Traditional Knowledge of Banyumas Community about *Mesua ferrea* as the Identity Plant

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Abstract. The population of *Mesua ferrea* L. in Banyumas Regency, Central of Java Province is very low. There are some factors affecting the quantity of plant population, particularly traditional knowledge of local community about the plant. The aim of this study was to describe the knowledge of Banyumas community about the existence, economic value, usefulness, and propagation technique of *M. ferrea*. The study was done by field survey on a total of 146 residents from 10 districts which were determined by proportionally stratified random sampling. Data obtained from questionnaires and interviews were analyzed by percentage descriptive. The results revealed that only 9% of respondents were familiar with the *M. ferrea* and knew its status as plant identity of Banyumas Regency. Most of the respondents did not understand the economic value, only 8% of respondents understood the usefulness, 2% of respondents had utilized the timber as craft material, and 3% understood the propagation technique. The utilization was very low, equal to 14.45% compared to the potential usefulness. Most of the respondents (98%) thought that conservation efforts should be undertaken. This study found that the traditional knowledge of *M. ferrea* in Banyumas was low. This result should be used as a basic information for developing conservation program of *M. ferrea*.

Keywords: *M. ferrea*, Banyumas, traditional knowledge, plant conservation

INTRODUCTION

Banyumas Regency is located in the southwest part of Central Java Province, Indonesia (Figure 1A). This regency establishes *Mesua ferrea* L. or *nagasari* as its identity plant. The plant's timber is tough and durable, therefore it is also called the ironwood tree. For the last 3 years, the population of *M. ferrea* in Banyumas Regency is very low. The population size of a species in regions of Central Java Province is affected by some factors, mainly the cultivation intensity and by the level of traditional knowledge of the community as well as the simplicity of propagation and cultivation (Rahayu & Martin, 2017).

There are many utilities of *M. ferrea* which have been known and utilized in various countries. Regarding ecology, the ironwood tree is a vital shade provider, attractive lawn tree, N_2 binder because of its symbiosis with *Rhizobium*, and water storage because of its endomycorrhizal association (Orwa et al., 2009). Almost all of its organs have benefits for human life. The timber is a moderately durable, heavy and sturdy; as a result, it is favorable use for heavy construction, heavy duty flooring and furniture, agricultural implements, vehicles and boat building. *M. ferrea* is a tree recommended to be planted along the road because it is a medium tree with an attraction of the leaves and flowers (Departemen Pekerjaaan Umum Republik Indonesia, 2012). Powder from dry flower and mixed with the root extract can be used in prickly heat and for coldness of body (Uddin et al., 2013). The seed is used as an ingredient of feed for cattle because it contains high protein and energy (Sayeed et al., 2014). Essential oil from whole flowers is most suitable for body creams and hair oil (Jadhav et al., 2016). Recent scientific studies have highlighted *M. ferrea* as a rich source of secondary metabolites which have multiple health benefits including antioxidant, anti-inflammatory, antimicrobial, and anticancer (Chahar et al., 2013; Naik & Indira, 2015; Asif et al., 2017).

Because of its status as the identity plant with many benefits and low population, *M. ferrea* must be preserved and increased in population, especially in Banyumas Regency. To increase the population of *M. ferrea* in Banyumas Regency, it is necessary to study the level of traditional knowledge. The knowledge is needed to optimize sustainable interest of community to cultivate a plant species (Cruz et al., 2013).

The aim of this study was to explore the traditional knowledge of local people in Banyumas Regency about the existence, economic value, utilization, kind of organs utilized, and propagation technique of *M.*

ferrea. The traditional knowledge of local community would be useful as a basis to develop an effective strategy of conservation management of *M. ferrea* by regency government and related agencies in Banyumas Regency.

METHODS

The study area was Banyumas Regency that covers an area of 132,759 ha with the average altitude of around 108 m above sea level. The study was carried out for 6 months since April 2018. The majority (more than 80%) of study area was land of 0-500 m above sea level, while the rest was land of 3,000 m above sea level or more (Figure 1B). Banyumas has two seasons, namely rainy and dry season with various average of rainfall ranging from 0 to 493.40 mm/month, and the range of daily temperatures are from 21°C to 31°C. The area encompasses 27 sub-districts (Central Bureau of Statistics of Banyumas Regency, 2018).

The field survey was conducted in sub-districts selected by stratified random sampling based on the altitude of the area. As a result, there were samples located in the lowlands and highlands. There were 10 chosen sub-districts, i.e. Baturraden, Purwokerto, Dawuhan Wetan, Kedungbanteng, Jatilawang, Kemranjen, Wangon, Somagede, Ajibarang, Cilongok, and Sokaraja. From each sub-district, as many as 15 respondents on average were selected through purposive snowball sampling.

The total number of respondents was 146 people. The respondents consisted of 78 men and 68 women. The age range of respondents were 38 young adults (<30 years), 45 middle-aged adults (30-55 years) and 63 older adults (> 55 years) people. The level of education varied from elementary school graduate (50%) to under/post-graduate (22%). The occupations included government employees, private employees, farmers, traders, and others (entrepreneurs, homemakers and students). The highest number of re-spondent occupation was farmers, while the lowest were government employees and others (Figure 2). All respondents have lived in Banyumas Regency for more than 5 years.

The aspects of the traditional knowledge measured were the 1) existence, 2) economic value, 3) usefulness, 4) kind of organs utilized, and 5) propagation technique of *M. ferrea*. Various techniques, such as questionnaire, interview, and observation were used to collect data. To identify the most used *M. ferrea* part, Organ Use Value (OUV) was calculated. OUV is defined as the ratio of the total number of the utilization of an organ (RU_{org}) to the total number of reported utilization (RU_{total}) for the all of the organs (Gomez-Beloz, 2002).

$$OUV = (RUV_{org} \times 100) / RU_{total}$$

Reported Use Value (RUV) is the total number of uses reported by respondents. This indicates the traditional knowledge of the respondents about the utilities of *M. ferrea*. The RUV was compared to the Theoretical Use Value (TUV) to determine the increase of efforts required (Gomez-Beloz, 2002) to optimize the usefulness of *M. ferrea*.

RESULTS AND DISCUSSION

The study found *M. ferrea* with the amount at around of 10 trees in Banyumas Regency. The trees grew at Sub-district of Purwokerto, Ajibarang, Baturraden, and Banyumas. The ironwood trees found in Banyumas Regency have up to 10 m tall (Figure 3A). Bark surface is smooth. The leaf is single (each petiole supports one leaf blade) and arranged in an opposite structure (from each node grows one leaf). The leaf edge is entire, usually elliptical to narrowly elliptical shaped, showing pink color when young and green when ripen (Figure 3B). Flowers are terminal or axillary, bisexual, and solitary. The flower has four green sepals and four white petals. The stamens are numerous at the base, and the anthers is yellow (Figure 3C).
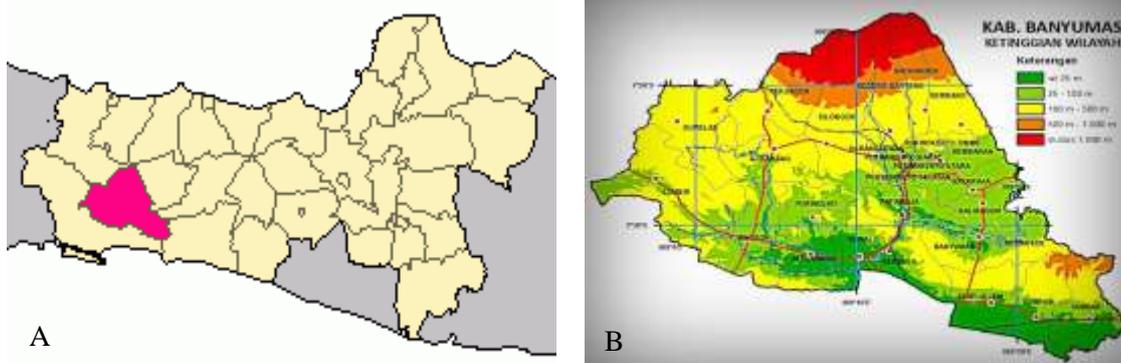

Figure 1. The area of Banyumas Regency. A. It is located at the southwest of Central Java Province. B. The area consists of lowland and highland (Central Bureau of Statistics of Banyumas Regency, 2018).
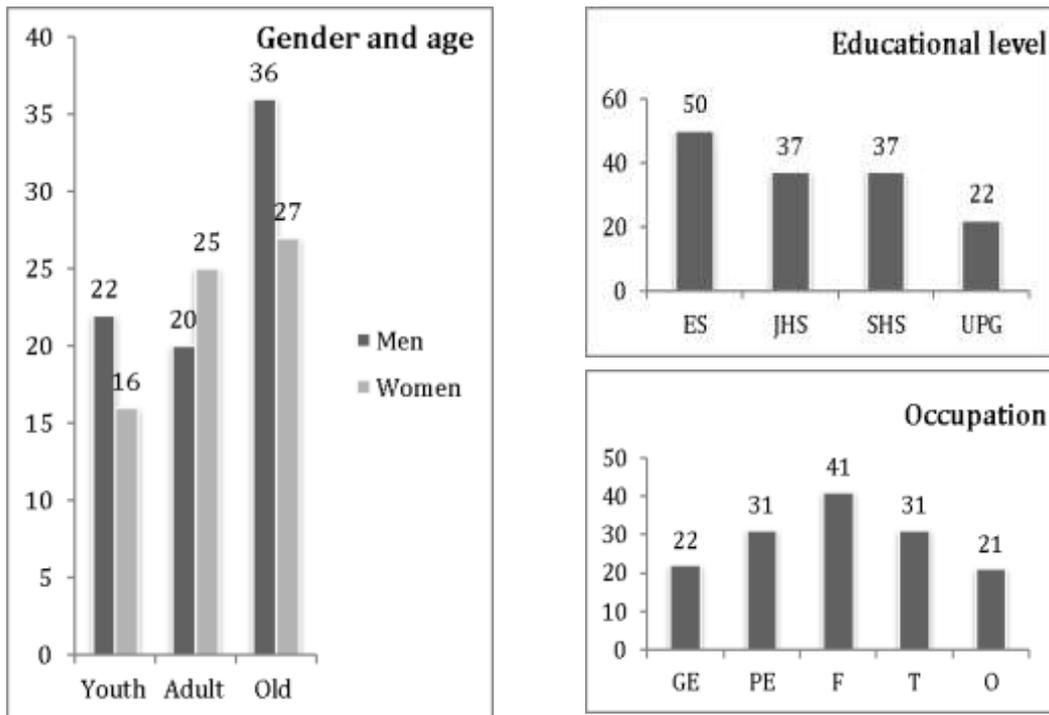
Figure 2. Respondents composition based on gender, age, educational level and occupation. ES: elementary school; JHS: junior high school; SHS: senior high school; UPG: under-graduate/post-graduate; GE: government employee; PE: private employee; F: farmer; T: trader; and O: others.
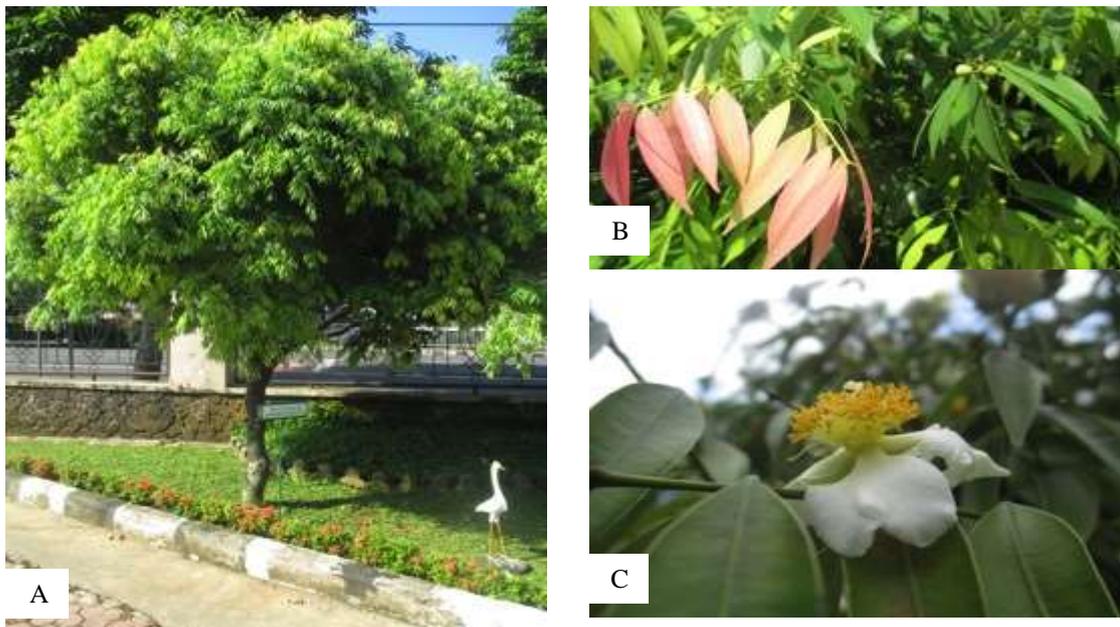
Figure 3. The morphological characteristics of *M. ferrea*. A. A tree grew at a park at Purwokerto Sub-district. B. The pink young leaves. C. The ripe flower showed white petals and many yellow stamens.

Results of interview and questionnaire showed that among 146 respondents, only 13 respondents (9%) recognized the morphological characteristics of *M. ferrea* and knew its role as Banyumas identity vegetation. There were only 12 respondents (8%) who perceived the usefulness, only 3 respondents (2%) had used it, and only 1 respondent had an *M. ferrea* tree (Figure 4). Among the 12 respondents who knew the usefulness of *M. ferrea* (Figure 4), the 7 respondents stated that the benefits were as craft materials, ornamental plants, and reforestation plants. However, only 3 respondents (2%) have used this plant, especially the stems for crafting (Table 1).
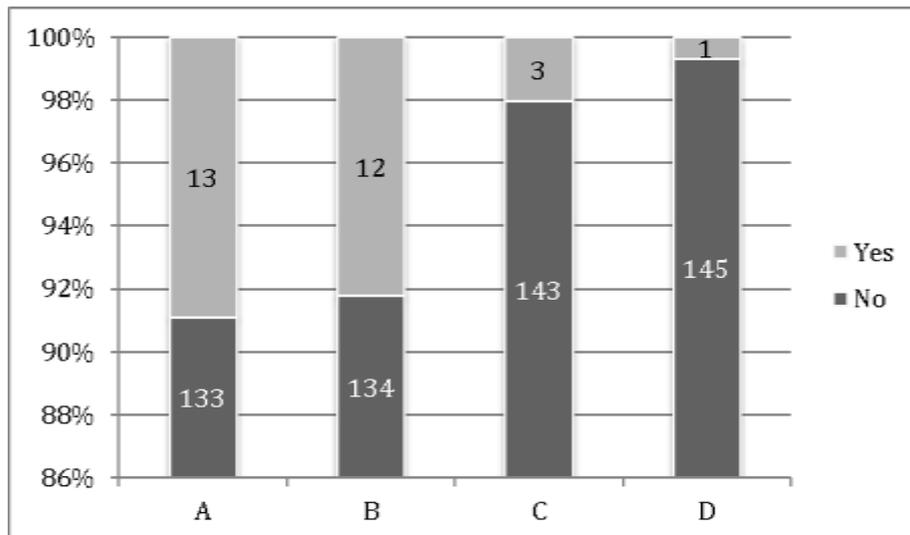
Figure 4. The community knowledge about the figure and status (A), knowledge about the benefits (B), the experience of using (C), and ownership of *M. ferrea* (D).

A matter of concern is the knowledge and utilization of ironwood plants that is lower than that of *balimo* (*Zanthoxylum nitidum*) by Kanayatn Dayak community in West Kalimantan. The study of Sepsamli et al. (2019) showed that 92% of respondents had seen and 55% had used *balimo* as medicinal plant.

The uses *M. ferrea* by Banyumas community were still very limited compared to the benefits based on residents' habits in other countries and regions or research results. Some research in many regions and countries concluded that there are 30 usefulness of *M. ferrea,* but the people of Banyumas Regency only used it for crafts materials, ornamental and reforestation plants (Table 1). The *M. ferrea* wood was made into various crafts such as rings, carving bracelets, beads, rosaries, and protector of *keris* (Figure 5). The root, flower, and seed have not been widely used by Banyumas people. As much as 85.55% of *M. ferrea* potential benefits have not yet been used (Table 1). It means that 14.45% of the potential benefits only have been used by Banyumas community. The use as medicinal and cosmetics ingredients has not been utilized at all (Table 1).

There were only one respondent own *M. ferrea* trees. The wood craftsman claimed that 90% of wood needs were met from trees that grow in cemeteries. This fact was predicted due to the ignorance of tree propagation. The survey showed that only the minority of respondents (3%) knew the technique of *M. ferrea* reproduction. Respondents who knew the tree propagation technique explained that they propagated by cutting and grafting. However, they had never tried to propagate *M. ferrea*. They commented that *M. ferrea* is a demanding species, and its seed germination and growth is very slow.

Actually, the propagation of *M. ferrea* is relatively easy. It is proven that this species frequently grow in the marginal land (Uddin et al., 2013). The seed is easy to handle in the nursery, can germinate quickly and produce healthy seedlings. The seedlings from 1-seeded fruit survive better with stronger vigor after 1 year compared to seedlings growth from 2-, 3- and 4-seeded fruits (Khan et al.*,* 1999). Furthermore, seedling survival and vigour from large fruits are greater rather than small fruits. Seed germination rates are in the range of 30-70%. However, germination rates of 75-90% in 11-24 days have been recorded (Orwa et al., 2009).

The low population of *M. ferrea* in Banyumas Regency is strongly predicted not due to the incompatibility of environmental factors in Banyumas. The optimal environment of *M. ferrea* is an altitude up to 2,300 m on a relatively rich and well-drained soil (Orwa et al., 2009). The most of Banyumas region is suitable with the optimal condition for *M. ferrea*. The region mostly consists of lowland of 0-500 m above sea level, and a small part of a highland (Central Bureau of Statistics of Banyumas Regency, 2018). The low *M. ferrea* population is strongly believed due to the lack of public knowledge about its benefits. The same fact happens on *Feronia limonea* (wood-apple) plant in Rembang Regency. The population of wood apple is also very low because the community does not pay enough attention to the cultivation of this plant. This is because they do not understand the great benefits of woody plant (Rahayu et al., 2017).

Table 1. The reported uses value (RUV), organ uses value (OUV), theoretical uses value (TUV) and an increase of effort required (ER) of *M. ferrea* organs

Organ	Reported uses	RUV_{org}	OUV*	Theoretical uses **	TUV	ER (%)***
Root and leaf	-	0	0.00	Herb after childbirth	1	100
Timber	Craft material	1	33.33	Craft material, Fuel Heavy construction Agricultural implements Vehicles and boat building	5	80
Flower	-	0	0.00	Body creams, Hair oil Dyeing for fixed colors, Herbs after childbirth, Anti-inflammatory and stomachic properties	5	100
Kernel/ Seed	-	0	0.00	Feed Ingredient, Cardiotonic, Treat rheumatism, Wound healer, Anti-dandruff, Immunity booster agent, Cough expectorant Treating various skin problems Treating small tumor, bleeding piles, Dysentery, headache,	12	100
Bark	-	0	0.00	Treating cough, dysentery Treating sore throat and vomiting Applied on venomous wounds	4	100
Whole plant	Ornamental plant Shade provider	2	66.67	Ornamental plant Shade provider N2-fixer	3	33.33
	Total Mean	3	100.00		30	85.55

* OUV = (RUV_{org} x 100) / RU_{total}; **   Orwa et al., 2009; Tiwari & Nandy (2012); Uddin et al., (2013); Chahar et al., (2013); Sayeed et al., 2014; Jadhav et al., 2016; Asif et al. 2017; ***   ER = (TUV - RUV) / TUV x 100%

Figure 5. Some kinds of crafts made from *M. ferrea* wood in Banyumas Regency. A. Protector of *keris*. B. *Tasbih*. C. Dragon-patterned bracelets. D. Cigarette pipes (http://www.selarasindo.com/?p=4644; http://rizacraft.com/product)

A small percentage of respondents stated that the *M. ferrea* is not needed to be conserved because of its less benefit, little usefulness, and low growth. It might be because the tree grows very slowly and is not popular for plantations. Seedlings should be planted in the field after one year when they are about 30 cm tall or after 2 years when they are about 75 cm tall. Moreover, there are some obstacles of *M. ferrea* cultiva-

tion, such as: 1) the wood liable to termite attack, 2) the attack of fungus *Ganoderma lucidum* causing root and butt rot, and 3) the feeding by larvae of the insects *Phenacaspis dilatata* and *Toxoptera aurantii* on the sap of leaves (Orwa et al., 2009).

Otherwise, the majority of respondents (98%) were aware of conservation of this species. This awareness is very meaningful to involve the community in conservation activities. According to Kewessa et al. (2015) design of sustainable plant conservation management needs to consider participation of the community by utilizing traditional knowledge. The preservation, protection and promotion of the traditional knowledge, innovations and practices of local and indigenous communities are important keys, particularly for developing countries. This knowledge is valuable to their daily lives as well as modern industry and agriculture (Sharrock et al., 2018). Therefore, we must involve the community in the enhancement of *M. ferrea* population. This involvement will be easier when the community understand the benefits of the plant.

Consequently, it is necessary to educate the community about the plants potential benefits (Luizza et al., 2013; Honfo et al., 2015). The education needs to be done to the wider community, especially to the younger generation. It is due to the traditional knowledge about *M. ferrea* of the young community were lower than that of the older. This tendency is also seen on *pelawan padang* (*Tristaniopsis merguensis*) at Bangka Island and various medicinal plants at Karangwangi District of Cianjur, West Java that the traditional utilities of plants are still mostly done by old generation residents, but the enthusiasm is decreasing in the younger generation (Malini et al., 2017; Hartanto et al., 2018).

The result of this study is a part of ethnobotany research that is still rarely performed. The ethnobotany research generally aims to explore the potential of a number of plants in certain areas that have identical benefits, such as medicinal plants, alternative food plants, and traditional ceremonies plants. This study describes one species of plant that has been designated as an identity plant but lacks the attention of the local community.

The benefit of this research is to enrich the results of ethnobotany research that has been conducted. Furthermore, the traditional knowledge of local community would be useful as a basis to develop an effective strategy of conservation management of *M. ferrea* by regency government and related agencies in Banyumas Regency. Based on the findings above, some programs that need to be done in the conservation management of *M. ferrea* are as follows.

a. Socializing about the status of *M. ferrea* as an identity flora of Banyumas Regency that needs to be preserved
b. Educating the community about varius potential uses of *M. ferrea* which are very diverse such as medicinal materials, cosmetic ingredients, construction materials, handicraft materials, and ecosystem quality preservation; and its economic value when the various benefits are applied.
c. Educating about an efficient and effective propagation and cultivation system to obtain large numbers of *M. ferrea* seedlings.
d. Establishing cooperation with various institutions to conduct research in the context of implementation and optimization of utilization and cultivation of *M. ferrea.*
e. Implementing large scale planting of *M. ferrea* in the yard and along the side road as a hallmark of local exotic plants.

CONCLUSION

The traditional knowledge of *M. ferrea* were low. Only 9% of respondents knew the existence of *M. ferrea* as plant identity of Banyumas Regency. Most of the respondents did not understand the economic value, 8% of respondents understood the usages, 2% respondents had utilized the timber as craft material, and 3% understood the propagation technique. The plant utilization was only equal to 14.45% compared to the potential usability based on research results.

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