Exploration and Morphological Characterization of Vegetative Part of Avocado at Bebesan Subdistrict Central Aceh District, Indonesia

Exploration
and
Morphological

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Abstract

Purpose – The purpose of this research was to get the initial information about the phenotype diversity of avocado plants and as an information source of Acehnese avocado germplasm.

Methodology – This research was conducted at Bebesan sub-district Aceh Tengah District, from March to October 2017. Exploration was conducted using the descriptive method with purposive sampling. Plants observed in accordance with predetermined criteria namely plants that have been several times fruitful and preferred by consumers.

Originality – The research shown that the avocado plants in the Bebesan sub-district have a high degree of diversity. The diversity can be seen from canopy width, stem circumference, plant height, stem surface, tree shape, number of branches, branch shape, leaf length, leaf width, leaf area, and leaf shape. The number of superior avocado plants that were sampled was 15 accessions. The similarity level of superior avocado accession in the Bebesan sub-district ranged from 0.34 to 1.00.

Keywords canopy, diversity, leaves, stems

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1. Introduction

Avocado (*Persea Americana* Mill) is an agricultural commodity that strongly supports the economic improvement of the society in Aceh, especially in the Gayo highlands (Central Aceh, Bener Meriah, and Gayo Lues). The total production of Aceh avocado in 2014 is 5,617.4 tons and 2,578.6 tons (46%) of it were produced in Aceh Tengah (BPS Aceh, 2015).

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The fruit of avocado can be consumed as a fresh fruit and also as the main ingredient of cosmetics where every two weeks 18 ton of the fruit is brought to Jakarta (Bakri, 2013).

The world avocado plants have a high diversity of characteristic (Dorantes, Parada, Ortiz, 2004; Griesbach, 2005) as well as the avocado in Indonesia (Destiyani, 2010; Susilo, 2010) and the avocado in Aceh (Putra, 2010). The avocado trees in central Aceh have a variety of properties such as the morphology of vegetative and generative organ, as well as the quality of the fruit, however, there are still many unknown characteristics and the collection of plant diversity has not been done yet. The limitations of information about the Aceh's avocado can lead into the poor protection of trees, the difficulty of tree development, extinction and the theft of genetic resources.

The conservation of superior avocado tree germplasm of central Aceh needs to be done as a basis to protect the extinction or the theft of genetic resources by others. The results of this research are very important to support the development of Aceh's Avocado trees. This research aims to explore and characterize the morphology of the vegetative part of the Bebesan avocado tree in Central Aceh, Indonesia.

2. Materials and methods

This research was conducted on the villages of avocado production center of the Bebesen Regency of Central Aceh, Indonesia. The research takes place from April to October 2017. The samples taken for this research are those with fruits, aged between eight to fifteen years and have more demand by the society. The equipment used are a knife, gauge, calipers, Haga altimeter and digital camera.

The exploration is done by using a descriptive method which is by *purposive sampling*. The exploration is carried out gradually by relying on informants and sources of information, either directly from the key informants or bibliographic data. The exploration is supported by farmers' descriptions about their preference for avocado quality.

The data were analyzed in two ways: descriptive and diversity analyses. Descriptive data of the vegetative morphological character of avocado trees were arranged in the form of standard blanks (IPGRI, 1996). The diversity analyses are based on vegetative morphological characterization data which was done using NTSYS-pc program.

3. Results and discussion

3.1. Trunk morphology

Older plants have a greater canopy width, height and trunk diameter. The surface of the avocado tree trunk is generally rough and brown in color. The differences in the trunk surface and color are caused by the age and planted seeds that come from different species, the older plants have a rougher trunk surface as they develop and the surface of the skin becomes wider causing the surface of the trunk become rough (Table 1).

There are seven tree shapes found at the research location, however, the one with circular, obovate and columnar shapes are more to be found. The differences in the shape of the tree can occur due to lack of light because the trees are planted close to each other so that it cover one another.

3.2. Branch morphology

Basically, avocado trees have a varying number of branches and branching systems. The branches usually form a certain angle with the main trunk. The number of branches varies from two to thirty-one. The number of branches is determined by the age of the plant, the cropping pattern and the branching shape.

Table 1.
Trunk morphology
of avocado tree in
Bebesen, Central
Aceh, Indonesia

No	Character	Sub character	Percentage/Range
1.	Tree age (years)	–	8.00 – 31.00
2.	Crown diameter (m)	–	4.21 – 15.10
3.	Trunk circumference (cm)	–	0.55 – 1.98
4.	Tree height (m)	–	8.12 – 13.67
5.	Trunk surface (%)	Rough	66.67
		Very Rough	33.33
6.	Tree shape (%)	Circular	33.33
		Obovate	26.66
		Columnar	13.33
		Semicircular	6.67
		Semielliptic	6.67
		irregular	6.67
		Pyramidal	6.67
7.	Trunk Color (%)	Brown	100

The Distribution of branches is most commonly found in Irregular, Ascendant and Verticillate forms. The color of the young twig is almost green in color. The colors of lenticels of young twig are all green. All avocado plants have an acute crotch angle of the main branches.

3.3. Leaf morphology

The leaves of the avocado trees in Bebesen vary widely. The leaf blade length ranges from 12.55 to 19.99 cm and the width ranges from 5.02 to 8.04 cm with the leaf area from 43.16 to 114.69 cm². The colors of mature leaves are all dark green. The leaf shapes found are generally lanceolate. The leaf apex shape is dominated by acute, and the margin is generally entire shape. The Color of mature leaves is all dark green and the crotch angle of the leaf petiole are all acute.

The measurement of the leaf area was done by gravimetric method. In principle, the leaves are estimated by weight ratio. The lower the intensity of light received by the plant, the wider the leaves of the plant would be. This is because the plant will reduce the leaf area so that the transpiration process of the leaves can be reduced. The leaf diversity is very clear in leaf length, leaf width and leaf area, so it is not possible if the 15th leaf accession also has a different level of similarity.

Table 2.
Branch morphology
of avocado tree in
Bebesen, Central
Aceh, Indonesia

No	Character	Sub character	Percentage/Range
1.	Number of branches	–	2.00 – 31.00
2.	Distribution of branches	Irregular	40.00
		Ascendent	26.66
		Verticillate	20.00
		Horizontal	6.67
		Axial	6.67
3.	Colour of young twig	Green	93.33
		Red	6.67
4.	Colour of lenticels of young twig	Green	100
5.	Crotch angle of main branches	Acute	100

Table 3.

Leaf morphology of
avocado tree in
Bebesen, Central
Aceh, Indonesia

No	Character	Sub character	Percentage/Range
1.	Leaf blade lenght (cm)	–	12.55 – 19.99
2.	Leaf width (cm)	–	5.02 – 8.04
3.	leaf area (cm ²)	–	43.16 – 114.69
4.	Petiol lenght (cm)	–	2.31 – 4.18
5.	Colour of mature leaves (%)	Dark green	100
6.	Leaf shape (%)	Lanceolate	73.33
		Oblong lanceolate	26.67
7.	Leaf apex shape (%)	Acute	80
		Very acute	20
8.	Leaf base shape (%)	Acute	100
9.	Leaf margine (%)	Entire	86.67
		Undulate	13.33
10.	Crotch angle of leaf petiole (%)	Acute	100

3.4. The diversity analyses

According to the dendrogram results, the similarity level of 15 accessions ranged from 34% to 100%. The smaller the similarity value of the lines that connect between individuals, the greater the differences that exist between the individuals. According to Lee (1998), closely related individuals will have close genetic distances, whereas if they are distantly related, they will have long genetic distances.

Genotypes from the same region are not always in the same cluster, which means that geographic diversity does not always have anything to do with genetic diversity. Of the five small groups samples of avocado trees, there are several accessions located in the same location however, they have a low level of similarity. Moreover, there are trees that are located in different locations but have a high level of similarity. The location of a plant is not a major factor causing the high similarity of a plant.

Figure 1.

Dendrogram of 15
accessions of avocado
trees in Bebesen,
Central Aceh,
Indonesia

4. Conclusion

- (1) Avocado trees in Bebesen of Central Aceh have a high diversity of vegetative morphological forms which are found in various characters and sub-character such as the trunk, canopy, and leaves.
- (2) The level of diversity in avocado trees in Bebesan, Central Aceh is between 0.34–1.00.

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