Morphological characteristic of local clove varieties in East Halmahera

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Abstract. The distinctive characteristics of local clove plants could be evaluated through morphological observations. The research was assessed during June - October 2019 in Talaga Jaya, South Wasile, East Halmahera. The study was conducted by survey method with the age of observed plants were more than 10 years old and which species consist of 10 productive trees, selected randomly. The research using local clove with comparative superior varieties of Afo. Leaf, flower, fruit, seed, and the symptom of blister blight disease were observed at 1 m² area on each tree. Form of the trees, stems, branches, leaves, flowers, fruits, and seeds were observed. The results showed that the characteristics morphology of local clove varieties was similar to Afo. The disease severity of blister blight in this study was mild with a 4.28% disease intensity. Morphological characteristics similar to Afo cloves and mild disease intensity of blister blight indicate that local clove varieties have the potential to be developed into new varieties.

1. Introduction
Closes (Syzygium aromaticum L. Merr& Perry) was the main plantation commodities originally from Indonesia [1], which used as an ingredient for cigarette and trade [2]. Cloves has known as a fragrant spice consist of 80% eugenol and 5% eugenic [3]. The economic rate in Southeast Asia in the 14th century increased because the Portuguese and Spanish bought cloves directly from the Maluku Islands [4]. Because of a high economic value of the clove, the farmers continue to maintain them generation to generation. High demand to the commodities was depend on the plant conditions and the flowering season. In general, the clove plantation in North Maluku was not cultivated optimally because fertilization and sanitation are not done properly.

The information of cloves diversity and types in North Maluku was limited. The diversity of clove could be done by observing the morphological characteristics on the field. The cloves in Talaga Jaya village consist of several varieties such as Afo, Zanzibar, Sikotok, and local varieties which known as superior local clove. This local varieties were similar to the other three, but if a detailed observation was carried out, it will show the morphological difference between the four types of plants. The differences can be seen from the shape of the tree, flower, fruit, flower color, leaf shape, and color of leaf [5]. This morphological character can be used to developed new varieties of cloves in the future.
The number of disease intensity from blister blight disease can be used to complete the information of local varieties. The morphological characteristics information of local varieties is important. This research needs to be done in order to determine the information including the number of blister blight disease intensity on local varieties.

2. Materials and Methods
The study was conducted by survey method with the age of observed plants were more than 10 years old and which species consist of 10 productive trees, selected randomly in the field of Talaga Jaya (0°51′45″N, 127°41′54″E), South Wasile, East Halmahera from June – October, 2019. The research using local clove with comparative superior varieties of Afo. Leaf, flower, fruit, seed, and the symptom of leaf blight disease were observed at 1 m² area on each tree [8] (n=10). Form of the trees, stems, branches, leaves, flowers, fruits, and seeds were observed. The 4th healthy leaf from shoots was selected for morphological observation [9]. The morphological character determination such as leaf, flower shape and other components based on the opinion of [5] and [10].

The disease intensity observed by the category of symptoms on each observed leaf and it was calculated using the equation given by [7] as follows:

\[
I = \frac{\sum (n \times v)}{N \times Z} \times 100\%
\]

Information:
- \(I\) = Desease Intensity (%)
- \(n\) = Number of infected leaves in each category
- \(v\) = Numerical value of leaves observed
- \(N\) = Number of leaves observed
- \(Z\) = Numeric value of highest category

3. Results and Discussion
3.1 Morphological characteristic of local superior clove varieties in East Halmahera
The height of local varieties was more than 15 m with cone (cylindrical) canopy types (Figure 1a). The main trunk divides into 2 – 3 branches with a diameter of 55 – 70 cm. High branch straight up forming an angle of 45°- 90°. It has long symmetrical oval-shaped leaves with a length of 11.2–13.5 cm and a width of 4.6 – 6.4 cm. Young leaves were light green (Figure 1b) while the older leaves were dark green (Figure 1c), leaf surface was smooth and the base of the petiole were circular red. The type of flower arrangement is medium peduncle consist of 11 – 21 flowers per stalk with weight of 6.9 – 7.4 g per flower (Figure 1d). The shape of young flower was slender and slightly funnel rednessgreen colored with length of 1.8 – 2.1 cm and 5 – 8 mm in diameter and weight of 0.2 – 0.3 g (Figure 1e). Ripe flowers are reddish yellow (Figure 1f), source of seed was ripe fruit with reddish black colored (Figure 1g), while the seeds have a creamy look (Figure 1h).
Figure 1. (a) local cloves superior tree (b) young leaf (c) old leaf (d) flowers arrangement (e) young flower (f) ripe flower (g) ripe fruit (h) flower seed

Table 1. Comparison of the morphological characters of Afo cloves with local superior.

| No. | Morphology characters | Afo cloves (*) | Local superior cloves (**) |
|-----|-----------------------|----------------|---------------------------|
| 1.  | Main stem             | Divide         | Divide                    |
| 2.  | Canopy tips           | Cone           | Cone                      |
| 3.  | Branching             | Irregular      | Irregular                 |
| 4.  | Leaf shape            | Oval           | Oval                      |
| 5.  | Old leaf color        | Dark green     | Dark green                |
| 6.  | Leaf surface          | Smooth         | Smooth                    |
| 7.  | Leaf length (cm)      | 8.7-12.3       | 11.2-12.5                 |
| 8.  | Leaf width (cm)       | 3.6-4.6        | 4.6-6.4                   |
| 9.  | Flower arrangement type | Long spadix   | Spadix medium             |
| 10. | Number of flowers per bunch | 18-27        | 11-21                     |
| 11. | Flower shape          | Slender slightly funnel | Slender slightly funnel |
| 12. | The young flower color | Reddish green | Reddish green             |
| 13. | Ripe flower color     | Reddish yellow | Reddish yellow            |
| 14. | Flower crown shape    | Round taper    | Round taper               |
| 15. | Weight 100 grains of wet flowers (g) | 27.05-30.23 | 27.30-30.20               |
| 16. | Weight of 100 grains dried flowers (g) | 9.25-10.58  | 9.1-10.1                  |
| 17. | Eugenol content (%)   | 70.65-73.19 (flower) | 78-80 (leaf)              |
| 18. | Fruit shape           | Long konis     | Long konis                |
| 19. | Fruit weight (g)      | 3.2-3.5        | 2.9-3.3                   |
| 20. | The young fruit color  | Reddish yellow | Reddish yellow            |
| 21. | Ripe fruit color      | Reddish black  | Reddish black             |
| 22. | Seed shape            | Long konis     | Long konis                |
| 23. | Seed weight (g)       | 2.1-2.3        | 1.5-2.0                   |
| 24. | Color                 | Dark brown-black | Cream                    |
| 25. | Seed long (cm)        | 2.85-2.99      | 2.2-2.4                   |
| 26. | Potential production of wet flower / trees (kg/tree/year) | 87-119        | 39-66                     |
| 27. | Potential production of dry flower / trees (kg/tree/year) | 30-41         | 13-22                     |
| 28. | Resilience Pests and Diseases | Moderately resistant | Moderately resistant |

Source: (*) = Decree the Minister of Agriculture RI, No. 3680/Kpts/SR.120/11/2010.  
(**) = Characterization results, 2020.
Morphological characteristics of local superior cloves become a clue of their potential and superiority in the framework of development and compounding so as to become candidates for new varieties in the future [16]. Although it does not have the potential for production such as the existing superior varieties but the morphological characters of local superior cloves are similar to those of Afo cloves (Table 1). Superior local cloves have 58.62% morphological characters that are similar with Afo cloves and two characters (length and leaf width) are greater than Afo cloves. Superior local clove in East Halmahera have the potential as a genetic resource in the development of new local varieties.

Temperature, humidity and rainfall data from the site were 27.6 °C, 82% and 2.552 mm/year [18]. Local superior cloves in East Halmahera are planted on dry land with altitude between 0 – 900 m from sea level and 200 – 600 m from sea level for flowering [15]. Rainfall is one of the factors that influence local superior clove productivity. Optimum rainfall for local superior clove growth is 1500 – 2500 mm/year [5].

3.2 Disease intensity of blister blight disease on cloves in East Halmahera
Blister blight disease of cloves is caused by Phyllosticta sp. The initial symptoms are black spots with red edges on the leaf then it became blister and malformation, severe attack cause the leaves to fall and the plant becomes bald (Figure 2). The disease severity of blister blight in this study was mild with a 4.28% disease intensity. It shows that the local superior cloves in East Halmahera have disease intensity > 0 ≤ 10% (skor 1) [17]. This information can be used for the development of new cloves varieties.

![Figure 2. Disease symptom of blister blight of cloves](image)

(a) young leaf (b) older leaf

The eugenol content of local cloves varieties in East Halmahera is quite high, ranging from 78 – 85% [11], this indicates that the plant has a good resistance to pathogen. Phenolic compound in cloves includes flavonoid, isoflavonoid and tannin. Flavonoids play a role in synthesizing chitinase and phenylalanine ammonium lyase (PAL) in plant resistance mechanism [12] as an inducer of resistance to pathogenic infection [13]. The phenolic compound will generally be produced as form of plant pathogenic infection which will be expressed especially at the infection sites [14].

4. Conclusion
Morphological characteristic and plant response against pathogenic infection can be used as information in the development of new varieties. Superior local clove in East Halmahera have the potential source as a genetic resource in the development of new local varieties.

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