

## DIVERSITY AND UTILIZATION OF *Dioscorea* spp. TUBER AS ALTERNATIVE FOOD SOURCE IN NGANJUK REGENCY, EAST JAVA

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### ABSTRACT

*Dioscorea* spp. is local tuberous food crop that has potential as alternative food source to support food security program in Indonesia. Exploration study and collecting mission subjected to *Dioscorea* spp. have been conducted in Nganjuk Regency. The study was aimed to 1) determine the distribution of *Dioscorea* spp. in Nganjuk, 2) to characterize tuber's morphological characteristic, and 3) to know how tuber's utilization by local peoples. The results showed that there were 4 species of *Dioscorea* found in Nganjuk. They are *Dioscorea alata* L, *Dioscorea esculenta* (Lour.) Burkill, *Dioscorea hispida* Dennst and *Dioscorea bulbifera* L. *Dioscorea alata* (uji) is the most cultivated by farmers in Nganjuk. It has the largest cultivar numbers which consists of 11 cultivars. *Dioscorea esculenta* (gembili) consists of 3 cultivars and *Dioscorea hispida* (gadung) consists of 4 cultivars, whereas *Dioscorea bulbifera* (uji gantung) consists only 1 cultivar in one location. Farmers and local peoples play important role in conservation of *Dioscorea* in Nganjuk region by cultivating and utilizing it as alternative food source for home consumption.

Keywords: *Dioscorea*, diversity, food source, Nganjuk, utilization

### INTRODUCTION

*Dioscorea* genus is tuberous plant which consists of approximately 600 species; of which there are about 50-60 species have been cultivated and utilized as food and medicinal plants (Coursey, 1976). *Dioscorea* spp. is distributed in the tropical, subtropical and temperate regions of the world especially in West Africa, parts of Central America and the Caribbean, the Pacific Islands and Southeast Asia (Maneenoon *et al.*,

2008). *Dioscorea* plants produce edible tubers, bulbils, corms or rhizomes (Islam *et al.*, 2011). Wild edible *Dioscorea* tuber contents are good source of protein, lipid, crude fibre, starch, vitamins (especially vitamin A and C) and minerals (calcium, iron, phosphorus, I.). In addition to essential dietary nutrients, *Dioscorea* tuber also contains of antinutritional substances like total free phenolics, tannins, hydrogen cyanide, total oxalate, amylase and trypsin inhibitor but it can be inactivated and eliminated by moist heat treatment and soaking followed by cooking before consumption (Shajeela *et al.*, 2011). Some level of steroid saponins and also sapogenins, such as diosgenin are also indicated in *Dioscorea* tubers, which is the starting material for synthesis of many steroidal hormones used as anti-inflammatory, androgenic estrogenic and contraceptive drugs (Dutta, 2015).

*Dioscorea* tuber has been known and utilized by Indonesian people as a source of carbohydrates as substitute or alternative food of rice or sago at dry season, especially in Maluku, Lesser Sunda, Sulawesi and Java (Sulistiyono and Marpaung, 2004). *Dioscorea* is an important food source especially in rural communities. Traditionally, yam is a minor tuber crop with a low priority commodity. *Dioscorea* is easily propagated by their tubers (Wilson, 1989) and it thrives well in marginal areas where the major crops cannot be successfully grown (Legaspi and Malab, 2013); so that it plays a crucial role for food security. The most advantageous factor from this crop is that it can be cultivated even by the side of the roads, homestead gardens, houses and in the forest, *etc.* with less consideration to cultivation practices (Islam *et al.* 2011).

Characterization data of *Dioscorea* spp. both morphology and genetics is still very limited. Distribution of genotypes and their characteristics are not well documented, which constraints the

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efficient conservation of these genetic resources thereby limiting their use in breeding programmes (Norman *et al.*, 2011). Proper characterization and evaluation of germplasms provides reliable information data (along with passport data) that give indication of the range of diversity in the collections, and is of considerable help to the breeders to narrow the selection of potential breeding stocks (Thomas and Mathur, 1991). Such basic data are needed to be used to determine the potential cultivars of *Dioscorea* tubers for further improvement programme

In East Java - Indonesia, there are at least 35 cultivars of *Dioscorea alata* inventorized by Solikin (2009) but the availability of complete characterization data is very shallow. Systematic work on identification of species should be conducted on *Dioscorea* spp. including local knowledge study regarding its utilization of crop to document its economic values. Every ethnic group also has their own cultural practices regarding to *Dioscorea* spp. cultivation. Some of different ethnic groups' case study in Bangladesh cultivate *Dioscorea* spp. under hill and forests shade and still have a good harvest (Islam *et al.*, 1997). The information about the various usages of the *Dioscorea* species as well as the sustainable use of this particular group of plants will be useful for future research on pharmaceutical plants, and the selection and propagation of some species of *Dioscorea* as crop plants (Manneno *et al.*, 2008).

Nganjuk Regency is a part of East Java Province, located between 7.21°-7.50° South Latitude and 111.45°-112.131° East Longitude. It has an area of 1182.64 km<sup>2</sup> divided into 20 districts; bordered by Bojonegoro at the north, Jombang at the east, Kediri and Ponorogo at the southern, and Madiun at the west. Its area is covered by the lower mainland and the mountains. Based on Schmidt and Ferguson, the climate division of Nganjuk is categorized as D-type climate since it is characterized by wet to medium precipitation with hot temperatures. The soil types are varied from alluvial, regosol, andosols, latosols, and grumusol. Generally, the soil conditions are quite productive for various types of plants due to the support of the presence of Widas river and Brantas river that irrigate the areas so that suitable for both food crops and plantation (Jatimprov, 2015). According to open-ended information, some tuber crops are still

cultivated and utilized by farmers in Nganjuk region for alternative food sources *viz.* *Dioscorea* spp., *Xanthosoma* spp., and *Colocasia* spp..

Exploration study subjected to *Dioscorea* spp. has been conducted in Nganjuk Regency and the tubers were then collected to be *ex-situ* conserved in Purwodadi Botanic Garden. The study was aimed to 1) determine the distribution of *Dioscorea* spp. in Nganjuk, 2) to characterize its tuber morphological characteristic, and 3) to know how its utilization by local peoples. Diversity study including distribution, agricultural practices also utilization of *Dioscorea* in Nganjuk may provides database for conservation and further breeding program.

## MATERIALS AND METHODS

### Exploration Method

*Dioscorea* exploration study was conducted in Nganjuk Regency, East Java Province in July 2011 with areas covered by some random sampling districts through direct survey and observation. Information regarding *Dioscorea* production were obtained from local people and traders in the local markets (Figure 1). The diversity of *Dioscorea* found on the sites were noted, inventorized, and documented. Soil depth of tuber at harvest time were recorded and categorized to A (0-5 cm), B (5-25 cm) and C (> 45 cm). Site and habitat informations were recorded including its latitude-longitude, habitat type, soil pH, temperature and air humidity. Information related ethnobotany of *Dioscorea* including utilization and cultivation practices were taken by using open-ended interviews to local farmers.

### Tuber Characterization Method

Materials observed in this study were *Dioscorea* spp. tubers found exploratively in Nganjuk Regency. Characterization of the *Dioscorea* spp. tubers were conducted in Purwodadi Botanic Garden using 'Descriptors for Yam (*Dioscorea* spp.)' as published by IPGRI/IITA (1997) and documentation of accessions were taken by digital camera. Tuber characteristics observed includes weight (kg), shape, skin surface and flesh color. Organoleptic tests were conducted to steamed tubers with variables observed including flesh texture, flesh tenderness and taste.

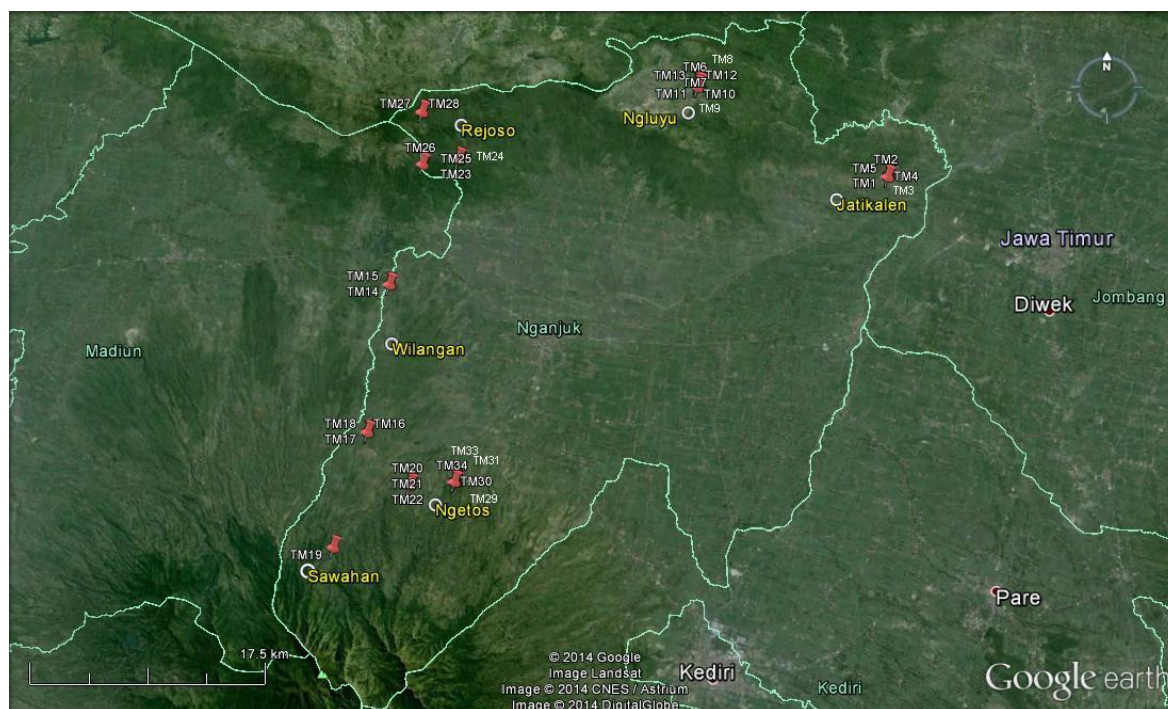


Figure 1. Site exploration map and distribution of *Dioscorea* spp. in Nganjuk Regency (Google Earth 2003)

Note: TM1-28 = accession code, see Table 1

## RESULTS AND DISCUSSIONS

The results showed that it was 4 species of *Dioscorea* found and cultivated by farmers in Nganjuk regions including. *Dioscorea alata* L., *Dioscorea esculenta* (Lour) Burkill., *Dioscorea hispida* Dennst., and *Dioscorea bulbifera* L. (Table 1). *Dioscorea alata* (local name: uwi) has the most cultivar numbers, consists of 11 cultivars e.g. uwi kelopo, uwi bangkulit, uwi ireng, uwi alas, uwi klelet, uwi randu, uwi senggrani, uwi bangkong, uwi putih, uwi ndoro and uwi dursono. *Dioscorea hispida* (local name: gadung) was found with 4 cultivars e.g. gadung, gadung lempuyang, gadung canting and gadung brengkel. *Dioscorea esculenta* (local name: gembili) was found with 3 cultivars e.g. gembili besar, gembili kecil, dan gembili teropong. Whilst *Dioscorea bulbifera* (local name: uwi gantung) was found with only 1 cultivar.

### Distribution of *Dioscorea* spp in Nganjuk

*Dioscorea* spp. was found in Nganjuk at altitude ranges from 60-700 m above sea level (asl), with average temperature of 30-35°C, relative humidity 59-78%, and soil pH 5.6 to 6.9 (normal). Farmers in Nganjuk mostly cultivated

and utilized *Dioscorea* tubers for home consumption and some of *Dioscorea* tubers are for traded in local markets (Table 1).

*Dioscorea alata* cultivars were widely cultivated and distributed by farmers than other *Dioscorea* species. It was found in 22 locations consist of 13 cultivars (Table 1). Economic value of *Dioscorea alata* is moderate so that farmers still prefer to cultivate and consume them.

*Dioscorea esculenta* (gembili) has narrow distribution in Nganjuk, and it also has few cultivars. Gembili kecil is the most widespread than other gembili cultivars. Although gembili kecil has small tuber size but it has good quality in texture and flavor. Distribution of gembili teropong and gembili besar were only found in 1 district i.e. Rejos District (Table 1).

Populations of *Dioscorea hispida* were still abundant in Nganjuk. *Dioscorea hispida* was found with 4 cultivars in 5 districts (Table 1). Gadung has better economic value and it is relatively easier to cultivate than other *Dioscorea* species. Whereas *Dioscorea bulbifera* has narrow distribution, only found in 1 location (Table 1). The cultivation of uwi gantung is rare, due to its low economic value.

In some districts in Nganjuk, it has not been found the presence of *Dioscorea* spp., such as in Kertosono, Nganjuk and Baron. According to local informants, *Dioscorea* plants became rarely cultivated due to the changes of land use into

sugar cane plantation. Sugar cane is preferable by local farmers due to its high economic value. The consumers of *Dioscorea* tubers are mostly from older peoples (above 50 years old) so that the demand is rather low.

Table 1. Inventory of *Dioscorea* spp. found in Nganjuk and its utilization

No	Scientific name	Local name (Cultivar)	Location (Village, District)	Utilization by local farmers		
1	<b><i>Dioscorea alata</i></b>	Uwi kelopo	- Songsong, Jati kalen (TM1) - SidomoroHarjo, Wilangan (TM17) - Ngetos, Ngetos (TM30) - Pathuk, Ngetos (TM33)	Home consumption and for traded		
		Uwi bangkulit	- Songsong, Jati kalen (TM4) - Nggurit, Lengkonglor, Ngluyu (TM10) - Tritic, Rejoso (TM23, TM28) - Ngetos, Ngetos (TM26)	Home consumption and for traded.		
		Uwi ireng	- Lengkong lor, Ngluyu (TM8) - Keduk, Kebun Agung, Sawahan (TM20)	Home consumption and remedies (anemia)		
		Uwi alas	Lengkong lor, Ngluyu (TM9)	Home consumption		
		Uwi klelet	Nggurit, Lengkong lor, Ngluyu (TM11)	Home onsumption		
		Uwi randu	Nggurit, Lengkong lor, Ngluyu (TM12)	Home consumption		
		Uwi lajer	Jegong Wilangan (TM15)	Home consumption		
		Uwi senggrani	- SidomoroHarjo, Wilangan (TM18) - Ngetos, Ngetos (TM31)	Home consumption and remedies (anemia)		
		Uwi bangkong	Ngliman, Nggimbal, Sawahan (TM19)	Home consumption		
		Uwi putih	- Keduk, Kebun Agung, Sawahan (TM21) - Sumberbendo, Ngeotos (TM34)	Home consumption and for traded		
		Uwi ndoro	Ngetos, Ngetos (TM29)	Home consumption		
		Uwi dursono	Ngetos, Ngetos (TM32)	Home consumption		
		2.	<b><i>Dioscorea hispida</i></b>	Gadung lempuyang	Songsong, Jati kalen (TM5)	Home consumption and for traded as chips
				Gadung	- Lengkong lor, Ngluyu (TM7) - SidomoroHarjo, Wilangan (TM16) - Keduk, Kebun Agung, Sawahan (TM22)	Home consumption and for traded as chips
Gadung canting	Bendoasri, Rejoso (TM25)			Home consumption and for traded as chips		
Gadung brengkel	Bendoasri, Rejoso (TM27)			Home consumption and for traded as chips		
3.	<b><i>Dioscorea esculenta</i></b>	Gembili besar	Songsong, Jati kalen (TM3)	Home consumption and for traded		
		Gembili kecil	- Songsong, Jati kalen (TM2) - Nggurit, Ngluyu (TM6) - Lengkong lor, Ngluyu TM13) - Jegong, Wilangan (TM14)	Home consumption and for traded		
		Gembili teropong	Tritic, Rejoso (TM24)	Home consumption		
4	<b><i>Dioscorea bulbifera</i></b>	Uwi gantung	Tritic, Rejoso (TM 28)	Home consumption		

Trimanto and Lia Hapsari: *Diversity and Utilization of Dioscorea spp. Tuber* .....

Table 2. Morphological characteristics and organoleptic test results of *Dioscorea* spp. tubers from Nganjuk

No	Local name (cultivars)	Depth at harvest (cm)	Tuber characteristic					Taste (steamed)
			Shape	Weight (kg)	Flesh color	Flesh texture	Flesh tenderness	
<b>A <i>Dioscorea alata</i> L. (Uwi)</b>								
1.	Uwi Kelopo	< 25	rounded	2-3	white	soft	very tender	sweet-savory
2.	Uwi Bangkulit	< 25	rounded-cylindrical	2-3	white	soft	tender	savory
3.	Uwi Ireng	25-46	irregular rounded	1	purple	rough	tender	savory
4.	Uwi Alas	> 46	cylindrical	1.5	pale yellow	soft	less tender	savory
5.	Uwi Klelet	25-46	cylindrical	2	white	rough	tender	less savory
6.	Uwi Randu	25-46	cylindrical	2	white	rough	very tender	savory
7.	Uwi Lajer	< 25	cylindrical	1.5	white	rough	tender	savory
8.	Uwi Senggrani	< 25	rounded-cylindrical	1.5-2	purple	rough	very tender	sweet-savory
9.	Uwi Bangkok	< 25	rounded-cylindrical, wavy	5	white	rough	tender	sweet-savory
10.	Uwi Putih	< 25	cylindrical	3-4	white	soft	very tender	very savory
11.	Uwi Nodoro	< 25	Oval	0.5	orange	rough	tender	savory
12.	Uwi Dursono	< 25	irregular cylindrical	3	white to cream	rough	very tender	less savory
<b>B <i>Dioscorea hispida</i> Densst. (Gadung)</b>								
13.	Gadung lempuyang	< 25	small cylindrical	0.1	pale yellow	soft	very tender	*
14.	Gadung canting	< 25	oval	1.0	white	soft	very tender	*
15.	Gadung biasa (common)	< 25	rounded	1.0	pale yellow	soft	very tender	*
16.	Gadung Brengkel	< 25	irregular oval	0.5	pale yellow	soft	very tender	*
<b>C <i>Dioscorea esculenta</i> (Lour.) Burkill (Gembili)</b>								
17.	Gembili besar (big)	< 25	oval-cylindrical	0.7	white	soft	very tender	very savory
18.	Gembili kecil (small)	< 25	oval-cylindrical	0.2	white	soft	very tender	very savory
19.	Gembili Teropong	< 25	oval-cylindrical	0.2	white	soft	very tender	savory
<b>D <i>Dioscorea bulbifera</i> L</b>								
20.	Uwi Gantung	-	small rounded	0.3	yellow	soft	tender	savory

Remarks: \* = Tubers were not tasted in *Dioscorea hispida*; - = Tuber of *Dioscorea bulbifera* was not available but in the form of bulbils (aerial tubers)

### Morphological Characterization and Organoleptic Results of *Dioscorea* spp. Tuber

Characterization of *Dioscorea* tuber plays as an important identifier to differentiate both inter and intra-species. Characterization can be approached through morphological, physiological characters, isozyme markers and molecular markers. Characterization activities will generate sources of

genes and traits that can potentially support further plant breeding programs (Kurniawan *et al.*, 2004). Morphological markers using traits are usually expressed in the phenotype, such as shape, size and color of both vegetative and generative parts of the plant (Sriyono, 2006).

Characterization data availability of *Dioscorea* spp. is still very limited to find. According

to Martin *et al.* (1975), the characters to determine quality of *Dioscorea* tuber include tuber shape and yield number, texture and flesh color, and flavor of cooked tuber. By having the information of the characters of each *Dioscorea* tuber then it will be determined which cultivars of *Dioscorea* potential to be developed and promoted as alternative food sources.

Common people in Nganjuk prefer to cultivate and consume *Dioscorea* tuber which has good quality characteristics, respectively: large tuber (tuber weight), easy to harvest (shallow depth < 25 cm below the ground), tuber shape relatively regular (oval-round-cylindrical), cooked tuber tasted sweet to savory, white tuber flesh color with smooth and tender texture. According to Osunde (2008), the sugar content in *Dioscorea* spp. is influenced by variety, location and cultural treatment.

Morphological characterization results showed that tuber of *Dioscorea alata* cultivars were very varied as shown in Table 2, Figure 2 and Figure 3. *Dioscorea alata* tuber shaped rounded to cylindrical with white, cream, yellowish, orange to purple flesh color. Organoleptic results showed that texture and tenderness of steamed flesh *Dioscorea alata* were very varied between cultivars. Even same cultivar found in different places will taste different, it may due to agro-climatic and soil conditions. Each of *Dioscorea alata* cultivar has their own characteristics. Best characteristic results goes to uwi kelopo and uwi putih; they have medium tuber size and taste soft and very tender (Table 3) so that uwi kelopo and uwi putih were considered to be promoted as potential tuberous food crops. In addition to its high carbohydrates, *Dioscorea alata* also contains of high protein about 6.66% (Richana and Sunarti, 2004).

Characterization results of *Dioscorea esculenta* showed that the variations are not so visible, and they shared quite similar characters. *Dioscorea esculenta* showed different characters than other *Dioscorea* species *i.e.* one individual plant may produce many tubers, more than 15 tubers. *Dioscorea esculenta* tuber shaped generally oval-cylindrical, and the difference was only apparent on its size. All of cultivars has white flesh, soft and tender, savory taste. For its big tuber size and good quality tuber taste, so that gembili besar is potential to be promoted (Table 3). Carbohydrates content in *Dioscorea esculenta* is about 81.6% (Kristiani, 2010).

*Dioscorea hispida* characterization results showed that the morphological variation between cultivars were not so evident. Its tuber shaped generally rounded to oval with white to yellow flesh color (Table 2, Figure 2, Figure 3). *Dioscorea hispida* tuber has never been eaten unsteamed, because it contains of anti-nutrition or poison compounds in forms of alkaloids such as Dioscorine, Dihydrodioscorine and Hydrogen Cyanide (Webster *et al.*, 1984) so that it has to be processed into chips (mostly) to eliminate its poison. Due to its high economic value, gadung is widely distributed and cultivated by farmers. According to its regular oval shaped and moderate tuber size, gadung canting is *Dioscorea hispida* cultivar which is potential to be promoted (Table 3).

*Dioscorea bulbifera* tuber was not available but in the form of bulbils (aerial tubers) so that farmers did not prefer to cultivate it. *Dioscorea bulbifera* tuber shaped rounded to oval with yellow flesh color (Table 2, Figure 2, Figure 3).

**Table 3.** *Dioscorea* spp. selected based on tuber morphological characters

No	Species / Cultivar	Superior tuber morphological characteristics
1	<i>Dioscorea alata</i> L. Cultivar: uwi putih from Ngetos	Tuber shaped cylindrical, easy to harvest at shallow depth, weighted > 3 kg and branched up to 5 tubers, white flesh color, soft and tender texture, tasted very savory
2	<i>Dioscorea alata</i> L. Cultivar: uwi kelopo from Ngetos	Tuber shaped rounded, easy to harvest, weighted up to 2 kg, white flesh color, soft and tender texture, tasted sweet-savory
3	<i>Dioscorea esculenta</i> (Lour.) Burkill Cultivar: gembili besar from Jaticalen	Tuber shaped oval-cylindrical, weighted up to 0.7 kg (bigger than other <i>Dioscorea esculenta</i> cultivars), tubers number up to 10 tubers per plant, soft and tender texture, tasted very savory
4	<i>Dioscorea hispida</i> Dennst Cultivar: gadung canting from Rejoso)	Tuber shaped oval, weighted up to 1 kg (bigger than other <i>Dioscorea hispida</i> cultivars), tubers number 6-8, white flesh color, soft and tender texture

Trimanto and Lia Hapsari: *Diversity and Utilization of Dioscorea spp. Tuber* .....

Environmental factors may cause variation in plant characteristics and taste. Plants required optimum environmental conditions to grow and produce maximum yields viz. soil type and contents, water availability, altitude, climate, air temperature, humidity, light intensity, etc. (Sitompul and Guritno, 1995). Same plant species

will show varied in morphology if environmental factor is more dominant in affecting plant than of the genetic factors and vice versa (Suranto, 1991). Genetic characterizations are needed to conduct in order to confirm the results of morphological characterization in *Dioscorea* spp.



Figure 2. Outer morphological features of *Dioscorea* spp. tubers from Nganjuk

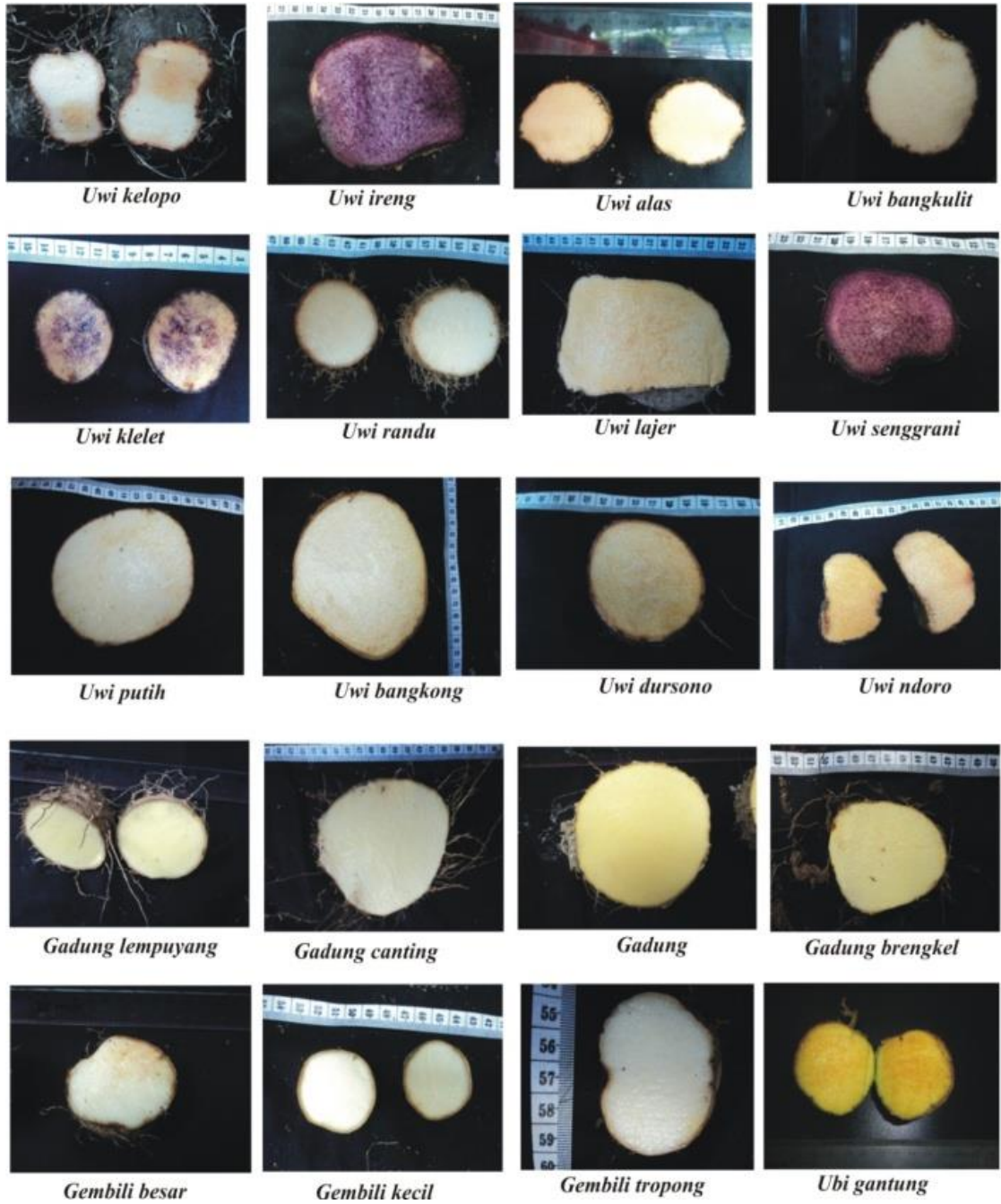


Figure 3. Cross section of *Dioscorea spp.* tubers from Nganjuk



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### Utilization and Cultivation Practices of *Dioscorea* spp. by Farmers in Nganjuk

Utilization of *Dioscorea alata* is more emphasized for personal or home consumption. People consume the tuber during dry season, which is usually used as a substitute to staple food, due to the limitations of rice and corn. The cooking process is very simple by steaming the tubers then served it with grated coconut and sugar. It remains peoples stomach full for a long time and may overcome flatulence. Uwi senggrani and uwi ireng cultivars which has purple flesh are used by local peoples for anemia remedies to produce haemoglobyn due to its purple tuber flesh color. It is presumed that its tuber contain of high anthocyanins.

Due to its low economic value that is only for home consumption (very small demand for traded), farmers did not prefer to cultivate *Dioscorea alata* anymore. To date, no production technology has been developed for this crop, according to interviews to local farmers it was stated that by proper cultivation it may yield 7-20 t ha<sup>-1</sup> depends on *Dioscorea* cultivar, environmental conditions and cultivation practices. Farmers' yields in Phillipines is relatively low at 2.6-3.3 t ha<sup>-1</sup> (Legaspi and Malab, 2013). It can be propagated by tuber and bulbil then its stem creeped to stand or tree and harvested at age of 8-12 months, and better yields if it was planted in sloping land with loose and fertile soil.

*Dioscorea hispida* is quite popular in Nganjuk and it is mostly sold in the form of processed chips. Farmers prefer to cultivate *Dioscorea hispida* cultivars due to its high economic value. According to FAO (1994) if it was properly cultivated, *Dioscorea hispida* may produce at 9-10 t ha<sup>-1</sup>. According to local informants, *Dioscorea hispida* plant is not suitable in waterlogged soil, and it prefers loose and sandy soil. Toxicity can be reduced by harvesting when the leaves have started to dry. Early harvest may caused blackening in tuber flesh.

*Dioscorea esculenta* (gembili) is rarely found in Nganjuk. Local farmers only planted gembili in their home gardens or as intercrops in their fields. *Dioscorea esculenta* tubers was processed by steaming and served with grated coconut steamed and eaten as snacks during tea/coffee time in the afternoon. Its flavor were preferable by peoples as more soft, tender and savory compared to other *Dioscorea*, and it has

been already in one consumer sized tuber. If properly cultivated, *Dioscorea esculenta* plant may produce tubers 24.6 t ha<sup>-1</sup> in Malaysia, 20-30 t ha<sup>-1</sup> in the Philippines, 70 t ha<sup>-1</sup> in Papua and 10-20 t ha<sup>-1</sup> in Papua New Guinea (Flach and Rumawas, 1996). In Nganjuk, farmers may harvest 15-20 tubers per plant.

Utilization of *Dioscorea bulbifera* is very little and not preferable since it only produces bulbils (aerial tubers), meanwhile root tuber is not well developed. The bulbils approximately weighted only 0.3 kg with less savory taste and rough flesh texture. Bulbils of *Dioscorea bulbifera* can germinate and grow easily, moreover one plant may produce 15-20 bulbils. The bulbil was usually cooked by steaming, and some people processed it by thin slicing then fried.

### Conservation of *Dioscorea* spp. in Nganjuk

Utilization of *Dioscorea* spp. give impacts on its conservation and sustainability. *Dioscorea* spp. tubers potential to be grown and developed in dryland of Nganjuk region. Mostly farmers planted *Dioscorea* spp. in agroforest system and intercropped it with tree plants or in land between rice fields without any special agronomy practices. Due to its low economic value and lack of utilization, also by land conversion into sugar cane plantations, industrial land and housing, so that *Dioscorea* spp. are vulnerable to extinction. Conservation by promoting the utilization of *Dioscorea* spp. is needed to conduct to keep the farmers prefer to cultivate them (*in-situ/on-farm* conservation). In addition to *in-situ/on-farm* conservation, *ex-situ* conservation is also needed to conduct as germplasm collection back up. The study of 34 accessions of *Dioscorea* spp. were *ex-situ* conserved in Purwodadi Botanic Garden. *Dioscorea* spp. tubers are potential to be promoted and developed as local food sources. Processing techniques are also needed to be explored and developed subjected to *Dioscorea* tubers so that there will some alternative products which will be preferred by younger generation such as cakes, noodles, etc.

### CONCLUSION

It was 4 species of *Dioscorea* spp found and cultivated by farmers in Nganjuk e.g. *Dioscorea alata* (uwi), *Dioscorea esculenta* (gembili), *Dioscorea hispida* (yam) and *Dioscorea*

*bulbifera* (uji gantung). *Dioscorea alata* has most numerous cultivars and it is widely distributed among others *Dioscorea*. Utilization of *Dioscorea* spp. mostly for home consumption and small amount for local trade. Farmers play an important role in conservation of *Dioscorea* spp by doing sustainable cultivation and utilization of *Dioscorea* spp. *Dioscorea* cultivars which are considered to be promoted and developed as potential food sources based on morphological characteristics and organoleptic test including uji putih and uji kelopo (*Dioscorea alata*), gembili besar (*Dioscorea esculenta*) dan gadung canting (*Dioscorea hispida*).

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