaves. In daily life, they often buy clothes in the market that have been dyed using chemicals.

100% of men and 95% of women do not like dyeing clothes in the traditional way because it is difficult and time consuming. The young believe that everything is available from the market so they do not need to waste time and effort making their own clothes.

Table 10. Attitude towards dyeing work in the Sop Cop district

Gender	Male		Female	
	Yes	No	Yes	No
Do you like wearing clothes that have been dyed using leaves?	0	100	60	40
Do you like dyeing in the traditional way?	0	100	2	98
Do you think that it is necessary to wear naturally dyed clothes?	0	100	5	95
Do you think that it is necessary to use leaves to dye clothes?	0	100	0	100
Do you experience any difficulty dyeing?	100	0	100	0
Is there any difference between hand-made dyed clothes and clothes from the market?	4	96	20	80
Is the price of hand-made clothes different to that of clothes from the market?	96	4	*	

**Dyed clothes are sold in the market in Sop Cop. Nobody makes clothes with the aim of selling them in the Tai communities.*

In Sop Cop, no household has dyed clothes in the last 10 years because of the shortage of colorant plants. Moreover, neither men nor women like wearing traditionally dyed clothes (100% of men and 98% of women)

They dislike wearing traditional clothes because indigo easily fades and they also have little knowledge of the dyeing process. Additionally, the young do not like wearing traditional clothes in public areas or work places. Older people still express their identity by wearing traditional clothes, but the other members of the community do not place such a high value on this clothing.

1-C. The practice

Table 11. The utilization of colorant plants for textile dyeing

Gender	Thuan chau				Sop cop			
	Male		Female		Male		Female	
	Yes	No	Yes	No	Yes	No	Yes	No
Do you often wear clothes that have been dyed using leaves?	97	3	83.3	16,7		100		100
Where do you usually get dyeing plants?	Garden 5.3 Forest 13.2 Village 0 Market 39.5				Not applicable			
Do you dye clothes in order to sell them?		100		97		100		100

In Thuan Chau, 97% of men and 83.3% of women wear traditional dyed costumes on special days. Among women who wear traditional costumes, 26.3% of

them bought them from the market, 18.4% made them themselves or received them from their mothers, 10.5% asked others to make them, and 13.3% asked their relatives to make them.

They still wear traditional dyed customs on special days or for their daughters' weddings. Only 3% of women dyed clothes in order to sell them. In Sop Cop, nobody wears traditionally dyed costumes. There is a stark difference between the two communities in this regard. We can discuss this by considering their different backgrounds.

3.4. Discussion

Based on the interviews and research, we can discuss the result of KAP research as follows:

In general, there are KAP differences between traditional colorant plants used, between men and women, and between different areas (Thuan Chau, Sop Cop). In relation to ability to recognize colorant plants, men fare better than women because they often pick the plants. Women know how to process the plants and dye the material; moreover, older women know much more about colorant plants then younger women.

In relation to attitude, dyeing clothes with indigo is disliked because it is time consuming, although 57.9% of men in Thuan Chau still wish to wear traditional indigo costumes on special days because of its ritual importance. On the other hand, in relation to food coloring, many villagers want to maintain the tradition of coloring food using natural colorant plants, especially for foods used on special days like violet sticky rice and black chung cake. I was unable to conduct sufficient analysis on the difference in attitude between food and textiles, but I believe that the character of the two is a key aspect of the difference: food is part of a more private sphere, while cloth is more official.

In relation to practice, differences exist between older and younger women in regard to dyeing. 100% of younger women do not dye or have knowledge of the process, but most older women, i.e., those over 35 years old, have intimate knowledge of the process. This situation is common to both communities.

Finally, I would like to discuss the KAP differences between Thuan Chau and Sop Cop. My main finding is that the villagers are all familiar with and wish to maintain the tradition of food coloring because it is very important for special days and daily life. However, the KAP concerning textile dyeing is clearly different between the two areas.

In Thuan Chau, the Black Thai people still know and practice textile dyeing. 73.7% of women are knowledgeable about colorant plants for textile dyeing but only 5% of them wish to dye clothes. Hence, it is easy to see that their knowledge is merely based on their memories or on lessons from their mothers and grandmothers. In Thuan Chau, a small number of elderly women (over 60 years old) continue to work as dyers or practice it as a hobby. When they were young, they dyed clothes for their husband's household. When they had daughters, they dyed for them, and now they dye for their grandchildren. While conducting our survey in three villages in Sop Cop, we found that no one maintains textile dyeing and that the young have no memory of it.

In my opinion, there are several reasons for the disappearance of textile dyeing: 1) The change in young people's perceptions of beauty. Men like to wear European suits, like the Kinh people, to working places; women still wear traditional clothes but they don colorful jackets instead of black ones. 2) there is a shortage of colorant plants such as *Buddleja officinalis, Dioscorea* spp*., Indigofera* spp*.*, although some villagers are now growing plants like *Peristrophe bivalvis* in their gardens. In the past, these plants were common in the forest; however, they have now become rare.

When colorant plants such as *Strobilanthes*, *Indigofera*, or *Wrightia* are used, the old-fashioned dyeing process for indigo takes time and the indigo color easily fades away or sticks to the body. Cotton planting is no longer continued: After the implementation of Doi Moi (a renovation policy), in the northwest area, the people began to focus on planting industrial crops like coffee, tea, rubber, and fruit and developing agriculture for generating higher incomes. Due to the changing structure of the economy, agricultural land has become utilized for growing cash crops and food.

Some groups have been affected by the changing operations of other groups: the Hmong people are very proficient indigo dyers, using powder produced from the *Strobilanthes cusia* tree. In addition to its use within the family, they also sell indigo powder to other groups as a fabric dye. Previously, Thai cotton weavers from Son La would buy powdered indigo from the Hmong for dyeing; however, today this practice

continues in only a few small areas in the northwest (Sa Pa, Lao Cai Province Muong Khuong).

In addition, there is another reason for the stark difference between the Black Thai people of Sop Cop and Thuan Chau in regard to the efforts to maintain these traditions, and also why there is a huge difference between the education and preservation of ethnic identity in each region. The Black Thai in the Thuan Chau district are family-oriented and many children grow to become successful; they educate their children about ethnic traditions. In addition to actively encouraging them, they teach Thai words in the evening. The children in the family are encouraged and supported by people in their homeland to learn the Thai language. They are proud of the community's traditions and of themselves for preserving the identity of one of the tributaries of the Black Thai. Hence, the cultural traditions are maintained in a natural way and within the traditional villages and clans. Consequently, by engaging in education within the family, the village plays an important role in preserving traditional cultural values.

CHAPTER VI - **FACTORS RELATED TO THE CHANGING USAGE OF NATURAL COLORANTS**

Colors from natural sources such as trees, insects, lichens, etc., always possess a natural beauty. Ethnic minorities are fond of using colorants sourced from trees for dyeing clothes because they reflect the colors of mountains, which signifies nature. For the Thai, the production and consumption of textile fabrics has a close relationship with social activities. [Kashinaga, 1999][1]

The KAP investigation in Chapter 5 shows a change in the thinking and practices of the Black Thai community in Son La in regard to the use of tree-sourced colorants. These practices relate to national identity are still being performed by ethnic minorities to ensure the continuity of village festivals, weddings, funerals, etc. However, instead of engaging in strenuously elaborate processing using naturally raw materials, as was previously the case, they now use artificial products that are available on the market. Although some Thai people still feel attached to the wearing of traditional clothing or eating ethnic food that has natural colors, they no longer practice these traditions or have much knowledge about them. Hence, in regard to the attitudes and practices, there is a significant difference between the communities as well as between different groups in each community. What are the factors that have caused this difference and what other related factors exist?

I. Difference between KAP in regard to the use of natural dyes in the Black Thai community - Son La

For this investigation, I selected two districts, Thuan Chau and Sop Cop, in Son La province, where Black Thai people account for over 60% of the population.

The results in Chapter 5 showed that that the people of Sop Cop have less knowledge of using trees to dye than the people of Thuan Chau (Figure 19). 100% of women in Thuan Chau know and can recognize trees that contain food-colorants, and 45% of women know how to make fresh and beautiful colors; however, in Sop Cop, 86.8% of women can identify dyeing trees, and 40.4% know how to dye.

[1] Kashinaga, 1999. Báo cáo chuyến điền dã tại Tuần Giáo từ tháng 10/1998 đến tháng 2/1999.

The majority of young people under 35 years old (both male and female) in Sop Cop do not have knowledge of the use of food-dyeing trees. When asked what colors are used for sticky rice, most of them did not know. In contrast, the majority in Thuan Chau know that sticky rice must be colored purple when used for worship, and other colors are used when visiting tombs and relatives. Thus, the practice of dyeing trees has changed greatly in Sop Cop; they no longer maintain the old traditions. However, the difference between the people of Thaun Chau and Sop Cop in regard to knowledge of food-coloring trees is not very large [Figs. 19 & 20].

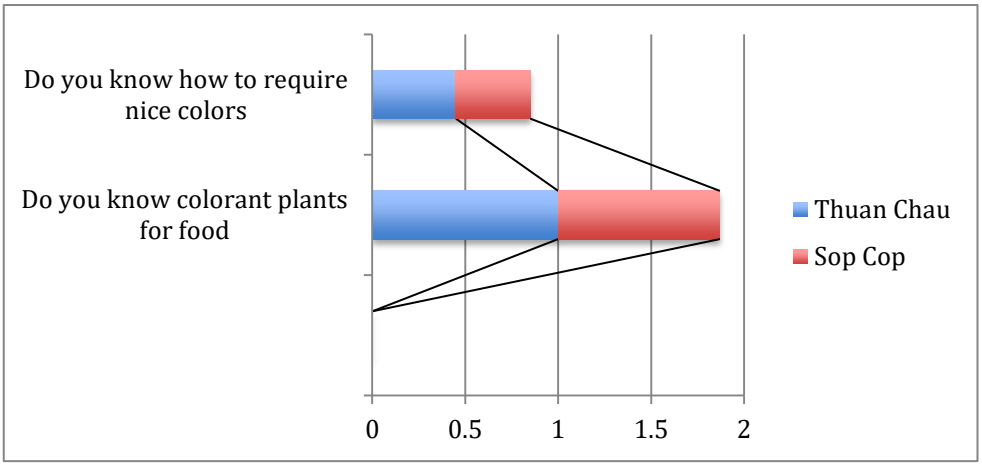


Figure 19. Knowledge of the use of food-colorant plants

Meanwhile, the knowledge of the Thai communities in these two areas in regard to dyeing fabric differs greatly [Fig. 20]. Compared to the people of Thuan Chau, the Thai community in Sop Cop has much less knowledge about trees that can be used to source colorants for dyeing fabric [Fig.20]. Similarly, the people of Thuan Chau gave many more positive responses to the question concerning knowledge and experience of dyeing fabric, as shown in Table 2 (55p.). 73.7% of women in Thuan Chau know which tree colorants can be used to dye cloth (of which 30% know which trees can be used for color-inlaying and 38% know which trees can be made into ash to create indigo); in Sop Cop, 52% of women can identify trees that provide fabric-dyeing colorants (25.2% know color-inlaying trees, 10% know which trees can be made into ash). The reason for these low results is that the practice of dyeing fabric disappeared in Sop Cop over 10 years ago. Only the elders have knowledge of or the ability to describe the process. 100% of the young have very little knowledge of it.

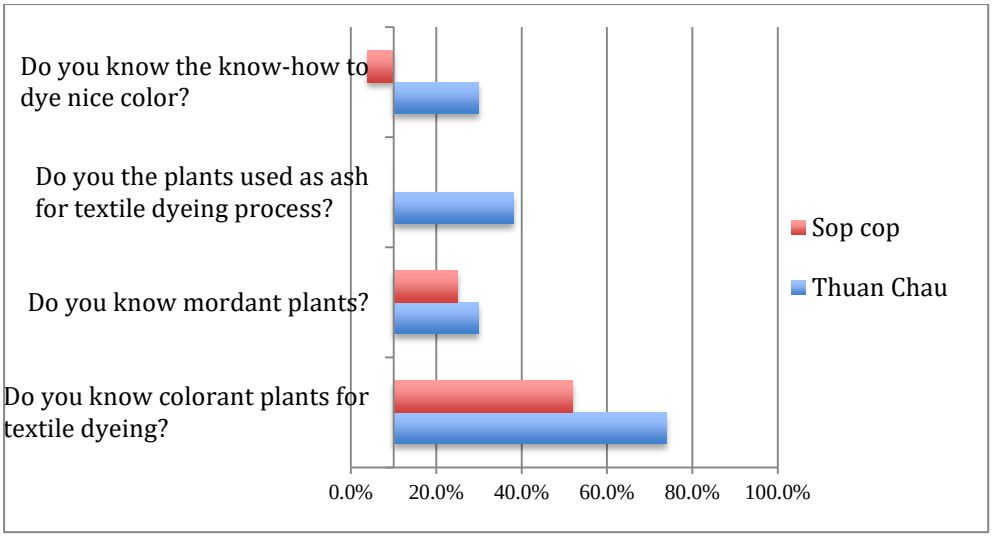


Figure 20. Knowledge of the use of fabric-dyeing trees (female)

There are various reasons for this lack of knowledge. In relation to accessibility, the people of Sop Cop find it much more difficult to access markets and the market economy than the people of Thuan Chau, since it is a frontier commune with poor transportation and a low-income economy. So, why don't they produce their own goods instead of using completely synthetic products? When asked why they have ceased dyeing, they give many reasons, which differed between the young and old. The young people believe that this work is disliked because it is too hard, and they do not think anyone is prepared to do the work required to teach them the tradition. However, when asked if they would learn if someone was prepared to teach them, they say they do not like dyeing, as they are busy with work and study.

The older people know how to do the work because they were taught by their mothers and they still enjoy doing it; however, there has been no source of cotton with which to weave fabric or trees from which to make dye for a long time. If they decide to search for trees, it would take them several days. Previously, the appropriate trees could be purchased in a Hmong village, but now the Hmong have no more trees for sale.

Therefore, the change in the way the younger generation think and in the natural conditions in the villages have affected activities relating to the use and maintenance of dyeing trees by the Black Thai in Sop Cop and Thuan Chau.

The next topic concerns the difference between practice and knowledge of textile dyeing in the Sop Cop district.

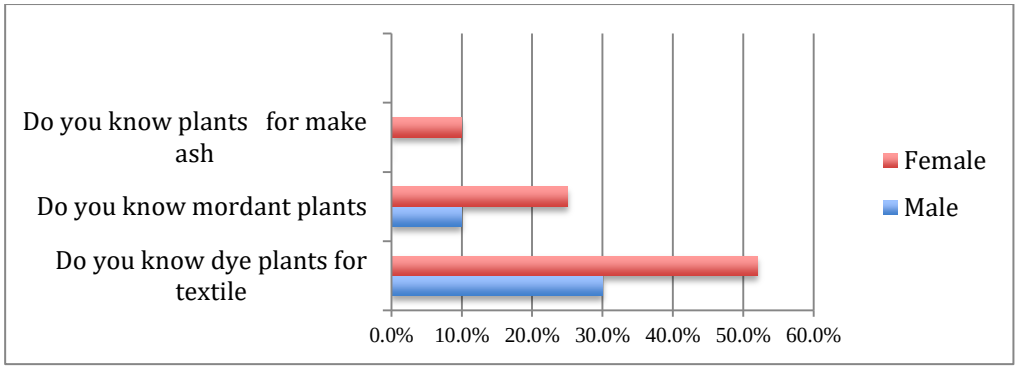


Figure 21. Differences in dyeing knowledge between men and women in the Sop Cop commune

When interviewed about the practice of dyeing fabric, 52% of the women and 30% of the men could identify the trees used for dyeing fabrics. 25.5% of women could identify trees that can be used for color-inlaying, and 10% knew what trees can be made into ash for dyeing.

However, when they were asked "Do you still wear traditional clothing dyed with tree leaves?," 100% of the men and women said they did not. Furthermore, 100% of males and females in Sop Cop do not dye fabric in the traditional manner (Figure 22). The reason for this difference is due to the fact that women who know the techniques no longer dye clothes, and everything is now bought at markets. Young people of 25 and under have no knowledge or experience of dyeing, and they are not interested in learning (2% of women answered that they like dyeing cloth). Men like to wear European suits like the Kinh do, so it is clear that they are also not interested in traditional clothes.

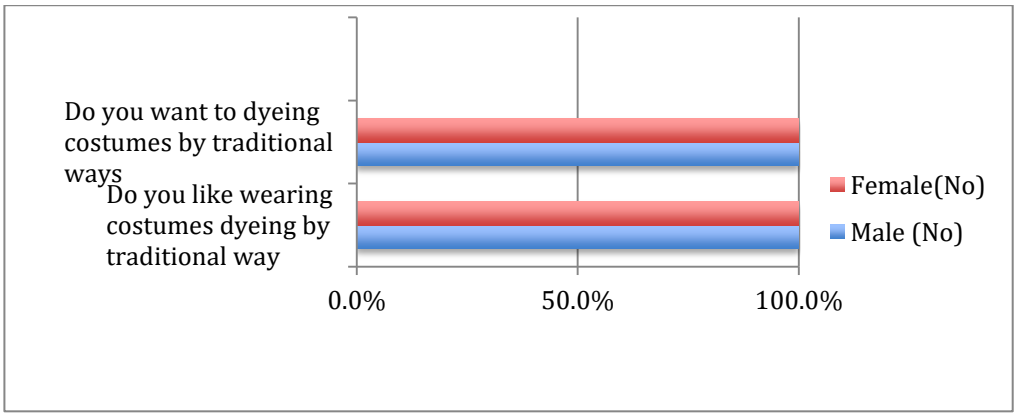


Figure 22. Behaviors of the Thai in Sop Cop towards dyeing plants

Differences in KAP in regard to sourcing colorant from trees are evident between not only different habitats, but also between the men and women of a community. What factors cause these differences? In fact, the Black Thai community in Sop Cop do not use tree pigments as dye or wear clothes dyed with tree pigments (Fig. 22). The Thai men in Sop Cop now mainly wear suits, and they do not wear traditional ethnic clothes, even on important days (holidays, weddings, etc.) They want to look like the Kinh people and become integrated into a bigger group.

Through the survey, no contradiction was found between the two districts in regard to KAP concerning the use of food-coloring trees. The people still use trees to color food and have no difficulty finding trees or maintaining tradition; it is considered an integral part of the worshipping tradition, so they believe it is necessary.

So, what are the causes of the difference in the knowledge–attitude (KA) between the two communes and in KAP in regard to dyeing fabric?

II. Factors related to differences in KAP

Factors related to the above-mentioned differences can be divided into two groups: objective factors and subjective factors.

2.1. Objective factors

In regard to the objective factors, the impact of social reality on Thai costumes, particularly socio-economic change is important. During the French colonial period, the officials and aristocrats (the rich) were affected by French culture. At one point, the Thuan Chau were placed under military control.

Figure 23. The Cam Family in Son La Province, Vietnam, during the French colonial period.[1]

Figure 23 gives evidence of the impact of French-colonial culture in Tay Bac (Northwestern), Vietnam. The figure shows members of Cam Trong's family, including Cam Oai (Cam Trong's father, on the right), Cam Oai's

[1] This picture is a reprotographical image by Professor Kashinaga Masao. The author captured it in Minpaku (National Museum of Ethnology) on March 2015.

father (Cam Van Thanh) and his two wives. In 1888, Cam Van Thanh was assigned by Ham Nghi Kinh, whom the Thai people considered to be the leader of the Tai chiefs, to become the leader of an army in 12 chau Muong in Northwestern Vietnam. The Cam were an aristocratic family from Maison District, Son La Province. Professor Cam Trong, Cam Van Thanh's grandson, was a specialist of Tai Studies in Vietnam. His career contributed importantly to the study and development of Thai culture and language in Vietnam. His father, Mr. Cam Oai, was one of leaders of the revolution against French Colonialism in the Tay-Bac area, Vietnam.

In this picture, all of the people shown are Black Thai, which we can tell from the Tang-cau on the heads of the two women. However, their costumes are influenced by European styles (French shoes and ao-dai (traditional clothes of the King people)). Furthermore, this picture was taken using a French technique of the time. Cam Oai had another famous son, Cam Dung, who became a leader, like his father. Cam Dung was a leader in a war of resistance against the French colonialists, contributing to the resistance in the Northwest after Cam Oai passed away. Although the "Tai Chief" Cam Oai fostered a heavily feudal ideology, Cam Van Dung (Cam Dung), his son, was trained under the French education system. He could fluently speak French, Chinese, and the Tai language. Figure 24 gives a clearer image of the impact of French colonialism on Northwestern Vietnam, as it shows Cam Dung and his wife wearing French clothes.[1]

Figure 24. Cam Dung and his wife (Source: baomoi.com)

After the pacification of the northwest (1896), the French colonial regime maintained the social organization of the mountain village model. This was ruled at the provincial level by new French colonialist policy. French colonialism still used Thai aristocrats to govern mountain districts; hence, on one hand Thai aristocracy maintained its dominance over traditional mountain villages but, on the other hand, they became subservient to the French. Besides benefitting from new laws and regulations, leaders of mountain villages were

[1] Source: baomoi.com

entitled be paid by the French. Therefore, it is clear that Western culture affected Thai people. When I conducted an investigation in Pan Village (Thuan Chau), an old man described traditional Black Thai costumes as black clothes of an ancient style (hand-tailored) with French bonnets. (Mr. Trọng, aged 63, Pan Village)

The beginning of the transition was triggered by the severe social and economic crisis of the mid-1980s. In fact, the transition began in 1979 but was not formally launched until the Sixth Congress of the Communist Party of Vietnam in December 1986. (Annette Luibrand, 2002). Before the August Revolution (1945), Thuan Chau, as well as other Northwest regions with autarky economies, was dependent on nature, and the people made products primarily to serve their own needs and those of their families.

Autarky-based economies transformed with the circulation of money during the market economy era. Before 1954 people traded natural materials for goods or used French silver coins; after the movement, everything could be bought or sold at the market using money. Thuan Chau's central market town became progressively more crowded and people gradually adapted to the market economy and found it much more convenient. (Cam Trong, 1975)

The Government of Vietnam created the policy of organizing and redistributing workers and residents around the country, moving large amounts of people from the plains and cities to the midlands, mountainous areas, and islands. This policy was implemented in North Vietnam in 1961 and across the country after reunification; it persisted until 1998. In 27 years, Vietnam organizationally moved 1,368,691 households; the average internal migration within a province was 702,761 households containing 3,342,253 people and, from province to province, 665,930 households containing 2,809,373 people. The Kinh people moved to the northwest to coexist with ethnic minorities and develop the economy of the region, and these exchanges also had a strong impact on the lives and mindsets of the people.

The second impact was educational change. By 1915, there were no teachers in Son La, and 99% of the ethnic minority population was illiterate. The Thai language was not encouraged during the French colonial period. In 1917, the French opened the first primary school in Son La and, by 1922, the local government had established three

elementary schools, one each in Thuan Chau, Mai Son, and Moc Chau. Thuan Chau was one of the first areas of Son La to be developed. In 1931, only one person from Son La Province passed the elementary France - Vietnam exam (Ha Van An), (Rambo, 2005)

During the French-colonial period, there were only six schools in the entire northwest area; however, by 1957 the municipality had 95 schools. On June 30, 1960, the Thai-Meo Autonomous Zone Secondary Pedagogy School was established, which is now the Northwestern University (located in Thuan Chau, Son La), where ethnic minority children from the northwest were taught. With the development of an education policy for children of ethnic minorities, primary education was gradually universalized, with an average of one high school student per every five people by 1990 (Proceedings of the 100th Anniversary of Son La Province). The increasing level of education also had a significant influence on changing the perceptions and thoughts of young people in the community; school girls engaged in equal work in government offices instead of merely loitering in their villages and moving nomadically with their communities.

The third significant impact relates to cultural exchanges between ethnic groups. Cheap and durable industrial products (cotton, synthetic colorants) can meet some of the requirements of traditional culture (black or indigo clothing, cotton fabrics, etc.). When the state introduced the policy for building a new economy, many Kinh families in Thai Binh, Nam Dinh, etc., moved to Son La to grow crops and build a new life. The Kinh people's lifestyle gradually changed the lives of the ethnic minorities in Son La. They slowly began to use industrial textiles products from lowland areas like Nam Dinh Province or Thai Binh Province.

Furthermore, communication development and improved commercial services enabled people to gain access to "technological" products. Thai women, besides working hard, know how to spin; weave; sew, sewing clothes, blankets, cushions, etc.; make Pieu; and dye fabric. Woven fabrics are closely associated with Thai social activities (Kashinaga, 1999). Thai women previously knew how to use leaves, bark, roots, turmeric, and cochineals (ligament) to dye fabrics. However, dyeing indigo with natural colorants has not been practiced in Tuan Giao since 1999. In this area, women have been able to buy synthetic dyes for over 20 years. Hence, along with the

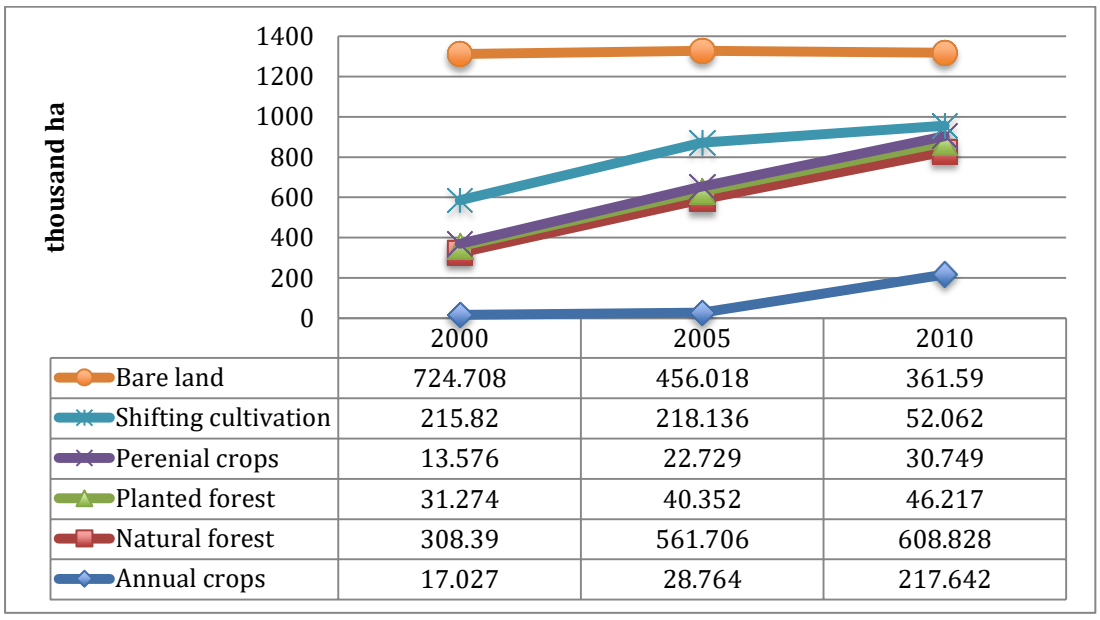
development of the market economy, industrialization and modernization has affected the way Thai people dye fabrics. The production and consumption of textiles has a close relationship with social activities.

In our survey at Thuan Chau market, we found that synthetic pigments such as industrial fabrics are very popular. The salesmen there said that this cloth is brought from lowland areas to serve the needs of the Thai who wish to make clothes for religious festivals and weddings.

The fourth impact is the decline in the quality of forests and floral resources. In Sop Cop, people explained why they no longer dye cloth.

> Previously, when you wanted to dye you might plant indigo trees in the woods, or went to a H'Mong village to purchase a tree (as the H'Mong people often planted trees in streamlines), but now you can rarely find trees, and the H'Mong people do not have any to sell. (Mrs. T, Cang village)

> Why are there no more trees? Because this kind of tree only lives in humid forests, and these forests are now far away (they take several days to access). (Mrs. L.T. H – Cang village, Sop Cop)



	2000	2005	2010
Bare land	724.708	456.018	361.59
Shifting cultivation	215.82	218.136	52.062
Perenial crops	13.576	22.729	30.749
Planted forest	31.274	40.352	46.217
Natural forest	308.39	561.706	608.828
Annual crops	17.027	28.764	217.642

Table 12. Land use in Son La province from 2000 to 2010

Statistics from the Forestry Academic Institute show that in the last 10 years the Son La forest area has increased significantly as a result of the reduction of slash and burn practices. Table 12 shows the degree to which areas of planted and natural forests have increased. Table 12 illustrates an increase in natural and planted forests, and that cultivation, nomadic farming, and population have significantly reduced. The growth rate of the forests is as follows:

year	2000	2005	2010
Natural forests	22%	40%	43%
Planted forests	2%	3%	3%

Thus, forests are not diminishing, and are actually expanding. So why do people say that there are no more trees, and that appropriate forests are too far away to access? According to the foresters of the Bat Xat commune, natural forest area has increased over the years due to many reasons, including a reduction in the H'Mong and Dao nomadic communities; moreover, some forest areas that merely consisted of grass and reeds (group IA) for the last number of years have developed into secondary groups (classified as forest land) as a result of the lack of human impact. However, timber and primeval forests no longer exist because they were exhausted during the French colonial period and during the reform era.

Thus, the reduced quality of the forests explains why the people are saying that there are no more dyeing trees.

The forests in Son La, and in Thuan Chau in particular, were exhausted during French colonial times. However, nomadic habits and shifting cultivation also caused a sharp decline in forest quality. So, where did this agricultural practice come from?

Thai people live mainly based on breeding animals and producing food, in addition to hunting and fishing. They generally plant rice in fields and food crops on the uplands (or plough on uplands, adopting techniques from the Ha Nhi people). The Thai people call agricultural workers "Po" or "me ne" (Mr. Upland, Ms. Field). In the old society, the dominant Thai aristocracy (members of the phia tao system), who exploited farming workers, possessed land and forced farmers to perform hard labor in

the fields and pay back in kind. Therefore, by leaving the land to live nomadically, Thai farmers were able to directly escape the exploitation of the dominant Thai aristocracy. Upland soil was not directly exploited by Thai aristocrats; in other words, the Phia tao regime took strict control of fields and ignored the uplands. Particularly during French colonial rule, two levels of oppression and imperialism, "Phia" and "tao," were in effect, and these were based on the distribution of land on which workers were heavily exploited; hence, some Thai farmers were forced to live nomadically. The uplands ("hay" in Thai) provided the necessities of life: food, clothing, and shelter. Therefore, during this era, upland rice, maize, and cotton were indispensable in Thai culture. Upland rice and maize accounted for 60% of the area used, upland cotton and indigo cultivation accounted for 30%, and the remaining 10% comprised shelters. However, this method of farming had a devastating effect on the natural surroundings. As a result, today most Thai people have access to little or no jungle. (Cam Trong, Ethnological Journal 1- 1975).

The last objective impact relates to the change in the plants grown, which was caused by national economic-development policies. The Thai people traditionally planted cotton fiber on the uplands for use in weaving and grew trees in upland areas to obtain black or indigo for dyeing cloth. Thus, to maintain the knowledge and experience of using coloring trees, not only dyeing trees, but also fabrics made from natural cotton are necessary.

Several years ago, cotton was intercropped with maize on uplands and harvested for spinning and weaving. After enactment of the renovation policies, the people of Son La turned towards crops such as sugar cane, tea, and coffee and, consequently, the share of cotton has begun to shrink.

Table 13. Area of industrial plantations in Son La from 2000–2012

Year	Area (ha)
2000	19,334
2005	22,082
2010	27,006
2012	30,843

The area of industrial tree plantations in Son La increased significantly from 19,334 ha (2000) to 30,843 ha (2012). By the end of 2014, the province had had approximately 6,577 hectares of rubber (many areas of 300 hectares or more), 4,013 ha of tea, 10,915 ha coffee, and 18,189 ha of fruit trees; coffee production is estimated at 10,382 tons, while fresh-tea production is estimated at 29,369 tons. Cotton areas have gradually been replaced by economic trees such as coffee, tea, and rubber. This has led to a shortage of raw materials in Thai communities for weaving and dyeing fabrics.

According to the Son La Bureau of Statistics, the popularity of industrial trees in the province has grown markedly. In 2005, the province had 15% perennial crops (coffee, tea, etc.) and 85% annual crops (cotton, sugar cane, peanuts, and soybeans), but by 2012 the balance had changed significantly: 61% of the area was perennial trees, and 39% annual crops. Although in the northwest cotton is considered to be the key to escaping poverty (due to climatic conditions and suitable soil), it covers the smallest area of the four annual industrial crops grown in Son La province. The people there mainly plant sugar cane and tea and appear to be reluctant to grow cotton (partly due to the policies supporting the growth of industrial trees in Son La). In recent years, the amount of land used to grow annual crops (cotton, soybeans, and sugarcane) has been reducing because of limited consumption, low productive efficiency, and the expansion of perennial crops. (Table 14)

Table 14. Details of land use for industrial plants in Son La from 2010 to 2012

Area: ha; yield: ton

		2010	2011	2012
Cotton	Area	692	2767	891
	Yield	614	2888	857
Sugar cane	Area	3265	4208	4656
	Yield	174664	249434	313488
Peanuts	Area	1.661	1682	1718
	Yield	1.584	1670	1705
Soybeans	Area	7380	7416	3595
	Yield	10644	10559	4621

2.2. Subjective reasons

Next, I would like to discuss subjective factors, which relate to humans. First of all, the changing perceptions of the people is related to differences in KAP.

2.2.1 Differing perceptions between people

We must first recognize that people in communities have different perceptions concerning the loss of knowledge and experience relating to tree-colorants. Some are no longer aware of the importance of preserving and engaging in traditional practices. In different socio-economic conditions, views on knowledge and experience differ, which has caused the differences between communities (in this case, in Thuan Chau and Sop Cop). The change in perception and opinion concerning the traditional Thai culture is a result of the actual impact of the economic-social reality of Vietnam. This phenomenon has also occurred with many other ethnic minorities in Vietnam.

In fact, after 1954 and the end of the war with the French, the State of Vietnam pursued a policy of socio-economic development in ethnic minority areas, adopting the slogan: “the mountains shall keep pace with lowlands.” As a result, Thai children were allowed to attend school and certain Thai people could govern areas or work in state offices. Economic and cultural activities (construction markets, department stores, state farms, mobile cinemas, etc.) were implemented in ethnic minority areas. Additionally, during this period people moved from the lowlands to live with ethnic minorities, which was a result of the "reclamation" and "new economy" policies of the State of Vietnam. In the midst of this social situation, the Thai participated in community activities and gained access to the culture of the Kinh and the rest of the world (via films). This contributed to changing the opinions of members of the Thai community, mainly teenagers and adolescents.

While the older people still believe that traditional costumes are beautiful and cherish them as well as the knowledge and experience required to make them, the youth want to wear the same costumes as the Kinh or Western people in order to quickly and fully integrate themselves into modern society. This is a general tendency

of mankind; small ethnicities (minority) always look towards common and broad trends. In fact, this is occasionally considered "progress" [1].

In Sop Cop and Thuan Chau, most young men do not like to wear traditional clothes in communal places (meetings, schools, etc.) or offices. This is because they feel embarrassed and prefer to wear suits to look more modern, like the Kinh.

In contrast to the men, women still retain Thai cultural characteristics in their dress. In the workplace and public places in the northwest, Thai women still wear traditional thick and wrap skirts; they also grow their hair into a particular shape to show that they are married.

The progress of science and technology has created products that are more durable and cheaper than traditional ones, which is also one of the reasons behind the changing thoughts and opinions.

The second factor is the rift between generations in regard to the preservation of traditional cultural values. While conducting surveys in the community, we found clear differences between the young and the old in regard to practical knowledge. The majority of children do not know or do not want to maintain the tradition of dyeing fabric. Most Thai adolescents do not want to wear ethnic clothing, so they do not feel the need to learn or practice traditional dyeing activities.

The older generation, which possesses the knowledge and experience to dye fabrics traditionally, has fewer chances to practice because the demand for this clothing has reduced. Meanwhile, there are no learners to bequeath the valuable knowledge and experience that has been accumulated over hundreds of years to.

Therefore, in some areas knowledge and experience of ethnic coloration practices will gradually disappear with the departure (death) of the elderly generation. This will have a huge impact on the cultural identity of ethnic minorities; however, this has been noticed by the government of Vietnam and policies are being created to address this.

[1] Huang Liang 2002, Ethnographic Magazine, issue 3: 52

Education in family and society is important to preserve and promote traditional culture. While socio-economical polices have had an erosive impact on the knowledge and experience of the use of dyeing trees, education at home and in society in recent years has somehow promoted the preservation and restoration of the beauty of traditional culture. Aware of the fact that there is the risk of the total loss of the traditional cultural characteristics of ethnic minorities in Vietnam, in 1998 the Central Committee of the Communist Party of Vietnam issued Resolution 05 VIII on "building and developing an advanced culture in Vietnam, imbued with national identity." With this resolution, the preservation and promotion of the cultural identities of the ethnic minorities has been implemented at all levels of government and is being pursued by social organizations with diverse and rich focuses. In this context, traditional clothing has become one of the targets of the objectification of Vietnamese culture.

In all villages in Thuan Chau, associations of women engage in exciting cultural activities. Village dance teams practice and perform every month. During rehearsals and performances, Thai women wear traditional costumes, dance, and sing traditional sli songs. This is an opportunity to honor the nation's traditional culture, including its costumes.

There are also study-encouragement societies in the villages to assist in the development of the Thai language. The learners are generally Thai men aged 40 and older, and they study at night. Traditions and customs are maintained, and these are then taught to children in a natural way through routine activities. They members of these classes are proud to be part of one of the best Black Thai branches in Son La at preserving its traditions and costumes.

Although only women wear traditional clothes, every household contains both male and female traditional clothes in the ancient style, dyed with indigo, and they dress in these garments on special occasions. When asked if they like traditional clothes, many men answered “yes” because of their beautiful colors, fresh feeling, and the fact that they make them aware that they are Black Thai.

We arrived at one particular Thai village in Thuan Chau (Pan village) on May 7, 2014. Although it was the 60th anniversary of the Dien Bien Phu Battle, the village was deserted, which is normal because the people were working in their fields and markets,

the children were at school, and only the old people had remained at home. However, on that very special day, women wore skirts and silver-buttoned shirts and men dressed in traditional black. All of the elderly people were watching TV, a live program celebrating the victory of Dien Bien Phu. When they were asked “what is the special event for which you have worn your beautiful dress?,” people said they had dressed in special clothing because it was the anniversary of the Dien Bien victory. The program showed Thai people dancing excitedly in Dien Bien province. The people in the village could not participate in the event, but had dressed up for it in their own homes. This shows that for these people, tradition is really respected and preserved.

III. Discussion

The declining use of dyeing trees and coloring techniques as well as the changing attitude of the Black Thai community in Son La have been caused by a number of factors, both objective and subjective. I summarize the objective factors as follows: The impact of social reality on Thai costumes, cultural exchanges between peoples, scientific and technological advances in the fields of textiles and dyeing, the decline in the quality of forests and floral resources, and the change in the crops grown as a result of the national-economic development policies. On the other hand, the subjective factors are the changing perceptions and views of some of the people, the rift between generations in regard to the preservation of traditional cultural values, and the role of education in family and society as a means of preserving and promoting traditional culture.

Considering these interactive subjective and objective factors, it is difficult to create a clear-cut, comprehensive explanation of the declining use of dyeing trees. However, these factors can help us recognize the erosion of indigenous knowledge, the change in attitudes, and the disappearance of practices relating to the use of dyeing trees, as well as the general decline of national identity. This is the result of many historical, social, and environmental elements. Ethnic minorities are subject to the combined effects of both subjective and objective factors. Hence, to maintain this tradition and encourage its sustainable use, appropriate measures should be integrated.

Whether the measures are employed aggregately or individually, they must stem from the desires of the people, the community, rather than scientists or policy makers. Through the attitudes of two Black Thai communities, in Thuan Chau and Sop Cop, this study has found that they truly respect their traditions and are preserving their unique characteristics through modern methods and the market economy. Silks and traditional food still require preservation but, in such a way that they are convenient to process, beautiful to use, and economical in regard to time.

I. Value of natural colorants in Vietnam Society

1.1. Abundant knowledge

Vietnam is the homeland of 54 ethnic groups and eight language groups. These combine to create a colorful picture, especially in regard to costumes and cuisine. As mentioned in Chapter 4, the use of colorant plants has accompanied the development of minority communities throughout history. In the modern period, these practices are maintained through participation in festivals and traditional costumes.
Knowledge of the trees used to dye clothes and food constitutes valuable intangible cultural heritage, and each minority group has their own method of maintaining and expressing this knowledge. To date, natural dyes have mainly served two purposes, dyeing fabrics and coloring food (Chapter 5).

In regard to dyeing fabrics, currently ethnic groups only continue to practice indigo dyeing, the dominant color in the costumes of the ethnic minorities in the north of the country. However, each ethnic group creates a different shade of indigo, as a result of varying plant sources and processing methods. Through my investigation I found that ethnic groups in Vietnam mainly use one of three plant species to create indigo: Wrightia laevis, Strobilanthes cusia, or Indigofera tinctoria. In particular, the Black Thai community of Thai Son La use Wrightia leaves. This plant seems to be used around the world to obtain indigo dye. [Dominique Cardon]

Each ethnic group has their own interpretation of indigo. The Hmong consider it to show the ingenuity of their women, while Dao people consider it to bring good health to a family.

In Vietnam, indigo can be found in a series of diverse shades. The Mong – Yao group prefer wearing dark-blue indigo, the Tay group in Cao Bang use light blue, the Thai and Tay in Lang Son are in favor of indigo that has been dyed black with faux yam (mak bẩu), and the Hmong - Yao only use Strobilanthes cusia to dye indigo, as they claim that when fabric is dyed using this species it appears blue and red in the sun.
Staining techniques also show the sophisticated practices of each ethnic group. The Tay – Thai group usually dye a long roll of fabric in indigo water, and then dye it again

using yams to make it completely black; then, they use it as embroidery material for making Pieu or they cut and tailor it to use it for clothing.

The Mong - Yao group employ the batik technique, in which they use wax to create patterns on fabrics before dyeing them indigo. The beeswax-infused fabric will not absorb the color, so the pattern they create will remain. Also, some combine more patchwork techniques or embroidery to create patterns on the cloth.

People in the highlands areas never dye fabrics; they simply dye yarn before weaving it to make clothing. They mainly create red and black dye by boiling sesame buds and bark in water (Barrington). When the dyeing is completed, the Ma (Dak Lak) will use snail shells from streams, and pound and soak them into the fibers so that the color is fastened. However, this activity is no longer practiced in the minority communities in the central highlands.

Referring to coloring dishes, the ethnic minority groups of the Tay and Nung are the most proficient users of plants to color food and drinks. The most common methods they use are hot extraction, solvent extraction, and possibly cold extraction (specific techniques are described in Chapter 4).

1.2 Diversity in regard to natural dye resources

Vietnam is within the Indo-Burma Biodiversity Hotspot (IBBH) and the country is ranked as the 16th most biodiverse country in the world. It hosts 110 key biodiversity areas (Mittermeier et. al., 2004) and 59 important bird areas (Birdlife International, 2013). The country also possesses two World Natural Heritage Sites, five Ramsar wetlands, eight United Nations Education, Scientific, and Cultural Organization (UNESCO) biosphere reserves and two Association of Southeast Asian Nations (ASEAN) Heritage Parks. Vietnam is not only of global importance for its naturally occurring biodiversity, but also because it is one of the richest countries in terms of agro-biodiversity. In addition to this impressive biodiversity, the country is notable for its high level of endemism. It is estimated that 10% of Vietnam's plants are endemic to the country. Much of Vietnam's biodiversity remains unknown. Vietnam's biological diversity is matched by its cultural diversity, evident through the fact that the country is home to 54 different ethnic groups.

Forests are estimated to cover approximately 13,800,000 ha of Vietnam's land

surface. Naturally regenerating forests account for approximately 10,200,000 ha. (74%), and planted forests account for another 3,500,000 ha (35%). Primary forests are estimated to represent only 80,000 ha (1%) of Vietnam's forest cover.

1.3 Specialization in blending plant species

1.3.1 For food

Among the ethnic groups, the Tay and Nung possess abundant knowledge and experience in processing food, especially in terms of coloring food.

The colorful sticky rice of the Tay and Nung peoples

From one species, four forms, the Tay people of Muong Khuong can make seven colors; they achieve this by controlling the pH when extracting dye from cam leaves. Ethnic people use ash water or water used for vegetable preservation for coloring. When extracting yellow dye from curcuma, they can make red and orange dye by controlling the pH. Furthermore, they can also make blue colors from the red and purple liquid of cam leaves (similar to the color of a duck's neck).

The black sticky rice of the Tay of Lang Son Province.

The Tay people use sau sau leaves (*Liquidambar formosana*) to obtain dye. When they boil them, the liquid turns red; they then soak rice in this liquid to create red sticky rice.

In another method, young leaves of *Liquidambar formosana* are ground, and the liquid is filtered. Then, they add ash water and soak rice in this liquid, which consequently turns the rice black.

1.3.2 Textile

Indigo has a glorious history around the world, with many valuable arts and techniques related to this color evident in many countries. Therefore, it is no coincidence that UNESCO has named Indonesian batik a cultural heritage item. This is a fabric that originated in Indonesia and has spread to Japan as well as other countries in Asia such as China and Vietnam.

Indigo blue is the dominant color in traditional costumes of the ethnic

minorities in Vietnam. There is no difference between the type of tree, technique, or batik fabric used in Vietnam and that which is used in China, Japan and Indonesia. The most notable thing is that when they migrated to Vietnam, these peoples changed the material they used in order to create indigo.

Two traditional species that are popular in Vietnam for their use as colorants are *Strobilanthes cusia* and *Indigofera tinctoria*, which were presented in Chapter 4. Through investigations in Thuan Chau and Mai Chau, Son La, it was discovered that the Thai people here still use another two species, *Wrightia* and *Marsdenia*, to make indigo. *Wrightia* was discovered and used extensively in India, and *Marsdenia* is used by Malaysian people to create indigo dye (Isend, 2012). However, the use of *Wrightia* has been discontinued around the world, so the discovery that it is still utilized by the Thai people in Thuan Chau is an important finding, This confirms that this species is still used by the minorities in Vietnam.

The Thai people of Thuan Chau prefer black, which is evidenced through their traditional costumes. After the indigo dyeing process is completed, they blacken the cloth with faux yam, and then use it to make clothing.

In the indigo-dyeing process, they use 2–3 citrus species to stimulate fermentation, and adjust the pH using ash water made from different types of trunk. In addition, to make the fabric aromatic, they occasionally add wine during the dyeing process.

This technique has also been recorded as being used by the Khmer people of Surin, Thailand, where they utilize cochineals to create red dye. The leaves used are generally tamarind leaves. (photos in appendix)

The Hmong people, the masters of indigo, have a unique method, as they infuse indigo leaves with pine leaves from the very beginning of the dyeing process.

II. Native knowledge in the modernized era

2.1 Indigenous knowledge in relation to science and technology

Natural colors and knowledge of their use have existed since 3,000 BC, but they entered a decline in 1895 when the first synthetic dye was discovered by William Perkin. After this milestone, the development of the chemical industry, along with the advent of synthetic colorants, appeared to be set to completely dominate the existence of natural colors. However, by the 1960s, the use of natural colors was restored as a

result of their advantages in regard to health and safety, as well as the natural color they gave to art works. However, scientists continue to seek artificial substitutes for the application of natural dyes.

In Vietnam, modernization and industrialization are gradually causing people to choose artificial colorants to replace natural colors. For the Kinh, the use of natural colors for fabric completely ended after the 1975 liberation. The brown (màu phòng không) shirts are now only memories of the elderly. However, things are different in relation to food. The natural color of red gac sticky rice, green com (young rice), pandan, and the yellow of turmeric are still used as a result of their beautiful colors, good taste, and safety. So, what is the situation in this regard among the ethnic minorities?

Traditional dishes still require coloring because this is a necessary aspect of ritual worship (purple sticky rice offerings are common in Son La)

Black chung cakes are indispensable during the new year celebrations of the Tay in Lao Cai (the black color helps the food remain fresh for a longer period; if green leaves are used, the cakes will quickly become stale). Sticky rice is made from boocphon flowers (*Buddleja officinalis*), the smell is similar to honey so it is very suitable for family meals or when a guest is present.

Traditional costumes are still worn in many minority communities. In particular, the Hmong - Yao maintain the practice of indigo dyeing and weaving brocade products (Lao Cai, Hoa Binh, Son La)

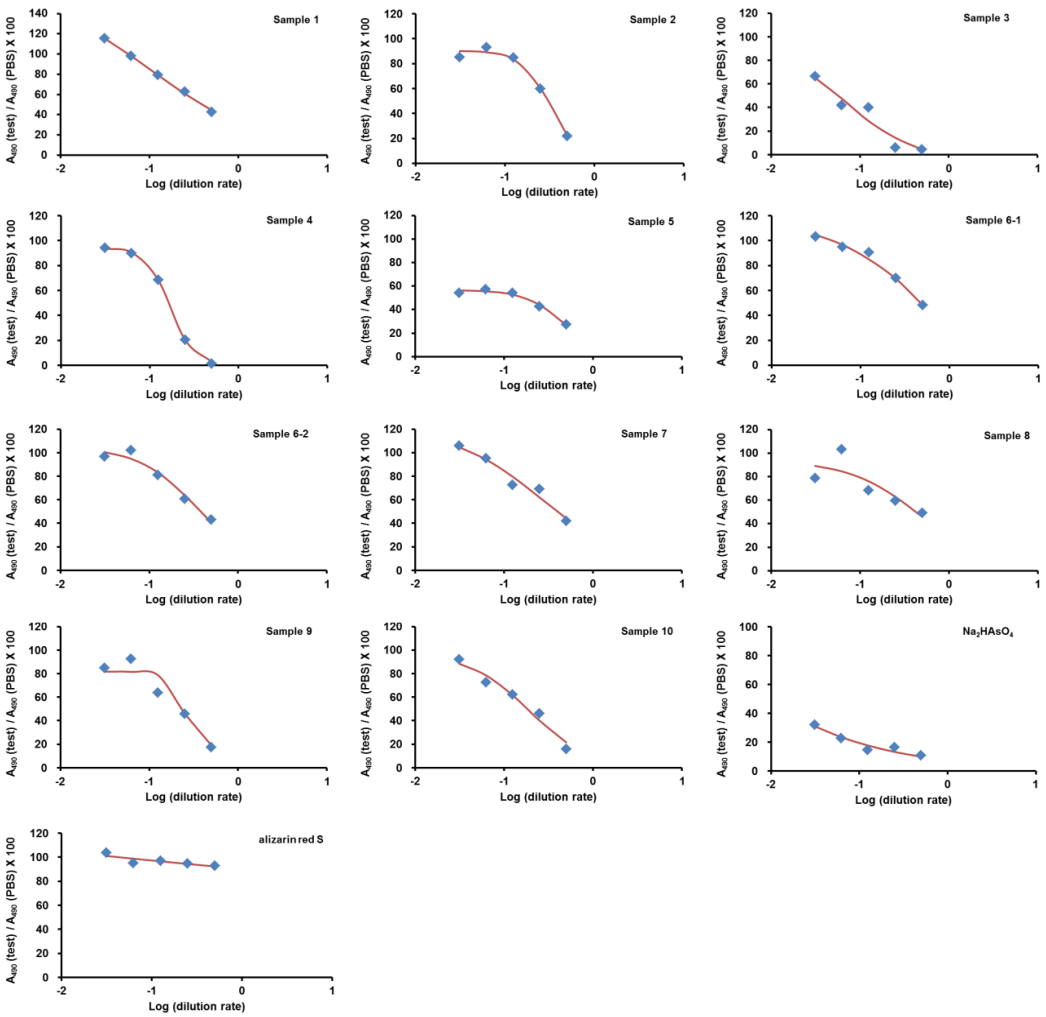
However, if we want to apply these colorants and their related practices on a larger scale, in order to ensure the safety of users we must examine local knowledge concerning the amount of food coloring to use, as well as the amount of dye and the types of material to use for fabrics. Hence, here we have selected 10 samples of pigments that are used as food dyes by ethnic communities in order to test their toxicity.The materials that are usually soaked in wine were applied to a 50% ethanol extraction. Those that are usually soaked in water and used to color rice, sugar, etc., were applied to water. At first, each sample's loss on drying was determined. Next, an extract of each sample was prepared and the content of each extract was determined. However, sample no. 9 was obtained as a liquid, so loss on drying and extract content were not determined in this case. These results are summarized in Table 15. Detailed data can be found on Sheet 1 of the supplemental data.

Table 15. Sample list

No.	Latin Name	Extraction Sol.	Loss on drying (%)	Extract cont. (%)
1	*Fibraurea tinctoria*	50% EtOH	7.03	24.80
2	*Clitoria ternatea*	Water	9.40	49.89
3	*Eleutherin bulbosa*	50% EtOH	12.34	23.83
4	*Chirita speciosa*	Water	9.09	20.57
5	*Rubia cordifolia*	50% EtOH	10.82	29.24
6-1	*Coscinum fenestratum*	Water	6.87	7.99
6-2	*Coscinum fenestratum*	50% EtOH	6.87	11.07
7	*Nauclea sp.*	50% EtOH	10.96	5.17
8	*Gmelina arborea*	Water	12.52	42.30
9	*Peristrophe bivalvis*	Water	N.D.*	N.D.*
10	*Hibiscus sabdariffa*	Water	8.83	49.81

*N.D.: Not determined.

Figure 25. Inhibition curves of for each sample. Blue symbols are experimental values. Red lines are fitting curves by featuring sigmoid functions .



The relative viability plots and their fitting curves are shown in Figure 24. Disodium hydrogenarsenate (Na_2HAsO_4) was used as a typical toxic chemical. Alizarin red S was also used as a reference. Raw data and the process of calculation can be found on sheets 2–6 of the supplemental data. The process used for curve fitting via optimization can be also found in the file "Optimization_of_Sigmoid_Parameters."

The dilution rates at IC50 were determined as shown in Table 16. The extract contents and the ratio of the plant material in the extract solution at IC50 are also shown in the same table. These transformation steps are shown on Sheet 7 of the supplemental data. IC50 of alizarin red S was not obtained because 100% viability was shown at the highest concentration. This means that the chemical does not possess acute toxicity.

Table 16. IC50 values

No.	IC50		
	Dilution rate	g/L (extract)	g/L (plant)
1	0.391	1.7981	7.2501
2	0.299	2.6968	5.4056
3	0.063	0.2624	1.1010
4	0.162	0.6044	2.9390
5	0.169	0.8791	3.0067
6-1	0.474	0.6989	8.7431
6-2	0.377	0.7753	7.0055
7	0.669	0.6154	11.9117
8	0.426	3.1651	7.4831
9 *1	0.210	0.8393	4.1967
10	0.182	1.6623	3.3370
Na_2HAsO_4	0.009	0.0901	
Alizarin red S	N.D.*2	N.D.*2	

*1: IC50 values for g/L (extract) and g/L (plant) were calculated by assuming that loss of drying and extract content were 10% and 20%, respectively. *2: Not determined.

The goal of this experiment was to evaluate the cytotoxicity of the food colorants used in Vietnamese local areas. Chemicals are required to replicate the digestive organs of a human body. This is the reason why we selected the intestinal epithelial cell Caco-2 as experimental material.

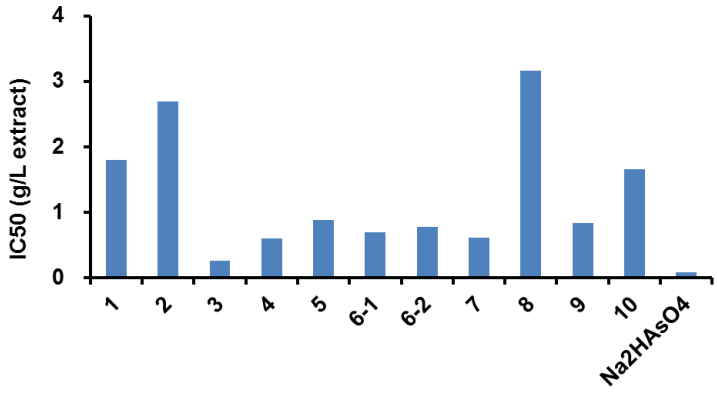


Figure 26. Extract content at IC50

We used alizarin red S, the colorant derived from *Rubia tinctorum Linne*, as the reference chemical. It has recently been found to cause mutagenesis. Consequently, the Ministry of Health, Labour and Welfare (in Japan) has banned the usage of the colorant as a food additive. In spite of this fact, the cytotoxicity of the colorant to Caco-2 was not observed in this experiment. This result shows that alizarin red S does not possess acute toxicity.

The IC50 of all samples was obtained in this study. A lower IC50 value means that the chemical's toxicity is higher. In this study, the lowest IC50 value for extract content (g/L) was obtained from Na_2HAsO_4. However, some samples showed similar IC50 values for their extract content (g/L) as for Na_2HAsO_4. These results suggest that the toxicities of these chemicals should not be ignored. The following should be noted: we used Na_2HAsO_4 as a pure standard, but all of the sample colorants were crude; hence, it might be difficult to directly compare IC50 values between Na_2HAsO_4 and the samples.

The major component of the color aqueous extract (CAE) of cam leaves was identified as peristrophine through spectral analysis, especially the 2D NMR spectra (HSQC, HMBC and NOESY) (Trinh TT, 2012). As the decoction of this plant is widely used for food dyeing, Thuy evaluated the acute oral toxicity of its CAE. Based on the results of an acute toxicity study in mice, the LD_{50} value of the CAE was determined as 9100 ± 290 mg kg^{-1} of body weight. Additionally, an *in vitro* cytotoxic assay showed peristrophine has an inhibitory effect on *Hepatocellular* carcinoma (HepG2, IC_{50}3.90 µg mL^{-1}). CAE and peristrophine (1) have also been tested for their ability to

affect the cell number of the OCI acute myeloid leukemia cell line and it was found that, at different concentrations and times of treatment, CAE and peristrophine significantly decreased the OCI cell number.

In recent years, zizilan compounds in cam-leaf extracts have been explored. These are believed to have the capability to treat diabetes and hepatitis B, function as anti-oxidative medicines and immune improvers, and be used in lotions or as color agents in many fields (Xie Y, Jiang X, Wen Y, 2003). Based on exclusion essay and the brine shrimp lethality bioassay method, Tanavade SS. et al. (2012) determined the anticancerous properties of ethanolic and aqueous extracts of leaves and stems of *Peristrophe bivalvis* in vitro using tryphan blue. In this study, the ethanolic extract was recognized to be more effective than the aqueous extract in regard to anticancerous activity. In addition, leaf extracts had higher anticancerous properties than stems. Furthermore, the CTC50 and LC50 values of ethanolic leaf extracts were 175.25+12.34 mg/ml and 176.49+7.43mg/ml in EAC cell lines, respectively. This shows that *Peristrophe bivalvis* possesses anticancerous properties. Additionally, CAE and peristrophine (a major bioactive component in cam-leaf extracts) significantly reduced OCI cell numbers (Trinh TT. et al., 2012).

Thus, the coloring substance obtained from cam leaves is potentially toxic, but only over a long period of use and in high doses. According to several studies, the coloring in cam leaves has the ability to protect the liver and is cancer-resistant. Indigenous knowledge in this regard should be recorded and tested.

*In regard to fabrics, we conducted experiments to determine the amount of indigotine in the *Strobilanthes cusia* species used by the people of Muong Khuong, Sapa Town.

The amount of blue and red in the indigo spectrum of the indigo powder samples used in the survey (*Strobilanthes cusia*, collected in Lao Cai) was calculated using the ultraviolet visibility (UV - VIS) method, which returned 39.8 and 25.4% (total 65.2%), respectively. Meanwhile, the indigo content was found to be 48% if calculated at a wavelength of 610 nm and using the same method of measurement as that used by Chinese pharmacopoeia.

This result also explains why the indigo fabrics of the Meo, which are dyed with *Strobilanthes*, appear blue and red in the sunlight. Furthermore, the high level of pigment (48%) can fully meet the requirements for the production of raw materials.

I. DISCUSSION

1. Native knowledge and using the experience of ethnic minorities

Through our investigation, we have identified 74 traditional trees that are used to dye food and other foodstuffs. Other activities such as dyeing teeth, hair, or tools are no longer practiced. Only Black Thai people still dye chopsticks red with cây cẩm and create black foodstuffs using cò mác ten. Dyeing of the hair and teeth and face painting have completely disappeared from ethnic minority communities.

Among these ethnic minority communities, the Tay and Nung are the most knowledgeable about using plants to dye food. they make several traditional dishes using dye from trees, such as five-colored sticky rice (Nung and Tay people), black gai cake (Nung and Tay people), nhả ngài cake (Tay people), chit leaves cake (Giay people), black chung cake (Thai people), sticky rice (Ha Nhi and Dao people), wine, and drinking water (multi-peoples).

The only ethnic groups that continue to practice cloth dyeing are the Mong – Dao and the Tay – Thai. Currently, only indigo cloth dyeing is maintained, which is used to make brocades and traditional costumes. Cochineal dyeing and silk weaving, the traditional handicraft of the Thai people, has completely disappeared in northwest Vietnam. In Tay Nguyen, there is no record of color dyeing in the M'nong, Ma, Banar, Ede, Grai in Dak Nong, Gia Lai, or Dak Lak communities.

2. Factors that affect using trees to source dye

Native knowledge has been considerably eroded, as shown by the KAP survey in Son La. Families and communities are social units, and that is why changes in social (regimes, policies) or natural environments (natural resources, climate) impact the activities and awareness of the communities. Vietnam's history of wars, colonialism, and reforms has affected people's awareness and activities. The impact of French colonialism is evident in people's perceptions of beauty, and there have also been changes in their costumes: Thai men wear French berets and believe that they are beautiful. They also like to wear suits to the office. Additionally, the feudal and French

eras had an effect on the natural resources, as forests were considerably exploited and the contemporary, booming farming practice caused a significant decline in forest area and quality, which resulted in the deterioration of floral resources. The loss of forests then led to the loss of native knowledge.

The changes in economy with the disappearance of subsidization, the appearance of multi-sector economy, and the "mountainous areas shall keep pace with the lowlands" policy have made life easier for ethnic minorities. Items can be bought and sold in the market in a much easier fashion than in the past, when the people practiced their own demand and supply, depending completely on nature. Consequently, people have gradually neglected traditional activities such as artisan cloth dyeing. Instead, they dye using chemicals and wear ready-made clothes bought in the markets.

Education and transportation have improved, children can attend school, and gender inequality has gradually been eliminated. Members of ethnic minorities can assume office and work with the Kinh, the majority ethnicity in Vietnam.

3. Sustainable use of dyeing plants in times of modernization

The value of dyeing plants has been highlighted in the previous chapters. This is a priceless intangible cultural heritage of Vietnam. The knowledge, techniques, and materials that contribute to community activities and festivals are unique to each group. As science progresses, the evaluation and development of this knowledge on an industrial scale will create economic benefits for both the communities and the country as a whole.

Hence, the sustainable use of dyeing-plant sources and related knowledge will contribute to preserving these valuable intangible cultural values, enhancing local economic activities.

However, the ethnic minorities' tradition of using dyeing plants is facing three main problems: the decline of gene sources, knowledge erosion, and disinterest on the part of the young members of their communities.

In relation to the decline of gene sources, this is very clear, as people believe it is difficult to find dyeing trees and good quality forests with many plants are far away. To

improve this, it is advisable to promote the maintenance and preservation of the gene sources of dyeing plants or those listed on the rare list by creating gardens of dyeing plants in villages or households where the natural conditions are similar to those required by these plants.

In regard to knowledge erosion, this is not only an issue in Vietnam but also in many other countries. This knowledge should be collected and recorded. Furthermore, other communication practices should also be promoted through endeavors such as raising awareness in schools and communities, and especially through home education. Moreover, the preservation of traditional festivals is another method of maintaining related native knowledge. Economic methods can also be implemented, such as finding a market for traditional products. Only when these activities are linked to profitable incomes will the people in the community care about them. In order to find outlets for the products, it is necessary to invest in innovative technologies, designs, and quality products to suit market requirements. In this study, the issue of technology is mentioned in regard to people buying industrial products or dyeing chemicals in order to save time and reduce labor. If the dyeing process can be improved by helping the people organize the production of indigo dyeing powder through the villages' women's groups or in the districts, this will rekindle the villagers' attraction towards the traditional dyeing practice. It is then proposed that the fabric and indigo powder, which are of great demand in minority communities, and the purple color from the cam and other dried materials, be provided in the markets for locals and tourists, especially in the northwest, where there is great potential for tourism development.

The apathy of young people is actually very easy to understand in the current climate, when the youth are constantly exposed to modernization. They attend school and work in big cities, using mobile phones and communicating on social networks, which makes time for dyeing and living in the village very scarce. In this situation, education within families and villages should be enhanced so that they can find it easier to acquire traditional dyeing practices from an early age, working with their mothers and grandmothers. However if, in the family, both mothers and grandmothers no longer dye, the children are certain not to adopt the habit or to gain practical experience in this.

Weaving and dyeing groups should be organized in a suitable way. The author was fortunate enough to participate in a field school that focused on maintaining the intangible cultural heritages of Surin, a northern province of Thailand. Here, they proceeded to teach three traditional activities of the Khmer people of Surin: silver making, silk weaving and dyeing, and kantrum (a traditional Khmer instrument).

The Khmers living in Thailand have many similarities with the Thai people and the Black Thai in Vietnam. They also eat sticky rice, farm, engage in sericulture, and weave. Their traditional fabric is ikat (which is a form of tie-dye textile). In the villages, the people still plant mulberry, raise silkworms, and perform cochineal dyeing. These products are manufactured and labeled Royal Thai because the products are under the protection of the Queen of Thailand. Different varieties of mulberry are collected and chosen from centers established by the royal state and then given to the people.

To maintain traditional mutmee textile and costume weaving, the women's association in the village organizes weaving practice sessions and purchases products woven by families. Women can travel directly to the center to work or make textile products at home and bring them to the center when they are finished. This organization method is designed so that they can work while staying home with their children and caring for their parents. They do not need to travel to another place to weave, and the products will be purchased if they are acceptable. In the school, 1–2 days a week students must wear uniforms made from fabrics woven in the village. Consequently, effective collaborative education between families and the school has been established.

In addition, although native knowledge has been used in the community for a long time, the evaluation of indigenous knowledge by modern science is also essential, especially in regard to the subject of food-dyeing plants. The toxicity of these plants should be checked and chemical composition analyses performed to determine plant species that are harmful to people's health. In this research, after 10 food-dye samples were collected in the north of Vietnam, it was concluded that two color samples are toxic and harmful to health if they are used for long periods and in high doses. To be able to give more detailed advice on dosage, further research is required.

The loss of knowledge and the decline of natural resources will cause these practices to disappear quickly. Hence, the conservation and development of the genetic resources of dyeing-plants requires urgent action, along with the strong development of the dyeing practices through modernization and scientific means.

II. CONCLUSION

The study was conducted using a combination of two methods, botanical ethnography and anthropology; therefore; it was capable of evaluating a combination of factors that affect the use of dyeing plants in Vietnam today.

74 species of traditional dyeing plants used by ethnic minorities were recorded and documented. In particular, the process of Pieu-making with dyed indigo cloth practiced by the Black Thai people of Thai Thuan Chau Son La was documented, along with the five-color sticky rice dye of the Nung in Lao Cai, the gai cake of the Nung in Cao Bang, and the chit leaves cake made by the Giay.

There is also the discovery that the Thai community in Son La use a species of *Wrightia laevis* for indigo dyeing, a dyeing method that was believed to have died out around the world.

A number of new discoveries have also been made concerning the use of certain plant species in Vietnam, specifically: *Gmelia arborea*, *Black*, *Cliotoria ternatea*, *Phylanthus*.

The factors affecting the use of trees that are sources of colorant were studied and evaluated through a KAP survey performed on Black Thai communities in two districts in Son La, Thuan Chau and Sop Cop. As a result, it was found that dyeing knowledge has been severely eroded, particularly as a result of the rift in knowledge between young people and the elderly in the community. The young people are indifferent to the traditional practices of community, and they want to blend in with the Kinh, which is reflected in the shunning of traditional costumes. However, brocade work and products related to textile and other dyeing practices are still maintained, albeit with modern influences (material is bought at the market). The elderly are passionate about and respect the old traditions, and they want to teach young people

these traditions before they are gone, but the young people like modernization and want to integrate themselves into the larger ethnic groups.

Without effective policies to use and maintain local knowledge or to develop traditional products, in approximately 10–15 years, when the people over 60 years old are no longer actively dyeing, fabric dyeing using natural colors will truly come to an end in the villages in the northwest of Vietnam where the people speak Tai - Kadam.

Ethnic minorities in Vietnam may have three possible strategies for the sustainable uses of colorant from plant resources. Each strategy has its own core value: ethnic identity, natural diversity and "safety" of naturalness.

Most of ethnic minorities still want to represent their identity by symbolic culture like their costume. But young generation gradually becomes indifferent to such clothes. Ethnic tourism might be a possible strategy for sustainability of the textile coloring. But as I show in this thesis, natural material coloring will be easily replaced with artificial material.

Second strategy is protecting biodiversity. As I mentioned in this thesis, quality of forest in Vietnam is decline. Ethnic local knowledge for symbiosis is the key to recover the diversity of the forest like *Satoyama*. Colorant plants are one of the significant local knowledge to be reactivated.

Last, the most possible strategy in the context of the modernization in Vietnam is emphasizing the safety of naturalness. Actually natural colors are increasingly used in food and drink all over the world. The global uptake of natural food colors in new product development is generally positive, with Europe leading, and Asia Pacific following as the fastest growing natural color market. The local knowledge of ethnic minolities on colorant plants will be an important resource for the need of natural color not only in Vietnam but also for the world market. But as I showed in chapter VII, Natural is not equal to safe. We have to study more on it in the both perspective of science and indigenous knowledge.

BIBLIOGRAPHY

ENGLISH

1. Aburjai,T &Natsheh, F.M. (2003). Plants Used in Cosmetics. *Phytotherapy Research* 17(9): 987-1000.
2. Adam, T. (1935). *The Art of Batik in Java*. New York: The Needle and Bobbin Club.
3. Adrosko, R.J. (1968). *Natural Dyes in the United States*. Smithsonian Institute Press.
4. Adrosko, R.J. (1971).*Natural Dyes and Home Dyeing*. Dover Publications Inc.
5. Anon. (1996). Recording and Using Indigenous Knowledge: A Manual. Silang, Cavite: International Institute of Rural Reconstruction.
6. Anthony, C. (2002). *Natural Colours from Botanicals*. London.
7. Anthony, D. (2001). Who Knows? On the Importance of Identifying 'Experts'. When Researching Local Ecological Knowledge. (LEK).
8. Antweiler, C. (1998). Local Knowledge and Local Knowing. *Anthropos* 93: 469-494.
9. Ash, M. & Ash, I. (1995). *Handbook of Food Additives*. Aldershot: Gower Publishing Ltd.
10. Balfour-Paul, J. (1997). Indigo in Arab World. Curzon.
11. Balick, M.J., &Cox, P.A(1996). Plants, People and Culture: The Science of Ethnobotany, Scientific American Library.
12. Barber, E. J. (1991). *Prehistoric Textile.* Princeton: Princeton University Press.
13. Battenfield, J. (1978). *Ikat Technique*. New York: Van Nostrand Reinhold.
14. Bechtold, T. & Mussack, R. (2009). *Handbook of Natural Colorants*. New York: John Wiley & Sons Ltd.
15. Bell, M. (1979). The Exploitation of Indigenous Knowledge or the Indigenous Exploitation of Knowledge. Whose Use of What for What? *Institute of Development Studies* 10 (2): 44-50.
16. Bernard, H.R. ed. (2000) Handbook of Methods in Cultural Anthropology: 365－403, Altamira Press.
17. Bennett, B. (1992). Plants and People of the Amazonian Rainforests: The Role of Ethnobotany in Sustainable Development. *BioScience* 42(8): 599-607.
18. Brokensha, D., Warren, D.M. & Werner, O. (1980)."*Indigenous Knowledge*

Systems and Development", Washington, D.C.: University Press of America.

19. Brouwer, J. (1998). IK, IKS and ITK. *Indigenous Knowledge & Development Monitor*, 6(3): 13.
20. Brush, S.B. (1996). Whose knowledge, whose genes, whose rights? In Brush, S.B., Stabinsky, D., (eds.) *Valuing Local Knowledge: Indigenous Peoples and Intellectual Property Rights,* 1–21. Washington D.C.: Island Press.
21. Buchanan, C. (1995). *Tie-dyeing: get started in new craft with easy to follow projects for beginners*. New England: Apple Press.
22. Burrows, A. (2009). Palette of our palates: A Brief History of Food Coloring and Its Regulation. *Comprehensive Reviews in Food Science and Food Safety* 8: 394-408.
23. Cannon, J. & Cannon, M. (1994). Dyes plants and Dyeing. Royal Botanic Gardens. Kew and Timber Press. Portland, Oregon.
24. Cardon, D. (2007). *Natural Dyes: Sources, Tradition, Technology and Science.* London: Archetype Publications.
25. Carlson, T.J.S. & Maffi, L. (2005). Ethnobotany and Conservation of Biocultural Diversity. *American Anthropologist*, 107(3): 512-5.
26. Carrithers, M. (1992). Why Humans Have Cultures: Explaining Anthropology and Social Diversity. Kettering: Oxford University Press U.S.A.
27. Casenkov, O. I. (1997). Preparation of red food dye from plant materials, Canning Vegatables Drying, 97-04608. (P-Patent).
28. Chambers, R. (1992). Rural Appraisal: Rapid, Relaxed and Participatory. *IDS Discussion Paper* 311. Brighton: Institute of Development Studies.
29. Conner, M. & Armitage, C. (2002). *Applying Social Psychology: The Social Psychology of Food*. Buckingham: Open University Press.
30. Daniel M., Bhattacharya, S. D., Arya, A. & Raole, V. M. (2006). *Natural Dyes: Scope and Challenges*. Jodhpur: Scientific Publishers.
31. Decelles, C. (1949). The Story of Dyes and Dyeing. *Journal of Chemical Education*, 26(11): 583-585.
32. Downham, A. and Collins, P. (2000). Colouring Our Foods in the Last and Next Millennium. *International Journal of Food Science and Technology* 35: 5-22.
33. Ellen, R., Parkes, P. & Bicker, A. (2000). *Indigenous Environmental Knowledge and Its Transformations: Critical Anthropological Perspectives*. Amsterdam:

Harwood Academic Publishers.

34. Evers, H.D. & Gerke, S. (2003). Local and Global Knowledge: Social Science Research on Southeast Asia. *Southeast Asian Studies Working Paper* 18. Southeast Asian Studies, University of Bonn.
35. Fabian, J. & Hartmann, H. (1980). Light Absorption of Organic Colorants: Theoretical Treatment and Empirical Rules. *Reactivity and Structure: Concepts in Organic Chemistry 12,* Springer-Verlag.
36. Ford, J. (2001). The Relevance of Indigenous Knowledge to Contemporary Sustainability. *Northwest Science* 7: 185–190.
37. Fuke, C. & al. (1985). Two Aromatic Compounds Related to Brazilian from Caesalpinia Sappan. *Phytochemistry* 24(10): 2403-2406.
38. Gadgil, M., Berkes, F. & Folke, C. (1993). Indigenous Knowledge for Biodiversity Conservation. *Ambio* 22: 151–156.
39. Gary, J. M. (2000). *Ethnobotany -A Methods manual.* Cambridge: Cambridge University Press.
40. Gedney, W.J. (1989). Selected Papers on Comparative Tai Studies. In Robert J Brickner et al. eds, Michigan Papers on South & Southeast Asia No. 29. Center for South and Southeast Asian Studies, University of Michigan.
41. Geertz, C. (1985). *Local Knowledge: Further Essays in Interpretive Anthropology.* Basic Books, New York.
42. *Gedney W.J (1965), Selected Paper on Comparative Tai Studies: 415-421.* Holland Publish Company, Amsterdam.
43. Gilbert, K.G. & Cooke, D.T. (2001). Dyes from Plants: Past Usage, Present Understanding and Potential*. Plant Growth Regulation, 34(1): 57–69.*
44. Glover, B. & Pierce, J.H. (1993). Are Natural Colorants Good for Your Health? *Journal of the Society of Dyers and Colourist*, 109(1): 5-7.
45. Gomez, M. (2003), Butterfly Pea (Clitoria ternatea). Pakistan Journal of Nutrition. Vol. 2 (6): 374–379.
46. Good, I. (2001). Archaeological Textiles: A Review of Current Research. *Annual Review of Anthropology*, Vol. 30 :209-226.
47. Grenier, L. (1998). *Working With Indigenous Knowledge: a Guide for Researchers*. Ottawa: International Development Research Centre (IDRC).
48. Hancock, M. (1997), Potential for Colourants from Plant Sources in England and

Wales, Cambridge CB2 8NN, 102p.

49. Hansen, C. (1999). The Advantage Natural Colors in Food Products. *Food Marketing and Technology*, 99: 12‑15.
50. Harborne, J. B. (1984), *Phytochemical Methods‑Guide to Modern Technique of Plant Analysis.* London; New York: Chapman and Hall.
51. Hendry, G. A. F. & J. D. Houghton (1992), Natural Food Colorants. Glasgow: Blackie.
52. Higgins, C. (1998). The Role of Traditional Ecological Knowledge in Managing for Biodiversity. *Forestry Chronicle* 74(3):323‑26.
53. Hofenk de Graaff, J.H. (2004). *The Colorful Past: Origins, Chemistry and Identification of Natural* Dyestuffs. London: Abegg‑Stiftung and Archetype Publications.
54. Houghton, J.D. & G. A. F Hendry (1992). *Natural Food Colorants*. Springer.
55. Jackman, R. L. & J. L. Smith (2008), Natural Food Colorants. Second Edition. G. A. F. Hendry and J. D. Houghton Eds. New York: Chapman and Hal.
56. Innsbruck, A.B & Jandl, R. (2009). Global Change and Sustainable Development in Mountain Regions. *Alpine–Space and Man & Environment 7*: 150 pp.
57. Jimreivat, P. (2000). Culture and Tradition of the Tai People in Sipsongchutai: Maintenance, Revitalization and Integration into the Present Vietnamese Society. In Hayashi Yukio and Aaronroot Wichienkeeo (Eds.): *Interethnic relations in the Making of Mainland Southeast Asia and Southwestern China*. Bangkok: Amarin Printing and Publishing Public Co. Ltd.
58. John T, M.J., (1967). Mountain Minorities and the Viet Minh: A Key to the Indochina War. In P. Kunstadter, ed. Southeast Asian Tribes, Minorities, and Nations. 2: 771–844. Princeton: Princeton University Press.
59. Johnson, M. (1992). *Research on Traditional Environmental Knowledge: Its Development and Its Role*. In Johnson, M., ed., Lore: *Capturing traditional environmental knowledge*. Dene Cultural Institute; International Development Research Centre: 33-39.
60. Kajembe, G.C., (1994). Indigenous Management Systems as a basis for Community Forestry in Tanzania: A case study of Dodoma Urban and Lushoto Districts. *Tropical Resource Management Paper* No. 6. Wageningen.

61. Kalland, A (2000), Indigenous knowledge: prospects and limitations. In Ellen R, Parkes P and Bicker A (eds) *Indigenous environmental knowledge and its transformations* (Harwood Academic Publishers, Amsterdam)
62. Kasahar, Y.S. ed. (1986). *Medicinal herb index in Indonesia*: 159. Borgo: P.T. Esai Indonesia.
63. Kratoska P. H. (2001), Southeast Asia Colonial History, Vol. VI: Indipendence through Revolutionary War, 351-401, Routledge.
64. Li, F.K. (1977). A Handbook of comparative Tai. Ocean linguistics special publication. No.15. Honolulu: The University of Hawaii Press.
65. Luibrand, A 2001: *Ten Years of Doi Moi: How did the Black Thai Participate in the Rural Reform Process in Vietnam*. Ph.D. Dissertation. University of Hohenheim.
66. Mahanta, D. & Tiwari, S.C. (2005). Natural dye-yielding plants and indigenous knowledge on dye preparation in Arunachal Pradesh, Northeast India. *Journal of Current Science*, Vol. 88, No.9.
67. Mai Phuong, N. & Catacutan, D. (2014), Land use change analysis in Dien Bien, Son La, and Lai Chau province, Northwestern Vietnam for the period 2000-2010. ICRAF, Vietnam, CGIAR Research Program on Integrated systems for the Humid Tropics.
68. Mairet, E.M. (1916). A Book on Vegetable Dyes. Douglas Pepler at the Hampshire House workshop Hammersmith W: 87-106.
69. Malcolm, R. (1982). Anthropology of Knowledge. *Annual Review of Anthropology*, Vol. 11 (1982), pp. 287-313.
70. Mauro F,Hardison PD. (2000). Traditional Knowledge of Indigenous and local Communities: International Debate and Policy Initiatives. *Ecological Applications* 10: 1263–1269.
71. McCargo, D. (2004). *Rethinking Vietnam*. London: Routledge.
72. Miraglia, R.A. (1998), Traditional Ecological Knowledge Handbook: A training Manual and Reference Guide for Designing, Conducting, and Participating in Research Projects Using Traditional Ecological Knowledge. Alaska Department of Fish and Game, Division of Subsistence.
73. Mitsui-Petrochem (1998), Production of secondary plant metabolite; *J. cell culture*, 10.02.98. (P-Patent)

74. Mukdawijitra, Y. (2009). Ethnicity and Multilingualism: The Case of Ethnic Tai in the Vietnamese State. PhD. dissertation. Maddison: University of Wisconsin.
75. Mohammed S Ali–Shtayeh, (2008), Traditional knowledge of wild edible plants used in Palestine (Northern West Bank): A comparative study, *Journal of Ethnobiology and Ethnomedicine 4: 13.*
76. Mohanty, B. C. (1987). *Natural Dyeing Processes of India*, Ahmedabad: Calico Museum of Textile.
77. Moore, H.L. (1996). *The Future of Anthropological Knowledge*. Oxford: Oxford University Press.
78. Mundy, P. & L. Compton. (1991). Indigenous Communication and Indigenous Knowledge. *Development Communication Report* 74 (3): 1–3.
79. National Institute of Materia Medica. (1999), Selected Medicinal Plants in Vietnam. Vol. 1: 316–319. Hanoi: Science and Technology Publishing House.
80. Nguyen, K. V. (2002). *Vietnam: A long history*. 5th Edition. Hanoi: The Gioi Publishers.
81. Pascual−Terasa, S.D. & Sanchez−Ballesta, M.T. (2008). Anthocyanins: From Plant to Health. *Phytochem* Rev, No.7: 281-299.
82. Pastureau, M. (2001). *Blue: The History of a Colour*. Princeton: Princeton University Press.
83. Patil, K. (2004). Comparative Study of fastness Properties of Silk Dyed with Synthetic and Natural Dye. *Journal of Textile Association* Vol. 64(3): 137-141.
84. Pottier, J. 1999. *Anthropology of Food: The Social Dynamics of Food Security*. Cambridge Polity Press.
85. PROSEA 3 (1992). *Dye and tannin-producing plants*: 16-21. Bogor.
86. Radomski, J.L. (1974). Toxicology Food Colorant, *Annual of Pharmacology*, Vol. 14: 124-174 pp.
87. Rambo, A. T. (2005). Searching for Vietnam, 281-341, Kyoto University Press.
88. Robinson S. (1969). *The history of Dye Textile*: *: dyes, fibres, painted bark, batik, starch-resist, discharge, tie-dye, further sources for research.* Cambridge, Mass., M.I.T. Press
89. Rossi, P.H., J.D. Wright & A.B. Anderson. (1983). *Handbook of Survey Research*. Academic Press. New York.

90. Schultz G. F. (1965). Vietnamese Legends: the origin of banh giay and banh chung: 41-45, Ruthland, Vermont & Tokyo, Japan.
91. Shiva, V., and Mies, M., (ed) (993). *Women Indigenous Knowledge and Biodiversity Conservation: In Ecofeminism*, 164 - 173. Zed Books.
92. Sikor, T. (1999). The Political Economy of Decollectivization: A Study of Differentiation in and among Black Thai villages of Northern Vietnam. Ph.D. Dissertation. University of California, Berkeley.
93. Sillitoe, Paul. (1998).The Development of Indigenous Knowledge: A New Applied Anthropology. *Current Anthropology* 39(2):223-52.
94. Sinclair, F. L. & Walker, D.H. (1999). A Utilitarian Approach to the Incorporation of Local Knowledge in Agroforestry Research and Extension. *Agroforestry in sustainable agricultural systems* 245.
95. Siva, R. (2007). Status of Natural Dyes and Dye-yielding Plants in India. *Current Science*. 92 (7): 916-925.
96. Socaciu, S. (2007). *Food Colorants: Chemical and Functional Properties*. CRC Press.
97. Solvay, G. & Campbell, B. (2004). *The Science of Sustainable development: local livehoods and the global environment*, Cambrige University Press, UK.
98. Socaciu, S. (2007). *Food Colorants: Chemical and Functional Properties*. CRC Press.
99. Sproull, N.L. (1995). *Handbook of Research Methods: A Guide for Practitioners and Students in the Social Sciences*. Second ed. Metuchen: The Scarecrow Press, Inc.
100. Taylor, G. W. (1990). Ancient Textile Dyes, *Chemistry in Britain* Vol. 26(12): 1155-1158.
101. Terahara, N., M. Oda, T. Matsui & al. (1996), Five new anthocyanins A3, B4, B3, B2 and D2 from *Clitoria ternatea* flowers. Journ. Nat. Prod. Feb. 59 (2): 139-144.
102. Thrupp, L. A., (1989). Legitimizing Local Knowledge: From Displacement of Empowerment for Third World People. *Agriculture and Human Values* 3, 13-24
103. Vi,Van An & Crystal, E. (2003). Rice Harvest Rituals in Two Highland Tai Communities in Vietnam. In R.W. Hamilton, ed., *The Art of Rice: Spirit and Sustenance in Asia.* 119-131. Los Angeles: UCLA Fowler Museum of Cultural

History.
104. Vietnam Studies 36, No. 41, Xunhabasa Press.
105. Walford, J. (1980). Historical Development food colouration. *In: Development in Food Colours* Vol. 1:1-25, London: Applied Science Publishers.
106. Walker, A. & Tapp, N. (2001) The Tai world: A Digest of Article from the Thai Yunnan Project Newsletter. Department of Anthropology, Research School of Pacific Studies, Australian National University.
107. Warren, H., (1982). *Ethno-Methodology: How People Make Sense*. New Jersey: Engle Wood Cliffs. 159p.
108. Warren, D.M., Slikkerveer L.J. &Brokensha, D. (eds) (1995) *The Cultural Dimension of Development: Indigenous Knowledge Systems*. London: Intermediate Technology Publications.
109. Williams, N.M.& Baines, G. eds. (1993) Traditional Ecological Knowledge: Wisdom for Sustainable Development. Centre for Resource and Environmental Studies, Australian National University.
110. Wissgott, U. & Bortlik, K. (1996). Prospect for New Natural Food Colorants. *Trend in Food Science and Technology* 7: 298-302.
111. World Bank. (2009). Country Social Analysis: Ethnicity and Development in Vietnam. Annual Report.
112. World Bank. (2011). Vietnam Development Report 2011: Natural Resources Management, Hanoi.
113. Wouters, J. & Verhecken, A. (1989). The Scale Insect Dyes. Species Recognition by HPLC and Diode-Array Analysis of the Dyestuffs. Annales Soc. Entom. France, 25(4), 393-410.

VIETNAMESE

1. Bân, N. T. 2003 *Danh lục các loài thực vật Việt Nam*, tậpII: 1203. Nxb. Nông nghiệp.
2. Bân, N. T. 2005 *Danh lục các loài thực vật Việt Nam*, tập III: 1248. Nxb. Nông nghiệp.
3. Cầm Trọng (1978), *Người Thái ở Tây Bắc Việt Nam*, Nxb Khoa Học Xã Hội, Hà Nội.

4. Cầm Trọng (2005), *Những hiểu biết về người Thái ở Việt Nam*, Nxb Chính Trị Quốc gia.
5. Cầm Trọng, Phan Hữu Dật (1995) --- *Văn hoá Thái Việt Nam* – Nxb Văn hoá Dân tộc.
6. Cư, L. D. and Hợi T. M. 1995 *Các cây nhuộm màu phổ biến ở Việt nam*. Tuyển tập công trình nghiên cứu: 46–58, Viện STTNSV. Nxb. Khoa học & Kỹ thuật.
7. Đại học Quốc gia Hà Nội --- Viện Việt Nam học và Khoa học phát triển (2009) *Địa danh và những vấn đề lịch sử --- văn hóa của các dân tộc nhóm ngôn ngữ Tày --- Thái Việt Nam.* Nxb Thế giới.
8. Đặng Thị Oanh (chủ biên) (2010), *Huyền thoại Mường Then*, Nxb Văn hóa Dân tộc.
9. Huyên, N. V. (1996). *Góp phần nghiên cứu văn hóa Việt Nam*, tập I: 466, Nxb. Khoa học xã hội.
10. Lành Đ. T. (2000). Bước đầu tìm hiểu về thần thoại dân tộc Thái Tây Bắc. Nxb. Văn hóa dân tộc.
11. Lô L.V. & Vạn Đ. N. (1968), Sơ lược giới thiệu các nhóm dân tộc Tày, Nùng, Thái ở Việt Nam, Nxb Khoa học xã hội, Hà Nội.
12. Lương H. (1988). Hoa văn Thái. Nxb Dân tộc học Hà Nội.
13. Ngọc Anh LD. và cs, 2013. Cây nhuộm truyền thống của người Thái đen tại huyện Thuận Châu, tỉnh Sơn La. Hội nghị khoa học quốc gia về Sinh thái & Tài nguyên sinh vật, lần thứ 5: 917-922. Nxb. Nông nghiệp.
14. Ngọc Anh LD. và cs., 2011. Vai trò của cây nhuộm màu đối với đời sống kinh tế xã hội của đồng bào thiểu số. Hội nghị Khoa quốc gia
về Hệ thống bảo tàng thiên nhiên Việt Nam, lần thứ I. NXB. KHTN & CN, Hà Nội, trang 206-213.
15. Nghịch T.H. (sưu tầm, biên soạn) (1995) *Phương ngôn tục ngữ Thái* --- Nxb Văn hóa Dân tộc, Hà Nội.
16. Pháp, T. T. (1968). Lĩnh nam chích quái, bản dịch Lê Hữu Mạc, Nhà sách Khai trí, Sài Gòn.
17. Phương, V. M. (2011). Trang phục của người Lào ở Tây Bắc Việt Nam. Luận án tiến sỹ, 66—67. Viện Khoa học xã hội Việt Nam.
18. Sơn,T. H. (1997). Văn hóa dân gian Lào Cai, 24-- - 37. Nxb. Văn hóa dân tộc.
19. Thắng L.N. (1991), Những giá trị có tính chất lịch sử của trang phục cổ truyền

Thái Tây bắc. Tạp chí dân tộc học Số 2: 49--‐51.

20. Thu H. V. Hệ thống tổ chức của chế độ phong kiến ở Mường Muổi, Sơn la: 285--‐291. Địa danh và những vấn đê lịch sử --‐ văn hoá của các dân tộc nhóm ngôn ngữ Tày--‐Thái Việt Nam.
21. Tình, D. T. (2010). Trang phục thăng long Hà Nội, 511. Nxb Hà Nội.
22. Trọng, C. (2005) Những hiểu biết về người Thái ở Việt Nam, Nxb Chính trị quốc gia.
23. Uỷ ban nhân dân tỉnh Sơn La (2005), Tỉnh Sơn La 110 năm (1895--‐2005), Nxb. Chính trị quốc gia Hà Nội.
24. Viên N.T.H. (2009). Tri thức bản địa của người Thái trong canh tác nương rẫy ở vùng ven thành phố Sơn La, Tạp chí Khoa học ĐHQGHN, Khoa học Tự nhiên và Công nghệ 25: 132--‐13

APPENDICES

Appendix 01: Checklist of colorant plants by ethnic people knowledge in Northern Vietnam

	Family name	Latin name	Vietnamese name*	Part containing	Colors	Food	Textile	Other	Process
1	Acanthaceae	*Dicliptera chinensis* (L.) Juss.	Diễn	Leaves	Red	Rice			Boiling for extraction, food
2	Acanthaceae	*Peristrophe bivalvis* (L.) Merr. (*Different cultivars*)	Cẩm	Leaves	Red, purple, yellow	Rice		Chopstic	Boiling,for food, tools
3	Acanthaceae	*Strobilanthes cusia* (Nees) Kuntze.	Chàm mèo	Leaves	Indigo		Cloth		Textile
4	Acanthaceae	Strobilanthes sp.	Chàm dại	Leaves	Indigo		Cloth		Textile
5	Aclepidiaceae	Marsdenia tinctoria	Dây chàm	Whole plants			Cloth		Textile, Hair
6	Altingiaceae	*Liquidambar formosana* Hance	Sau sau	Leaves	Black	Rice			Boiling for extraction, food
7	Amaranthaceae	*Amaranthus caudatus* L	Dền tía	Leaves	Red	Drink			Boiling, food
8	Anacardiaceae	*Rhus chinensis* Mill.	Muối (ashes)	Stem (bark)	Black	Rice			Ash, food
9	Apocynaceae	*Wrightia laevis* L.	Lòng mức	Leaves	Indigo		Cloth		Textile
10	Asteraceae	*Artemisia indica* Willd.	Ngải cứu	Leaves	Green	Cake			Mixing with material, steaming
11	Asteraceae	*Artemisia vulgaris* L.	Ngải cứu	Leaves	Green	Cake			Mixing with material, steaming
12	Asteraceae	*Eclipta alba* Hassk.	Cỏ mực	Leaves, steam	Black			Thing	Implements
13	Asteraceae	*Gnaphalium affine* D. Don	Rau khúc	Whole plant	Green	Cake			Steaming and grinding
14	Basellaceae	*Basella rubra* L.	Mồng tơi	Fruit	Purple	Rice			Use fresh extraction
15	Bignoniaceae	*Oroxylum indicum* (L.) Kurz	Núc nác	Stem-ash Bark	Black Yellow	Chưng cake			Mixing ash and rice, steaming
16	Bixacaceae	*Bixa orellana* L.	Điều nhuộm	Coat-seed	Orange, dark yellow	Rice	Fibre		Boiling Food, Textile (embroidery thread)

17	Buddlejaceae	*Buddleja macrostachya* Wall. ExBenth.	Búp lệ chùm to	Flower	Yellow	Rice			Boiling food
18	Buddlejaceae	*Buddleja officinalis* Maxim.	Mật mông hoa	Flower	Yellow	Rice			Boiling food
19	Buddlejaceae	*Buddleja paniculata* Wall.	Búp lệ chùm tụ tán	Flower	Yellow	Rice			Boiling food
20	Caesalpiniaceae	*Caesalpinia sappan* L.	Vang	wood	Red	Rice	Fibre		Boiling Food, textile (thread)
21	Combretaceae	*Terminalia chebula* Retz.	Chiêu liêu	Bark	Yellow, orange		Cloth		Boiling Textile
22	Curcubitaceae	*Momordica cochinchinensis* (Lour.) Spreng.	Gấc	Coat seed	Red	Rice			Mixing with material, steaming or boiling Food
23	Dioscoreaceae	*Dioscorea cirrhosa* Lour.	Củ nâu		Brown, black		Cloth		Textile, fishing net
24	Dioscoreaceae	*Dioscorea* sp.	Củ nâu củ dài	Tuber	Red		Cloth		Textile (mordant)
25	Dracaenaceae	*Dracaena cambodiana Pierre ex* Gagnep.	Huyết giác	Stem	Red	Drink	Fibre		Soaking in alcohol or boiling Food
26	Dracaenaceae	*Dracaena cochinchinensis* (Lour.) S.C.Chen	Bồng bồng	Stem	Red	Drink			Soaking in alcohol or boiling
27	Euphorbiacae	*Phyllanthus emblica* L.	Me rừng	Leaves Bark	Black Grey		Thing Cloth		Stem use for grey color (textile)Vỏ Grinding fresh leaves for dyeing black textile
28	Euphorbiaceae	*Cleidocarpus cavaleriei* L.	Đen	Leaves Bark	Black		Cloth		Boiling fresh leaves or stem to require black
29	Euphorbiaceae	*Grewia paniculata* Roxb.	Cò ke lá lõm	Leaves	Grey		Cloth		
30	Euphorbiaceae	*Phyllanthus* sp.	Gióng xanh	Leaves	Grey		Cloth		

31	Euphorbiaceae	*Sapium biscolor* (Champ. ex Benth.) Muell.-Arg	Sòi tía	Leaves	Black		Cloth		Dyeing black silk
32	Fabaceae	*Clitoria ternatea* L.	Đậu biếc	Flower	Blue	Rice			Coloring sticky rice
33	Fabaceae	*Dalbergia volubilis* Roxb.	Trắc leo		Ash	Black	Rice, Cake		Ash for coloring food
34	Fabaceae	*Indigofera suffruticosa* Mill.	Chàm cong	quả	Leaves	Indigo		Cloth	Textile
35	Fabaceae	*Indigofera tinctoria* L.	Đậu chàm		Leaves	Indigo		Cloth	Textile
36	Fabaceae	*Milletia* sp.	Cát sâm		Stem	Red	Drink		Soaking in alcohol, food
37	Fabaceae	*Spatholobus suberectus* Dunn	Kê đằng	Huyết	Stem	Red		Fibre	Soaking in alcohol, food
38	Fabaceae	*Vigna cylindrica* (L.) Skeels	Đậu đen		Seed	Black	Rice		Mixing with material, after that boiling, food
39	Iridaceae	*Eleutherin bulbosa* (Mill.) Urban	Sâm hành	đại	Corn	Red	Drink		Boiling or Soaking in alcohol, food
40	Lythraceae	*Lawsonia inermis* L.	Lá móng		Flower, Leaves	Red		Finger-nail	Nail
41	Malvaceae	*Hibiscus sabdariffa* L.	Bụp giấm		Fruit	Red	Drink		Boiling, food
42	Marantaceae	*Phrynium imbricatum* Gagnep	Lá dong		Leaves	Green	Rice cake		Cover rice cake, steaming
43	Menispermaceae	*Fibraurea tinctoria* Lour.	Hoàng đằng	Stem	Yellow		Fibre		Boiling, textile
44	Moraceae	*Morus alba* L.	Dâu tằm	Fruit	Purple	Drink			Extraction by sugar
45	Myrsinaceae	*Embelia parviflora* Wall. Ex A. DC	Chua ngút	Stem	Red	Drink			Soaking in alcohol
46	Myrtaceae	*Rhodomyrtus tomentosa* (Ait.) Hassk.	Sim	Fruit	Purple	Drink			Mixing fresh fruit with material and steaming or

47	Pandanaceae	*Pandanus amaryllifolius* Roxb.	Dứa thơm	Leaf	Green	Rice, Cake			Grinding fresh leaves, Mixing extraction and material, steaming or boiling for make cake, jelly (food)
48	Piperaceae	*Piper sp.*	Trầu không rừng	Leaves	Mordant		Cloth		Mordant (boiling fresh leaves)
49	Poaceae	*Oryza sativa L. var. glutinosa* Blanco	Lúa nếp	Than của thân Hạt	Black, Mordant	Rice, Cakr	Cloth		ash (stem) for making black Chung cake. Using seeds for mordant (in indigo dyeing process)
50	Poaceae	*Thysanolaena maxima* (Roxb.) Kuntze	Chít	Leaf	Yellow	Rice cake	Fibre		Cover rice cake, Giay traditional cake (food) Dyeing thread (boiling)
51	Polygonaceae	*Reynoutria japonica* Houtt.	Cốt khí củ	Tuber	Yellow		Fibre		Grinding or boiling fresh leaves for dying thread in red
52	Rubiaceae	Gardenia jasminoides Ellis	Dành dành	fruit	Yellow		Fibre		Dyeing embroidery thread (boiling)
53	Rubiaceae	*Gardenia tonkinensis* Pit.	Dành dành bắc bộ	Fruit	Yellow		Fibre		Dyeing embroidery thread (boiling)
54	Rubiaceae	*Gmelina arborea* Roxb. Ex Sm.	Lõi thọ	Flower	Yellow	Rice			Boiling, soaking rice in this extraction (food)
55	Rubiaceae	*Luculia gratissima* (Wall.) Sweet	Gạc nai	Wood	Yellow	Drink			Boiling, Soaking in alcohol Food
56	Rubiacea	*Morinda citrifolia* L.	Nhàu	Rood, Bark	Yelloww		Fibre		
57	Rubiaceae	*Paederia scandens* (Lour.) Merr.	Mơ dây	Leaf	Green				Grinding, mixing with rice to make rice cake
58	Rubiaceae	*Rubia cordifolia* L.	Vấn vương	rood	Yellow		Fibre		Boiling, dyeing textile

59	Rubiaceae	*Rubia tinctoria* L.	Thiến thảo	rood	Yellow		Fibre		Boiling, dyeing textile
60	Smilacaceae	*Smilax glabra*	Khúc khắc	Stem	Red		Fibre		Boiling, textile
61	Urticaceae	*Boehmeria nivea (L.)* Gaudich.	Lá gai	Leaf	Black	Cake			Boiling leaves with lime water, grinding this solution with rice then steaming for making gai cake (Tay and Nung traditional cake)
62	Zingiberaceae	*Alpinia gagnepainii* (Gagnep.) K. Schum	Riềng	Leaf	Green	Rice			Grinding fresh leaves, mixing with glutinous rice for make chung cake to require green color
63	Zingiberaceae	*Alpinia officinarum* Hance	Riềng	Leaf	Green	Rice			Grinding fresh leaves, mix with glutinous rice for make chung cake to require green color
64	Zingiberaceae	*Curcuma longa* L.	Nghệ vàng	Rhizomes	Yellow	Rice	Fibre		Coloring sticky rice
65	Zingiberaceae	*Curcuma zedoaria* (Christm) Rosc.	Nghệ đen	Rhizomes	Yellow		Fibre		Grinding and mixing with material
66	Zingiberaceae	*Zingiber officinale* Roscoe	Gừng	Leaves	Green	Rice			Grinding fresh leaves, mix with glutinous rice for make chung cake to require green color

*Plant name can be found in Vietnam checklist of plants (Bân2003, 2005)