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Exploration in utilization of *Lablab purpureus* (L.) Sweet in Central Lombok Regency as a support in food security based on local germplasm management and conservation

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Abstract: *Komak* (generally assumed and known as *Lablab purpureus* (L.) Sweet) is one of the important food commodities in Fabaceae family, especially for people on Lombok Island, West Nusa Tenggara. *Komak* bean is also one of the common plants which is widely grown on Lombok Island in general. The objects of this research are to explore the various uses on some morphological variants of *komak* plant in Central Lombok Regency as one of *komak* production area on Lombok Island, including its potency of development strategies. This descriptive exploratory research was conducted in Central Lombok Regency as one of the important areas for *komak* population, supported by interviews, participatory observation and documentation. Snowball sampling method was applied in informant selection. Data were analyzed based on the calculation of Reported Use (RU) and Index of Cultural Significance (ICS). As the results, there are about 10 (ten) utilizations of komak plant reported by the community: as food, yard plants, land boundaries, economic plants, natural fertilizers, ecological functions (soil cover/erosion prevention), animal feed, seasonal indicators, ritual, and socio-cultural functions. Dissemination of information about processing technology and utilization of komak plant are still needed in order to support the optimalization of the management and utilization of this commodity as one of potential legumes that has a strategic role in realizing national food security.

Keywords: *komak*, utilization, food security, germplasm

Introduction

Komak (generally known as *Lablab purpureus* (L.) Sweet) or lablab bean is one of the important food commodities in Fabaceae family, originating from Africa with distribution covering tropical and subtropical regions (Kimani, et al., 2012). *Komak* bean is thought to have come from Asia, which spreads in Africa, and other tropical and subtropical areas. This plant is widely cultivated in Brazil and Arab peninsula. Over the last few decades, *komak* has become an important agricultural crop, especially for animal husbandry in Australia and America (Maass et al., 2005). *Komak* bean is also one of the common food commodities and is widely grown on Lombok Island and West Nusa Tenggara Province in general (Setyorini, 2008; Jayanti & Harisanti, 2013).

Komak bean has a good nutritional composition, so it can contribute as a source of protein, fat, carbohydrates, phosphorus, sodium, potassium, and several vitamins (Mahmud et al., 2008). In Indonesia, *komak* bean is used as the main ingredients in tofu, tempeh, soy sauce, composite flour, chips, and protein concentrates or isolates (Subagyo & Morita, 2008; Anonymous, 2009). On Lombok Island, *komak* plant is mainly used for its fruist and seeds in various vegetables-based dishes and other foodstuffs. Based on research by Jayanti et al (2016), there are several genetic variants of *komak* bean with various morphological characteristics and growing locations on Lombok Island. These variants are commonly used as food ingredients by local people, and have different flavor characteristics. Information related to the potential use of *komak* plant on Lombok Island has not been fully documented. Each community may have its own traditions and preferences in utilizing *komak* plant in their daily lives.

In addition, *komak* bean is one of the minor species of legumes that has not received much attention in scientific research or studies, and there is still a need for more research related to its possibility as a potential food source (Jayanti, 2017). Based on nutraceutical side, *komak* can be categorized as a potential protein source that has not been widely explored (NAS, 1979). *Komak* should be a priority in developing the potential of tropics legumes in agriculture (Pengelly & Maass, 2001).

Related to the facts mentioned above, a study is needed that explores more important information about *komak* plant, not only from the botanical aspect but also more on information related to the potential utilization and distribution of its growth, especially on Lombok Island as a komak-producing area. *Komak* with various morphological variants which could be the infraspecific variants are expected to provide an alternative food development based on local germplasm diversity in West Nusa Tenggara Province.

This study aims to explore the various uses on some morphological variants of *komak* plant (*Lablab purpureus*) in Central Lombok Regency as one of *komak* production area on Lombok Island, including its potency of development strategies. It is expected that the results of this study will be beneficial for following up the data on utilization and distribution of *komak* plants on Lombok Island. It is also hoped that there will be a development strategy that can be used to support food security efforts based on local germplasm management and preservation.

Materials and Methods

The study area was directed to Central Lombok Regency, at some regions or villages that have some *komak* planting areas (Ubung, Puyung, Ranggagata, Sengkol, Kawo, Aik Bukak, Montong Terep, Bon Jeruk, Teruwai and Setiling). Data collection is based on field observations and interviews, with informant selection carried out with snowball sampling method (Endraswara, 2006). Interviews used semi-structured techniques and in-depth interviews (Cotton 1996; Martin 2007).

Informants in this research were local civil servants as initial information providers, farmers and communities who cultivate *komak* plant, vegetable traders, players of home industries based on *komak* plants, agricultural land owners, and people who are competent in providing information related to the required research data. Detailed observations of plant morphological characteristics were held in the Laboratory of Advanced Biology, FMIPA, University of Mataram.

Data analysis

Qualitative data were information related to the utilization of *komak* plant (*Lablab purpureus*) along with the infraspecific variants found, kinds of plant organs that are used, way of utilize and process the plant, aspects of botanical, socio-cultural aspects, conservation and other related aspects in ethnobotany. Plant samples were also taken to accommodate the manufacture of herbarium and voucher specimens to support the identification and confirmation process to the informants. Quantitative data were all information related to the Index of Cultural Significance formula (Turner 1988 in Hoffman & Gallaher 2007): number of uses, quality, intensity, and exclusivity of the plant use in the society.

Plant utilization data was then followed up with a potential analysis based on the factors of strengths, weaknesses, opportunities, and threats (SWOT analysis) with a qualitative approach which can then be used as a basis for formulating a strategy for developing *komak* plant. The results could be used in summarizing recommendations and designs of efforts that can be made regarding the strategy of developing *komak* plant, in an effort to support increased food security, as well as the management and preservation of local germplasm on Lombok Island, West Nusa Tenggara.

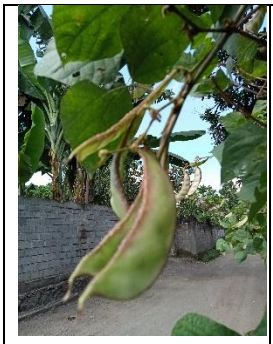
Result and Discussion

Morphological variation in *Lablab purpureus*

People in Central Lombok Regency (and Lombok Island in general) have the perception and concept that certain legume plants are referred to as *komak*, which generally have morphological characters as *Lablab purpureus* (L.) Sweet. Based on field observations, the types of nuts that are referred to as *komak* by the community are not all morphological variants of *Lablab purpureus* (L.) Sweet, but also included in *Phaseolus* and *Mucuna*. The followings are 13 variants (types) of *komak* plants based on main morphological character found in Central Lombok Regency (Table 1 & Fig. 1):

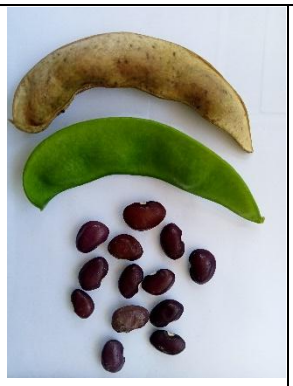
Table 1. Morphological variations in *komak* plants found in Central Lombok Regency

No.	Local name	Morphological character	Species
1.	Komak (type A)	Pods with purple edges	*Lablab purpureus* (L.) Sweet
2.	Komak (type B)	Light green or white pods, tailed	*Lablab purpureus* (L.) Sweet
3.	Komak Pujut	Pods not puffy, smell raw, not propagate	*Lablab purpureus* (L.) Sweet
4.	Komak IR (1)	Tiny white pods, speckled seeds, purple flower	*Lablab purpureus* (L.) Sweet
5.	Komak are	Bigger pods with purple edges, white flower	*Lablab purpureus* (L.) Sweet
6.	Komak IR (2)	Pods with purple edges, purple stem, purple flower	*Lablab purpureus* (L.) Sweet
7.	Komak ijo	Green pods, soft texture	*Lablab purpureus* (L.) Sweet
8.	Komak siu	Tiny pods, dry seeds seem like soya beans	*Lablab purpureus* (L.) Sweet
9.	Komak putih	Light color or white pods	*Lablab purpureus* (L.) Sweet
10.	Komak kaci (1)	Green pods, puffy seeds	*Phaseolus lunatus* L.
11.	Komak kaci (2)	Green pods, purple seeds	*Phaseolus lunatus* L.
12.	Komak kaci (3)	Big purple pods	*Phaseolus lunatus* L.
13.	Komak benguk	Big purple pods, cause itching	*Mucuna pruirens* (L.) DC.



Komak A
Lablab purpureus (L.) Sweet

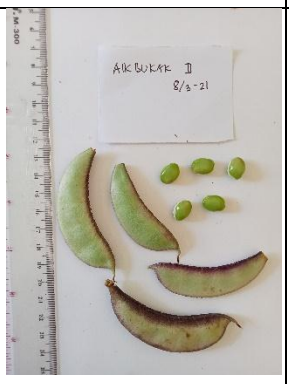
Komak B
Lablab purpureus (L.) Sweet



Komak Pujut
Lablab purpureus (L.) Sweet

Komak IR (1)
Lablab purpureus (L.) Sweet

Komak are
Lablab purpureus (L.) Sweet



Komak IR (2)
Lablab purpureus (L.) Sweet

Komak ijo
Lablab purpureus (L.) Sweet

Komak siu
Lablab purpureus (L.) Sweet

			
Komak putih *Lablab purpureus* (L.) Sweet	Komak kaci 1 *Phaseolus lunatus* L.	Komak kaci 2 *Phaseolus lunatus* L.	Komak kaci 3 *P. lunatus* L
			
Komak benguk *Mucuna pruirens* (L.) DC.			

Figure 1. Thirteen types of komak beans found in Central Lombok Regency

The morphological variations in *komak* plants are quite diverse, and mainly found in fruit organs (pods), seeds, flowers and stems. This indicates that the morphological diversity of seeds can not necessarily be used as a reference for identifying or grouping *komak* plants in a particular taxon, because the characteristics shown are not stable or consistent.

These various morphological variations are thought to relate with the adaptability and high sensitivity of *komak* plants to their environment, as well as genetic factors. Research conducted by Jayanti (2011) concluded that *komak* plants on Lombok Island have variability in morphological characters for stem, leaf, flower, fruit, and seed organs. Radford (1986) states that morphological features are a combination of genetic and environmental factors. According to Jayanti et al (2016), a high level of polymorphism in *komak* plant is a strong indicator that this plant has high variability, which is useful for future development.

Utilization aspects

There are about 10 (ten) various uses or Reported Uses (RU) reported by the community regarding the use of *komak* plants: as food, yard plants, land boundaries, economic plants, natural fertilizers, ecological functions (soil cover/erosion prevention), animal feed, seasonal indicators, ritual, and socio-cultural functions. The main use of *komak* is generally aimed at its function as food.

The community has several kinds of food processing based on *komak*, which are generally processed as daily dishes by using the fruits and seeds. Another preparation is the use of *komak* seeds as additional food (snacks), either by frying or chili seasoning. Other plant organs are not consumed by people regarding the taste and aroma, for example leaf organs. People tend not to be interested in trying to process and consume *komak* leaves because the texture and unpleasant aroma. In addition, it is also possible that people have higher expectations for the production of *komak* fruit, so that leaves and other organs tend not to be used in order to support fruit growth properly.

According to Sumarjan & Listiana (2018), basically *komak* beans have the potential to be used as a substitute for soybeans, which can be processed creatively. Some of the processed

products of *komak* that have been socialized to the community and youth organizations are *tempeh* (fermented *komak* seeds) and *komak* nugget. It is hoped that the diversification in komak-based food will support the community to have alternative businesses to increase their income, while also optimizing the utilization of *komak* plants which is quite abundant in several areas on Lombok Island. Trustinah and Karso (2002) stated that *komak* beans are one of the potential food ingredients to complement the nutritional needs of the community, as well as having a low-fat content so that it can support the provision of low-fat and cholesterol-lowering menus.

In its use as cattle fodder, in general it is not an alternative choice that is deliberately taken by farmers. They use *komak* plants (especially leaves and stems) as cattle fodder only they could not find the main feed, such as grass, and usually use the non-productive plants or when the population is very abundant in an area. Another use is as organic fertilizer, and as plant with ecological function such as ground cover, where this will affect soil moisture, and also bind soil grains (erosion prevention). Another ecological function is related to the nature of Fabaceae plants that can associate with nitrogen-fixing bacteria, thus supporting the availability of soil nitrogen (Samosir et al., 2019).

Komak is traditionally used also as an indicator for the beginning of dry season, which in local terms is called *telih kembang komak.* This season is marked by the flowering of *komak* plants, cold temperatures, and dry air. As ritual function, people in some area in Lombok use it as a means to speed up the delivery of their cattle or buffalo, by hitting their livestock with the stems and leaves of the *komak* plant. The community believes that by carrying out this ritual, their livestock will be faster in giving birth, so that the cattle do not have to experience pain for too long before giving birth. It is suspected that this is related to the psychological aspects experienced by livestock so that it affects the intensity and quality of uterine muscle contractions.

Based on ICS scoring, five types with the highest ICS value, respectively, are komak kaci/kedit (82), komak type A, type B, type IR2 (73), and komak ijo (63). Basically, the high value of ICS is determined by the variety of uses it has, and the high value of quality, intensity and exclusivity of a species (Turner, 1988 in Hoffman & Gallaher, 2007). From the results of these calculations, it can be assumed that in general, *komak kaci/kedit* has a wider variety of uses, and is often used and chosen by the community. Based on detailed calculations, actually the five types have the same value for each variety of use, except that *komak kaci/kedit* has one kind of use that other variants do not have, namely as food coloring (source of green color in making *poteng* or sticky rice snack). This difference in the variety of uses is assumed to be due to the different knowledge of the community at each research location.

Community preferences in *komak* utilisation

People have specific preference in utilizing *komak* plants, especially as food ingredients. People's preferences are more determined by the texture character of the organs, especially the fruit. *Komak* fruit (pods and seeds) are generally processed as soup (eg, tamarind soup, stir-fried vegetables, light soup). *Komak* plants have several variants where the morphological differences are mainly seen in the fruit. In addition to morphological characters, certain variants have different characters in fruit texture, especially after being processed or cooked. *Komak* fruit favored by the community is the fruit that has soft texture after being processed or cooked, such as in *komak kaci/kedit*, *komak* type A, type B, type IR2, and *komak ijo*. Some types have a dominant scent (smells such as raw fruit), but this will disappear after processing so it does not interfere with the taste when consumed.

Related to its use as food ingredient, *komak* kaci/kedit leaves are also used as a natural dye (green color) in the manufacture of traditional food called *poteng reket* (fermented glutinous rice). *Poteng reket* is a traditional snack on Lombok Island, which is mainly served during the Eid al-Fitr and Maulid Nabi Muhammad SAW day (Sukenti et al, 2016). The organ used is mature leaves, which are ground until soft and then the liquid is taken to be added as a dye to the sticky rice. This traditional extraction technique is actually also found in the use of *pandan* leaves (*Pandanus amaryllifolius*) and *suji* leaves (*Pleomele angustifolia*) related to their function to produce green color using in various traditional snacks in Indonesia.

These community preferences also determine the size of the population of a certain variant in a planting area, or the availability of *komak* bean at the selling place (eg. traditional markets, mobile vegetable traders, or food stalls).

However, this does not prevent the planting of other *komak* types, because basically the taste of the plant is very well accepted by the people on Lombok Island, as long as it does not have an extreme character, such as bitter taste, hard skin texture, or has a dizzy effect after being consumed (such in *komak benguk*). This type can still be found in community planting areas, but with minimal use as food, because they can still be used as land dividers, animal feed, or other minor utilization.

Local knowledge related to the use of *komak* plants, processing methods

Basically, the community acquires knowledge related to the use of *komak* plants through information received from their predecessors, as well as from the community in their environment. This knowledge is the result of community observations over a long period of time, so that in the end the community has its own concept of utilization of *komak* plants. The flow of new information related to the use of *komak* plants (for example related to diversification and innovation of processed *komak* into various kinds of foodstuffs) is also received by the public through various sources, including mass media, social media, socialization from agencies and institutions, and so on. However, the sustainability of the use depends on the decisions and tastes of the community, whether they will accept and use it or just get to know the new knowledge as additional insight. These things are closely related to the local genius of the community. Local genius is the identity or cultural personality of a nation (group) which causes this group to be able to absorb and process cultural influences from outside its territory according to its character and personal needs. Local genius then plays a role in determining whether the community will maintain the original cultural elements or accept new elements and adapt them to their own culture (Rahman, 2011).

Socio-cultural and tradition

Based on socio-cultural and traditional aspects, basically *komak* plant is very commonly used in the culture and traditions of the community. Besides being used in several traditional dishes (*kelak bageq, pereseng, tolang komaq, poteng reket*, etc.) served at traditional events, komak is also used as a traditional cloth motif (Efendi et al, 2014). The komak flower motif is one of the motifs of woven fabric (sarong) on Lombok Island, among others, it can be found in Sade Village and Sukarara Village, Central Lombok. This motif is used by Sasak men in Nyelabar traditional event, which is a notification to the family of a girl that she has been rushed to be invited to marry by someone. *Komak* flower cloth is also used as a complement (*ajen-ajen* and *sorong serah*) in a series of traditional weddings. *Komak* flower fabric consists of two colors: black (as the base) and white (for the plaid shape). Religiously, this motif means that humans are initiated by or come from darkness, who is born into the world to encounter a bright (white) light. Another thing that is implied is that humans do not forget their dark origin as soil, and will return to soil. According to Herusatoto (1987), symbolism is an element that is often present in Indonesian culture and is a reflection of people's beliefs and expectations regarding things in their lives.

Traditional rituals and traditions basically contribute to maintaining the diversity of food crops (Mundita, 2013). Regarding the *komak* plant, the cloth motif used in local tradition is a potential to maintain the existence of the *komak* plant in the community's food tradition, especially on Lombok Island. Likewise, there are several types of food, both daily food and special food for certain rituals. The weaving tradition has been a hereditary tradition for women on Lombok Island, where Lombok *songket* (traditional woven cloth) also has its own market related to its quality and aesthetic value (Efendi et al., 2014). The existence of these traditions will also have a positive impact on the sustainability and availability of the *komak* population with all its germplasm diversity. The thing to watch out for is that these rituals or traditions also have the potential to be displaced by the influence of modernization that has hit the young generation today, if it is not balanced with efforts to preserve the culture, as well as preserve the resources of the *komak* plant and its germplasm.

Komak germplasm diversity and its potential for food security

Based on this study, it was concluded that the *komak* plant has many morphological variations in organs, especially flowers, fruits, seeds and stems. Fruits and seeds appear to have a very wide variety, where this variation can also be found on an individual plant. Previously, it was mentioned that morphological diversity, as well as genetic diversity (germplasm) can basically be used as capital for plant breeders to be able to develop *komak* into plant that have the

desired superior characteristics. These characteristics include large fruit, soft texture, good taste, large seeds, odorless fruit, and others.

Regarding to food security, the presence of *komak* germplasm allows the community to choose types (variants) of *komak* that are tailored to their needs. The existence of food diversification, of course, can support food security efforts for the community. In addition to adequate availability, other things obtained are the fulfillment of the quantity and quality of food, safe for consumption, diverse, nutritious, equitable and affordable and does not conflict with religion, belief and culture, so that people can live healthy, active and productive in a sustainable manner.

SWOT analysis

The following is qualitative SWOT analysis based on strengths, weaknesses, opportunities and threats factors of *komak* plant in Lombok Island:

Strengths

Komak is a spesies of legume that can grow with minimal care, and has a high adaptability to its environment. Suitable habitat for this plant is dry land, with various soil types. Currently, the population of *komak* on Lombok Island does not have a significant problem in terms of quantity, even this plant can almost certainly be found in all districts on Lombok Island, and provides adequate production for the needs of the community. *Komak* is very familiar in people' daily use, especially in terms of food, both daily food and food used in certain events. From the nutritional aspect, *komak* as a potential legume is also a good source of nutrition, related to its protein, fat, and carbohydrate content. Basically, *komak* as part of local beans has enough advantages that can compete with other species of beans found on Lombok Island.

Weaknesses

What is still needed in the utilization of *komak* is socialization and education related to food diversification. So far, *komak* beans as a food ingredient are only used in the manufacture of vegetables or dishes that are less varied (e.g *sayur bening, tumis, tolang komak, sayur asem,* and *kacang komak goreng*). The public needs to be given insight into the alternative of processed *komak*, where basically this preparation is also quite good as a source of nutrition, for example, *komak* tempeh, *komak* nuggets, pastries made from *komak* seeds, and others. With this knowledge, it is hoped that the community can process *komak* beans (or other plant parts) into more creative and innovative dishes, to take advantage of the very adequate availability of *komak* on Lombok Island.

Regarding the processing of these *komak*-based foods, another weakness is that certain variants of *komak* (e.g *komak* Pujut) have an unpleasant aroma and taste when have not been processed, even after have become certain dishes (e.g *komak* tempeh). A special technique is needed to minimize this aroma so that the taste of *komak* does not hinder the efforts in food diversification. Another thing to note is that in certain variants of *komak* fruit, the skin texture is not soft enough even after had been cooked (e.g boiled or used in soup dishes), so that sometimes the fruit is not used but only the seeds are taken for processing. Information is still needed regarding the processing technology and utilization of *komak* fruit.

Opportunity

Related to the availability of *komak* plant population on Lombok Island which is quite promising, the existence of knowledge related to technology and processing of *komak*-based food is a form of effort to increase community food security. *Komak* plants with various morphological variants which are also related to the diversity of taste and texture are basically a wealth of germplasm that needs to be managed for further development. With better management of the *komak* plant, it is hoped that it will become a support for the preservation of germplasm, especially for local resources on Lombok Island, NTB.

Potential opportunities include the introduction of *komak* tempeh manufacturing technology, where basically the process of making tempeh is not a new thing for Indonesian people in general. In addition, various variations of the basic ingredients of tempeh are already known by the public, it's just that not all variations of the ingredients have been socialized. Economically, making tempeh is also a potential business opportunity for the community. Apart from having sufficient availability of raw materials, it can also be obtained at a cheaper price than soybeans. With adequate processing technology, it is hoped that *komak* tempeh can be a business opportunity that also has the potential to become a mainstay

product in several *komak*-producing areas on Lombok Island.

Another opportunity is the use of *komak* seeds as raw material for making nuggets, where the target consumers of this product are mainly children. Komak nugget product is also expected to be one of the efforts to diversify food that has good nutritional value. *Komak* nuggets as additional food for children can also be used to deal with the difficulties of housewives to motivate their children to consume vegetables, because nuggets can be given other additional ingredients such as carrots, spinach, mustard greens and others.

With the more intensive use of *komak* as a food raw material, it is hoped that new business opportunities will emerge that can be cultivated by the community, for example, *komak* seed peeling services. This will create new job opportunities and additional income for the community in the *komak*-producing areas, or areas around the *komak*-based home industry.

Threats

Regarding the availability and potential use of *komak*, if development efforts are not carried out in a better direction, the abundant availability of *komak* on Lombok Island cannot be utilized optimally, and only functions as a minor food, even as a cover crop or land barrier. Management of plant resources that are not carried out seriously will result in inadequate attention to these resources, so that in the end the sustainability of plants becomes a threat for the future. On the other hand, with optimal management and utilization, plant resources will be given more attention, more efforts and research development will be carried out, so that the sustainability of these plants will be more guaranteed.

Conclusion

There are 10 (ten) various uses of *komak* plants in the community on Lombok Island, where the main use is as food. Based on variations in morphological characteristics, there are about 13 types of *komak* in Central Lombok Regency. Various morphological variations in *komak* plants are thought to be related to their adaptability and high sensitivity to the environment, as well as genetic factors. Related to follow-up efforts, things that need to be prioritized in developing the management and utilization of *komak* plants are the dissemination of information about processing technology and utilization of *komak* fruit or plants for the community on Lombok Island. These efforts will help the optimalization of the management and utilization of *komak*, because *komak* is one type of potential legumes that has a strategic role in realizing national food security.

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