Identification of Bio mordant in Merbaun Village, West Amarasi District, Kupang Regency

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Abstract. East Nusa Tenggara (NTT) is a province that has cultural diversity. One of the cultures that are the pride of the people of East Nusa Tenggara is ikat weaving. In the observation stage related to this research, a small group of weaving craftsmen (Runpah and Narwastu) was found still use plants as natural dyes. The color produced from these plants is very distinctive, and besides using plant dyes, other ingredients are also added to prevent natural color fading. This study aims to determine the types of mordant plants, the used organs, the processing method, and the produced color by the craftsmen in Merbaun Village, West Amarasi District, Kupang Regency. The method used in this research is descriptive qualitative. The results of the research in Merbaun Village found 8 types of plants that were used as mordants, including Kepuh (Sterculia foetida L), Hibiscus (Hibiscus rosa-sinensis L), kesambi (Schleichera oleosa L), candlenut (Aleurites moluccana (L.) Willd), kapok randu alas (Bombax ceiba L), pomegranate (Punica granatum L.), Loba (Symplocos sp.), and Utaruna, plant organs that are used, namely, fruit skins, leaves, bark, fruit and pulp. The processing process is burning, pounding, soaking, cooking and the resulting colors are yellow and red.

1. Introduction

East Nusa Tenggara (NTT) is a province that has cultural diversity. One of the cultures that are the pride of the people of East Nusa Tenggara is ikat weaving. Concerning the process of making woven fabrics, in principle, they use the available biological resources. Merbaun Village is one of the villages in West Amarasi Subdistrict, Kupang Regency, which so far still uses plant biological resources as the main ingredient in dyeing the weaving.

The observation phase related to this research found a small group of weaving craftsmen (Runpah and Narwastu) who still used plants as natural dyes. The plant parts used, such as noni root, tarum leaves, and turmeric rhizome, are used to produce natural colors. The use of dyed plants in the manufacture of woven fabrics means that the resulting color fades faster (Suirta et al. 2013). To maintain the color durability of the fabric, one alternative is to use mordant.

Mordant is a term for color enhancing or also as a special substance that can increase the adhesion of various dyes to fabrics. Mordant is divided into two, namely natural mordant and synthetic mordant. Plants that have the potential to become natural mordants are found in nature but are still underutilized. This type of mordant is harmless to the skin and is also environmentally friendly. To reduce the use of...
synthetic mordants, natural mordants are an alternative that can be used. According to Ramelawati et al. (2018), the use of natural mordant results in fairly bright colors, as well as good color evenness. Craftsmen and the community already know about plants that can produce color and make use of mordant plants, but knowledge of Biomordant species has not been recorded properly. Starting from the description, it is necessary to research on: "Identification of Biomordant in Merbaun Village, West Amarasi District, Kupang Regency".

2. Research Method
The research was carried out from January to March 2019 in Merbaun Village, West Amarasi District, Kupang Regency, and the Biology Education Laboratory Universitas Kristen Artha Wacana. The tools used in the research include: the camera is used to take pictures of samples/types of plants obtained, knives/machetes are used to take plant organs to be used, stationery is used to record the results of interviews with respondents directly or field observations, mortal is used to smooth the samples, a hot plate is used to boil the sample, analytical scales are used to determine the appropriate sample weight required, a clock/stopwatch is used to control the time in each mordanting process, a stirrer/spatula is used in the mordanting process, a glass beaker is used for the mordanting process, sieve to filter the solution and stove to boil the sample. The materials used are cotton threads used for dyeing, water, and mordant plant organs taken from Merbaun Village, West Amarasi District, Kupang Regency.

The method used in this research is descriptive qualitative, the main objective of qualitative descriptive research is to describe systematically the facts and characteristics of the object and subject under study accurately. Sampling and data collection of potential mordant plants were carried out by exploration methods around the location of Merbaun Village, West Amarasi District, Kupang Regency, assisted by a group of craftsmen (Runpah and Narwastu) and people who have used plants as natural dyes and color generators (mordant). To find out the use of mordant plants, interviews were conducted. Interviews were intended to obtain data as information on plant species that have the potential for mordant. The data collected includes the name of the species, the part of the plant used.

3. Results and Discussion
3.1. The type of plant produced
Based on the results of observations and interviews about mordant plants with informants in Merbaun Village, the observation results can be seen in the following table:

| No. | Types of Species | Family       |
|-----|------------------|--------------|
|     | General          | Local        | Scientific          |                          |
| 1   | Kepuh            | Nitas / nisfui | Sterculia foetida L. | Malvaceae               |
| 2   | Hibiscus         | Hibiscus     | Hibiscus rosa-sinensis L. | Malvaceae               |
| 3   | Kesambi          | Kusambi / kulabe | Schleicheria oleosa L. | Sapindaceae             |
| 4   | Candlenut        | Kemiri / fenu | Aleurites moluccana (L.) Wild | Euphorbiaceae          |
| 5   | Kapok Randu alas | Kapok hutan / nekfui | Bombax ceiba L. | Malvaceae and also Bombacaceae |
| 6   | White Pomegranate | Delima       | Punica granatum L. | Punicaceae              |
| 7   | Loba             | Noba         | Symplocos sp.       | Symplocaceae            |
| 8   | -                | Ularuna      | BT (Unidentified) | BT                      |
3. Based on table 1 above, there are 8 species found in Merbaun, namely from the family Malvaceae, Sapindaceae, Euphorbiaceae, Punicaceae, and Symplocaceae. In previous research in the East Sumba area, to be precise in Kaliuda Village, there were 3 types of plants used as mordants including Loba, Candlenut, and Dadap (Seran and Hana, 2018).

There is one type of flora that is found to enhance color, which has not been identified/has not been found the scientific name. This type of plant has characteristics: green leaves, serrated leaf edges, sharp leaf tips, stems reaching 2-5 meters, gray-white stems, growing freely in the forest. This plant is known to the public by the name Utaruna.

3.2. Plant organs

The plant organs used as mordant/biomordant obtained from interviews with craftsmen and communities in Merbaun Village are presented in Table 2.

| No. | Plant name     | Scientific name                  | Organs used  |
|-----|----------------|----------------------------------|--------------|
| 1   | Kepuh          | Sterculia foetida L.             | Rind         |
| 2   | Hibiscus       | Hibiscus rosa-sinensis L.        | Leaf         |
| 3   | Kesambi        | Schleicheria oleosa L.          | Bark         |
| 4   | Candlenut      | Aleurites moluccana (L) Willd   | Flesh of fruit |
| 5   | Kapok Randu alas | Bombax ceiba L.        | Bark         |
| 6   | White Pomegranate | Punica granatum L.     | Fruit and leaves |
| 7   | Loba           | Symplocos sp.                  | Bark         |
| 8   | Utaruna        | BT                              | Leaf         |

Based on the table above, it can be seen that the organs used as mordants in kepuh plants are in the form of fruit skin/fruit shells. This kepuh fruit shell has a thick skin and a tapered tip. The level of maturity depends on the individual and the factors where it grows. Inside the kepuh fruit shell, there are shiny black seeds, which contain lots of oil so that they can be used to soften threads. There are also other benefits of kepuh seeds, namely as an industrial ingredient in the manufacture of shampoo, soap, paint, and plastics (Herdiana, 2005). The plant organ that is used from the porch is the bark. Kesambi can be used as a tanning agent, because according to the results of the study, in the skin of kesambi, 6.1-14.3% of tanning substances were found. Even in the past, the Balinese and Madurese used kesambi skin as a very effective skin medicine, especially against scurvy and other skin diseases (Bachli, 2007). However, Merbaun Village uses kesambi skin as a soaking thread. The plant organ used from candlenut is the fruit flesh. Candlenut pulp is generally used for cooking spices, medicines, raw materials for paint, soap, and cosmetics (Seran and Hana, 2018). In the handicraft of weaving in Merbaun Village, candlenut pulp is used as a mixture in coloring as a reinforcement and color preservative. In the village of Merbaun, craftsmen and the community use kapok skin as a soaking thread, to strengthen the color of the thread. The plant organs that are used from pomegranate are the fruit and leaves. Pomegranate leaf contains tannins because tannins are substances that are widely distributed in plants (Oci in Setiawati, 2014). The plant organs that are used from grease are dry bark. The inner grease of peppers (stems) contains a large amount of aluminum (up to 50% of the ash) which is a type of mordant substance that functions as a binding agent in dyeing yarn (Lemmens and Wulijarni-Soetjipto in Murniati and Takandjanji, 2015).

3.3. Method of processing the mordant plant

The methods of processing mordant plants are burning, pounding, soaking, and cooking. The flora found as a color enhancer by craftsmen and the Merbaun community, the initial processing method before entering the coloring stage as a whole is almost 100% done by pounding. Meanwhile, the dyeing process is carried out by soaking the threads and cooking / boiling the threads together with mordant and dye plants. Kuntorini (2005) states that traditional processing is one of the processes that is carried out by
still maintaining its authenticity which has been passed down from generation to generation by the elders.

3.4. Color resulting from the mordanting process

Table 3. Colors resulting from the mordanting process.

| Types of color | Types of Dye Plants | Mordant | Mordanting stage | The resulting color |
|----------------|---------------------|---------|------------------|---------------------|
| Yellow         | Turmeric            | Pomegranate and pomegranate leaves | √ | Turmeric + mordant pomegranate and pomegranate leaves |
| Red            | Noni root           | Loba, candlenut skin, Hibiscus flower, Utaruna, kesambi, randu alas, kepuh ash | √ | Soaking yarn with mordant (pre-mordanting) |
|                |                     |         | √               | Yarn coloring (noni + loba) (meta-mordanting) |

The formation of the yellow color is required by types of plants, namely turmeric and pomegranate (leaves and fruit). The thread coloring stage is as follows: the crushed turmeric is weighed as much as 20 g, then the pomegranate is pounded as much as 12 g, and the ground pomegranate leaves weigh 12 g. After that, add 150 grams of water, then the crushed pomegranate leaves weigh 12 g. After that, add 150 g of water, then add the threads and cook together for 5 minutes, this process is called the meta-mordanting process, then remove the threads and then dry in the sun for 2 days. The resulting color is bright yellow. This is because turmeric contains chemical material curcumin, essential oils, resins, desmethoxycurcumin, oleoresin, and bidesmetoxicurcumin, resin, gum, fat, protein, calcium, phosphorus, and iron. However, turmeric contains active ingredients which are very useful in giving yellow color is curcumin (Shan and Iskandar, 2018), while pomegranate plants contain flavonoids. One of the flavonoid components from plants that can function as antioxidants is a natural dye called anthocyanin. The red color in pomegranates is caused by the high anthocyanin content in pomegranates. When turmeric and pomegranate are boiled together, the resulting color is bright yellow.

The formation of red color requires the types of mordant plants in the initial process of mordanting, namely kepuh ash, kesambi skin, randu alas skin, utaruna leaves, hibiscus leaves, candlenut pulp, and loba skin. The stages of coloring are as follows: dried kepuh fruit skin/shell is burned until the ash is left, then kepuh ash is weighed as much as 30 g, then the skin is cut into small pieces, then crushed using kepuh, then weighed as much as 12 g, skin kesambi cut into small pieces, then pounded using kepuh,
then weighed as much as 12 g, then ground hibiscus leaves until smooth then weigh as much as 12 g, then the *utaruna* leaves that have been provided are pounded until smooth, then weighed 18 g. Next, separate the hazelnut fruit from the shell, then mash the hazelnut pulp to release the oil, then weigh 30 g, and don’t forget to provide a thread that has weighed 7 g. After all the ingredients are ready, mix all the ingredients, then put the threads and add 400 ml of kepuh ash water. Soak the provided thread, then knead the thread so that the mordant plant mixture seeps into the thread. Leave the threads for 1 week, after 1 week removes the threads and dry them in the sun for 5 days. The color resulting from the soaking process is brownish. Then insert the thread and add 400 ml of kepuh ash water. Soak the provided thread, then knead the thread so that the mordant plant mixture seeps into the thread. Leave the threads for 1 week, after 1 week removes the threads and dry them in the sun for 5 days. The color resulting from the soaking process is brownish. Then insert the thread and add 400 ml of kepuh ash water. Soak the provided thread, then knead the thread so that the mordant plant mixture seeps into the thread. Leave the threads for 1 week, after 1 week removes the threads and dry them in the sun for 5 days. The color resulting from the soaking process is brownish.

These types of plants are used as soaking yarn, the soaking of yarn using all types of plants is intended so that before the yarn is colored the fibers are limp and open the pores so that they are easy to dye and weave (Rumeksa and Saftyaningsih, 2012). Subagiyo (2008) states that the mixed ingredients in coloring can increase the affinity of the dye molecules in the yarn fibers and chemically help diffuse molecules or red dyes to yarn fiber cells with the help of mordants.

The process of red coloring requires a type of noni root plant and greasy shell which acts as a mordant. The stages of staining the thread become red as follows: cut the noni root into small pieces, then mash until it is crushed, then weigh 300 g, then the dry grease skin is pounded until smooth, then weigh 20 g. After that, mix the noni root and loba bark into one, add 1000 ml of water, then insert the soaked thread into the mixture. Cook for 20 minutes, then remove the threads and dry in the sun for 1 week. The color that results from mixing dye and mordant plants is bright red.

Noni (*Morinda citrifolia*) contains morindin compounds (Lemmens and Wulijarni in Farida et al., 2015). Morindin is a disaccharide derivative of anthracenedione (anthraquinone) and has the molecular formula $\text{C}_{27}\text{H}_{30}\text{O}_{14}$ (molecular weight = 578). This compound produces a yellow color. While morindon, which is the result of hydrolysis of morindin glycosides and has a molecular formula of $\text{C}_{15}\text{H}_{10}\text{O}_{8}$ (molecular weight = 270), produces a red color (Hamid and Muhlis, 2005). Whereas for the grease skin containing large amounts of aluminum, this is the origin of *Symplacoc*’ work as a mordant (Nooteboom in Hanum, et al. 2012). The use of the *S. fasciculata* mordant is in conjunction with the coloring process, by pounding the dry skin then mixing it with a mixture of natural dyes.

Some things that need to be considered in its use as a natural color generator are when using noni (*Morinda citrifolia L*) for natural dyes without mordant from *S. fasciculata*, the red color will not appear. If the noni root is mixed with grease skin it will form the desired red color.

The mordant substance added to the dye plant functions to form a chemical bridge between natural dyes and fibers so that the affinity of the dye increases to the fiber. This shows that the mordant compound can bind colors so they don't fade easily (Fitrihana in Hanum, et al. 2012).

| Table 4 | Color Resulting from the Mordanting Process without Using Biomordants. |
| No. | Dye Plants | Processing Method | Resulting Color |
|-----|------------|-------------------|-----------------|
| 1   | Turmeric   | Pounded           | Pale yellow color |
| 2   | Noni       | Pounded           | Pale red color  |

Based on table 4 above, it can be explained that the color produced from the dyeing process without mordant mixture as shown in the table produces 2 types of colors, namely pale yellow and pale red.

a. **Pale Yellow Color**
   The type of plant used to give a yellow color is turmeric. The stages of dyeing the threads are as follows: the turmeric that has been mashed is weighed as much as 12 g, then add 150 ml of water, then add the thread and boil it simultaneously with turmeric for 5 minutes, then remove the thread and dry in the sun for 1 day. The color produced after the yarn is dry is pale yellow and the texture of the thread is slightly coarse.

b. **Pale Red Color**
   The coloring of the threads becomes red, using only the noni root, the resulting color is not good. The stages of dyeing the thread are as follows: cut the noni root bark into small pieces. Mash the noni roots using a mortar. Then weigh the noni root as much as 0.3 kg. Then add 1000 ml of water, then enter the provided thread and cook it together, for 20 minutes. Then remove the threads and dry the threads in the sun for 1 week, see the resulting color. The color resulting from the coloring process using the noni root is pale red.

4. Conclusion

*Biomordant* is a type of plant that has the potential as a reinforcement or color binder to the yarn. There are 8 types of biomordant found in Merbaun Village. Biomordant types include kepuh (*Sterculia foetida* L), hibiscus (*Hibiscus rosa-sinensis* L), kesambi (*Schleichera oleosa* L), candlenut (*Aleurites moluccana* L.) Willd, kapok randu alas (*Bombax ceiba* L), pomegranate (*Punica granatum* L), loba (*Symplocos sp.*), and one plant species has not been identified, namely utaruna. The organs of mordant plants that are used are fruit skin/shells (kepuh), leaves (pomegranate, hibiscus, and utaruna), bark (kesambi, kapok randu alas, loba), and fruit (pomegranate). Biomordant type processing is burning, pounding, soaking, and cooking. The colors produced from the mordanting process are yellow and red.

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