MAP OF EDIBLE ARACEAE BASED ON ABIOTIC FACTORS IN GOWA REGENCY, SOUTH SULAWESI

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ABSTRACT

This study aims to create a distribution map and find out the relationship between the distribution of edible Araceae and abiotic factors in Gowa Regency, South Sulawesi. Edible Araceae explorations were carried out in 18 sub-districts in November 2016 to September 2018. Edible Araceae which was found to be marked with GPS location, documented with a camera, and measured abiotic factors including altitude, air temperature, soil temperature, light intensity, soil pH, humidity soil, air humidity and soil organic matter. The types of Araceae found included 9 species from 4 genera, namely Xanthosoma sagittifolium (L.) Schott., Xanthosoma nigrum, Colocasia esculenta (L.) Schott., Colocasia esculenta, Alocasia calidora, Alocasia macrorrhiza (L.) Schott. Amorphophallus muelleri Blume, Amorphophallus paeonifolius, Amorphophallus variabilis Blume. Distribution of edible Araceae in Gowa Regency, South Sulawesi includes coastal areas (<100 m asl), lowlands (100-400 m asl) and highlands (<400 m asl). The distribution of Araceae which is affected by light intensity is Xanthosoma and Alocasia, while the distribution of Colocasia is influenced by altitude, soil organic matter, and soil moisture and Amorphophallus is influenced by soil pH. Araceae conservation strategy compiled based on species data, habitat preference, utilization and distribution of Araceae is expected to be used for the establishment of community business activities for the management of Araceae in each village that has an Araceae distribution.

Keywords: Araceae, distribution, Gowa Regency, map.

1. INTRODUCTION

Araceae or better known as taro is a plant that has unique characteristics, namely inflorescence arranged in the form of cob (spadix) which is surrounded by a spathe which is spread almost throughout Indonesia (Asih, 2015). Bulbs of the type of family Araceae are plants that are useful as a source of food because they contain carbohydrates, proteins, and glucomannan consumed by the community both consumed directly after simple cooking and after certain management to produce raw materials such as flour, chips, and others. However, not all people in Indonesia understand the benefits and uses of Araceae tubers therefore these natural resources have not been well managed.

A previous preliminary survey known there were one region that have a fairly high Araceae distribution is South Sulawesi. South Sulawesi consists of 21 districts and 3 cities, one of which is Gowa Regency. The existence of Araceae in Gowa Regency is quite large and can be found in several places, both cultivated and wild. Gowa Regency has a geographical area of 1,509.87 km2 which includes nine sub-districts, namely Parangloe, Manuju, Tinggimoncong, Tombolo Pao, Parigi, Bungaya, Bontolempangan, Tompobulu, and Biringbulu. Whereas the lowlands are 373.46 km2 consisting of nine sub-districts namely Bontonombo, South Bontonombo, Bajeng, West Bajeng, Pallangga, Barombong, Somba Opu, Bontomaranu and Pattallassang (Wilayah administrasi Kabupaten Gowa, 2013).

so far the distribution of edible Araceae in Gowa Regency, South Sulawesi has never been mapped comprehensively in the form of distribution maps. It makes difficult to access data on the distribution of edible Araceae in Gowa Regency. Comprehensive map of the distribution of edible Araceae is useful in tracing the edible trace of Araceae. Based on this description, this study was conducted on the distribution map of edible Araceae based
on abiotic factors in the Gowa Regency, South Sulawesi. It is expected to be able to provide information to the community about the distribution and location of Araceae's presence and the factors that influence its growth.

2. METHOD

2.1. Description of The Study Area

The study area of this research is one of the districts located in South Sulawesi Province, namely Gowa Regency. Gowa Regency is located between 5.573°S South Latitude, 5.083°N North Latitude, 12.037°E East Longitude and 119.377°W West Longitude (Hakim, 2015). Gowa Regency has an area of 1,883.32 km² consisting of 18 Subdistricts, 45 sub-districts and 122 villages and has an altitude of 2,910 m above sea level (Regency in South Sulawesi, as well as its height, 2014), temperature 22-28°C, rainfall 237, 75 mm (Lakip Gowa Regency Government, 2014) and has a population of 735,493 people (Yusnita, et al., 2017).

2.2. Exploration of Edible Araceae in Gowa Regency, South Sulawesi

Exploration was carried out using the roaming method along the forest and the road being traversed, as well as information obtained about the existence of edible Araceae from residents in Gowa Regency, South Sulawesi, Araceae sellers/traders and other related informants. Edible Araceae exploration was carried out by conducting surveys in all sub-districts in Gowa Regency. If there were an edible Araceae in an area, edible Araceae data was collected using GPS. During the data collection process, location marking was carried out and recorded the coordinates of the location of the individual edible Araceae (1 coordinate representing 1 plot of land measuring 10x10 m²). During the collection of coordinate data, documents on edible Araceae were carried out using a camera. In addition, in each sampling area soil collection was also used to determine abiotic factors in each sampling area including soil moisture, soil organic matter, and soil pH, and other abiotic factors were recorded which included altitude, air temperature, soil temperature, intensity light, and air humidity.

2.3. Measurement of abiotic factors

Measurement of abiotic factors was carried out in each sampling area. Abiotic factors examined or observed include altitude (m asl) using a GPS (global positioning system), air temperature (°C) and soil temperature (°C) measured using a thermometer, soil pH using soil tester, measured light intensity by using lux meters, soil moisture using an oven, and soil organic matter.

2.3.1. Soil moisture

Soil moisture describes the amount of water contained in a number of soils. Soil moisture was measured by the gravimetric method. The soil at a certain horizon was taken and weighed as much as 100 g of fresh weight, then the soil was dried in an oven at 105°C for 24 hours, then the dry weight was weighed again (gram), then soil moisture was calculated by the formula (1).

\[ \text{Soil moisture (\%) = } (a - b).b^{-1} \ldots (1) \]

2.3.2. Soil organic material

Organic compounds in soil come from the decomposition of waste or litter by soil microorganisms. This organic material has good absorption of water and minerals (in ionic form) and can be hundreds of times greater than clay. Organic material that accumulates will decompose with speed depending on soil moisture and microbial decomposition. The simplest determination of the concentration of soil organic compounds is by ignition. Dry soil that has been sieved with a 2 mm perforated sieve, mashed with a mortal, then weighed 1.0 g using analytical scales, placed in a porcelain dish and burned in a furnace at a temperature of 500 °C for ± 3 hours. After the land was whitish/gray/red and there were no black, the burning is stopped, then cooled and weighed (g). The content of organic compounds is formula (2).

\[ \text{content of organic compounds(\%) = } (1,0 - b).(1,0)^{-1} \ldots (2) \]

2.4. Making a distribution map of edible Araceae in Gowa Regency.

Making a distribution map of edible Araceae using Quantum GIS software. The edible distribution data map of Araceae comes from data that has been inputted in a text-based program. The recommended program is a program with the extension format .txt or...
.csv. This is because for vector data input processes such as location coordinates, it requires an input file in the form of text data. The point of distribution of edible Araceae which is displayed in Quantum GIS is vector data so that when it is processed it will show its distribution point. The addition of map information is also done to add clarity to the map created. Additional information includes adding portraits of remote sensing, base maps and contour lines. Remote sensing used to add information to the distribution of edible Araceae is to use Google Layers plugins. The appearance of Google Layers is like the Google Earth software. The base map is used to make maps that have color gradations such as maps in general. Contour lines are used to support information about the topography of the distribution area of edible Araceae in Gowa District, South Sulawesi (Alifianto, 2013).

3. RESULTS AND DISCUSSION

Based on the results of the exploration in Gowa Regency, South Sulawesi, there are 9 types of the 4 genera of the Araceae family which are used as food crops, namely Amorphophallus muelleri Blume (Tire), Amorphophallus paeonifolius var hortensis (Tire), Amorphophallus variabilis Blume. (Tire), C. esculenta (L.) Schott. (Pacco), C. esculenta (Pacco), X. sagittifolium (L.) Schott. (Pacco makkah), X. nigrum (Pacco), Alocasia macrorhiza (L.) Schott. (Bira), Alocasia calidora (Bira).

The results from Araceae are found in several sub-districts in Gowa Regency, South Sulawesi. Construction sites of Edible Araceae family 38 locations and spread in 16 different sub-districts, including:

1. 1 location in Pallangga District
2. 8 locations in Somba Opu District
3. 1 location in Patallassang District
4. 3 locations in South Bontonompo District
5. 1 location in Bontonompo District
6. 2 locations in Bontomaranu District
7. 3 locations in Tinggimoncong District
8. 2 locations in Manuju District
9. 4 locations in Bungaya District
10. 1 location in Parigi District
11. 2 locations in Parangloe District
12. 2 locations in Biring Bulu District
13. 3 locations in Tombolo Pao District
14. 3 locations in Tompobulu District
15. 2 locations in Bontolempangan District

3.1 Map of edible Araceae distribution in Gowa Regency, South Sulawesi

Edible Araceae species found in Gowa Regency, South Sulawesi have their own habitat preference, so the distribution of Araceae species is strongly influenced by habitat factors that support their lives and if observed further will form certain patterns that will describe the edible Araceae habitat zones. This zone is formed from the position points of the discovery of edible Araceae which geographic coordinates are marked using GPS.

The distribution of edible Araceae in Gowa Regency was found to be quite good in coastal, lowland and highland areas. Explored coastal areas start from the coast to an altitude of <100 m above sea level. The type of edible Araceae found were Alocasia macrorhiza, Alocasia calidora, X. sagittifolium, X. nigrum, Amorphophallus paonifolius, Amorphophallus variabilis Blume, C. esculenta (L.) Schott., and C. esculenta.

Edible Araceae in coastal areas were commonly found in forests, gardens and home yards. X. Sagittifolium is a type of Araceae which is most often cultivated because it produces many tubers. In an area of 1 sampling plot in the coastal area, there were sometimes several types of Araceae, there are even locations that find 2 to 3 types of Araceae in 1 plot, such as in areas A, B, F, G, H, J, and Y.

Lowlands in Gowa Regency, South Sulawesi are areas that were at an altitude of 100-400 m above sea level. Edible Araceae found in lowland areas is X. sagittifolium, X. nigrum, Amorphophallus muelleri, Amorphophallus paonifolius, Alocasia calidora, Alocasia macrorhiza, C. esculenta (L.) Schott. Edible Araceae in lowland areas, it was generally found in forests, gardens, roadside, and landfills. In an area of 1 sampling plot in the lowlands, there are sometimes several types of Araceae, there are even locations found in up to 4 types of Araceae, such as those in the W area.

he plateau in Gowa Regency, South Sulawesi is an area that has at an altitude of> 400 m above sea level. Edible Araceae found in highland areas were X. sagittifolium, Amorphophallus variabilis, C. esculenta (L.) Schott. dan C. esculenta. Edible Araceae in
highland areas are generally found in forests, gardens, roadsides, landfills, swamps, and waterways. This area was also an area that has a fairly low air temperature. In an area of 1 sampling plot in the highlands, there were sometimes several types of Araceae, there are even locations that are found in up to 2 to 3 types of Araceae, such as those in the D, R, AF, and AL regions. In the highlands not found *Amorphophallus muelleri* which it caused *Amorphophallus muelleri* could grow at temperatures between 25-35 °C, optimum at temperatures of 22-30 °C, while in the highlands the air temperature is 17-28 °C.

Figure 1. Map of the Distribution of Edible Araceae in Gowa Regency, South Sulawesi

Explaination:
A: Tattakang, Parang Banua Village, Pallangga District, Gowa Regency
B: Jl. Yasin Limpo, Romang Polong Village, Somba Opu District, Gowa Regency
C: Jl. Kr. Pado', Malino Village, Tinggimoncong District, Gowa Regency
D: Jln. Mustafa with flowers, Romang Polong Village, Somba Opu District, Gowa Regency
E: Jln. Vetran bakung, Samata Village, Somba Opu District, Gowa Regency
F: Jl. Teratai Indah Macanda, Romang Polong Village, Somba Opu District, Gowa Regency
G: Jl. Karang Makkawari. Samata Village, Somba Opu District, Gowa Regency
H: Villa Samata Housing, Samata Village, Somba Opu District, Gowa Regency
I: Patallassang Village, Marannu Hamlet, Patallassang District, Gowa Regency
J: KB Village, Pammandongang Hamlet, Salajangki Village, South Bontonompo Kelahan, Gowa Regency
K: Hamlet of Benua Jaya, Salajangki Village, South Bontonompo Village, Gowa Regency
L: Jipang Village, South Bontonompo District, Kabuoaten Gowa
M: North Bontolangkasa, Bontonompo District, Gowa Regency
N: Tanakkaraeng Village, Manuju District, Gowa Regency
O: Pattiro Village, Manuju District, Gowa Regency
P: Pengempang Village, Bungaya District, Gowa Regency
Q: Sapaya Village, Bungaya District, Gowa Regency
R: Siriya Hamlet, Parigi District, Gowa Regency
S: Pakkatto, Bontomaranu District, Gowa Regency
T: Pangajiang, Parigi Village, Tinggimoncong District, Gowa Regency
U: Bontokassi Village, Parangloe District, Gowa Regency
V: Bontoparang Subdistrict, Parangloe District, Gowa Regency
W: Baturappe Village, Biring Bulu District, Gowa Regency
X: Manggarupi Village, Paccinongan Village, Somba Opu District, Gowa Regency
Y: Baturappe Village, Biring Bulu District, Gowa Regency
Z: Pattapang Village, Tinggimoncong District, Gowa Regency
AA: Kanreapia Village, Tombolo Pao District, Gowa Regency
AB: Tonasa Village, Tombolo Pao District, Gowa Regency
AC: Tonasa Village, Tombolo Pao District, Gowa Regency
AD: Sapaya Village, Bungaya District, Gowa Regency
AE: Alla Hamlet, Rappolemba Village, Tompobulu District, Gowa Regency
AF: Lambaya Hamlet, Rappolemba Village, Tompobulu District, Gowa Regency
AG: Bili-bili Village, Bontomaranu District, Gowa Regency
AH: Bontotangnga Village, Bontolempangan District, Gowa Regency
AI: Bontomanai Village, Bungaya District, Gowa Regency
AJ: Palladingan Village, Bontolempangan District, Gowa Regency
AK: Rappoala Village, Tappaikodong Village, Tompobulu District

The topographic condition of the area of Gowa Regency is flat, bumpy to hilly. The research location is at an altitude of 10-1547 m above sea level, the area is a flat, bumpy and hilly area. The difference in altitude at the three locations causes differences in climatic conditions such as temperature and humidity. As the location higher, the air temperature decreases, but the air humidity increases.

Siswanto In this study it was found that Amorphophallus muelleri in Gowa Regency was able to grow to an altitude of 1125 m above sea level, whereas according to Siswanto (2016), this type of plant grows from low land to 1000 m asl. Amorphophallus muelleri plants which are found not only grow in the forest but also grow in gardens and curbs. But it grows wild because it has not been cultivated by the community.

3.2. Light intensity

Light intensity has an important role in plant growth as the main energy source for photosynthesis. Every plant has optimal light intensity for its growth. The intensity of light that is not in the shade will be greater than that in the shade. The intensity of light received by a particular area will result in changes in air temperature and soil temperature and air humidity and soil moisture in an area. The highest light intensity is located in the coastal area of 15-276 Lux meters. Amorphophallus muelleri grows a lot in the forest because it can grow well on dry soil with a light intensity between 50-60% (Jansen et al, 1996). Based on the graph it appears that the light intensity between locations has no difference in the coastal (P), lowland (DR), or in the highlands (DT).

3.2.3. Soil temperature and air temperature

Temperature affects plant growth related to respiration and plant metabolic activity (Rondon et al, 2006). Based on the graph it appears that there is no difference in soil temperature between locations both at P, DR and DT as well as with air temperature. all three locations are in the temperature range of 0-17 °C. Temperatures that are too high will inhibit plant growth and can even lead to death for plants, and vice versa the temperature is too low. The optimum temperature is needed by plants so that they can be best utilized by...
plants. Amorphophallus muelleri grows at an optimum temperature of 22-30 °C. At temperatures above 35 °C the plant leaves will burn, while at low temperatures cause plants to be dormant (Perut Perhutani, 2009).

3.2.4. Air humidity and soil moisture

Humidity is related to water content in a habitat and can affect the evaporation of water from plants (Brooks & Keyker-Snowman, 2008). Too low air humidity or too high will inhibit plant growth and flowering (Kramer and Kozlowski, 1979). Air humidity can affect growth because buffer can affect the photosistesis process. Photosynthesis rates increase with increasing humidity around the plants (Widoastuti, et al., 2004). Based on the graph it appears that there is a difference in air humidity between regions P and DR, in area P air humidity is 60%, while in DR and DT humidity reaches 100%, both are not significantly different. The highest air humidity is located at DT, which is 60-100% but not significantly different from the air humidity in the DR, which is 70-80%. However, it is significantly different from the air humidity on P. Whereas soil moisture, based on the graph, it appears that there is no difference in soil moisture between locations both at P, DR and DT. The highest soil moisture is located in the highlands of 14.95.

3.2.5. Soil pH

Soil pH is very influential in plant growth. The soil pH that is suitable for growth is 5.0-6.5, whereas if the pH is too low (<4.5) or too high pH (> 7.0) it can inhibit or stop growth and development. Based on the graph it appears that there is no difference in soil pH between locations both at P, DR and DT. The highest soil pH is found in DT locations, reaching 7.08.

3.2.6. Soil organic matter

Soil organic matter (BOT) has an important role to support the life of Hannah’s vegetation. BOT provides the main nutrients for plants around it (Fontaine et al., 2003). BOT has a large influence in determining soil structure and the ability of soil to absorb water (Fleming et al., 2006). In this study the habitat that has the highest BOT is Pengempang Village, which is a plateau area which is 21.70%. The amount of BOT in Pengempang village is higher than that of other habitats due to very varied microbial activity. Based on the graph it appears that there is no difference in BOT between locations both at P, DR and DT. The highest BOT is found in the highlands of 5.70-21.70.
Relationship between abiotic factors and the distribution of edible Araceae

Analysis of the main components (PCA / Principal Component Analysis) of Past software was used to determine the similarity of each habitat. Habitats that have high similarity values will be formed in the same cluster. The aspects used in making clusters are abiotic data including topography, light intensity, soil temperature, air temperature, air humidity, soil moisture, soil pH and soil organic matter. In addition, the genus Araceae data from each habitat used as a comparison between habitats so that it is known to be characteristic of each Araceae habitat.

Some Genus Araceae like Amorphophallus tend to like high soil pH but with low light intensity, Xanthosoma and Alocasia tend to like high light intensity with low soil pH (pHT) and humidity (KU), Colocasia tends to like areas that high, high soil organic matter (BOT), high soil moisture (KT) but relatively lower air temperature (SU) and soil temperature (ST). This result is supported by Goldsworthy & Fisher (1996), who stated that Colocasia likes dry land and on irrigated land such as rice fields where the water flows continuously otherwise Xanthosoma is not suitable for wet environments or grows well on dry soil.

Figure 2. Profile of abiotic factors for edible Araceae habitat in Gowa Regency, South Sulawesi

4. CONCLUSIONS

In the coastal area were found, Alocasia macrorrhiza, Alocasia calidora, X. sagittifolium, X. Nigrum, Amorphophallus paeonifolius, Amorphophallus variabilis, C. esculenta (L.) Schott, and C. esculenta. In the lowlands were found type X. sagittifolium, X. nigrum, Amorphophallus muelleri, Amorphophallus paeonifolius, Alocasia calidora, Alocasia macrorrhiza, C. esculenta (L.) Schott, and X species sagittifolium, Amorphophallus variabilis, C. esculenta (L.) Schott, and C. esculenta. As well as abiotic factors that affect the distribution of Araceae namely Xanthosoma and Alocasia influenced by IC, Colocasia is influenced by BOT and soil moisture and elevation, Amorphophallus is influenced by soil pH.

5. REFERENCES


Lakip pemerintah Kabupaten Gowa. 2013. Akuntabilitas kinerja


Wilayah Administrasi Kabupaten Gowa. 2013. Kabupaten Gowa