Characterization of Morphology from Orchid Vanda sp. as a Genetic Information Source for Preservation and Agribusiness of Orchids in Indonesia

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Characterization of Morphology from Orchid Vanda sp. as a Genetic Information Source for Preservation and Agribusiness of Orchids in Indonesia

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Abstract: The aim of the study was to characterize the collection of endangered Indonesian Vanda orchids based on morphological characters. The information obtained is useful for the conservation of germplasm and for the development of superior Vanda orchid breeding programs in the future. The research activity was conducted from May to November 2018 at the Biosciences Laboratory and Plant Laboratory - State Polytechnic Jember, East Java, Indonesia. The experimental design used in this study was a non factorial completely randomized design with three replications. The treatment in this experiment consisted of fourteen Vanda orchid species from various regions in Indonesia. Observation variables based on qualitative morphological characterization. The results of the experiment showed that the coefficient of similarity in morphological characters ranged from 0.33 to 1.00. The lowest value is found between Vanda Helfola and Arades. The results of the dendogram from grouping based on similarity coefficients are divided into two groups, namely the Vanda group consisting of all types of groupings at coefficients of 0.67 - 0.73 and Vanda groups which group at coefficients 0. 39

1. Introduction

Orchid (Orchidaceae) is an ornamental plant that is favored by many Indonesians because of the beauty of flowers [1] [2]. Orchid has 736 genus with 26,000 species. One genus of orchids that is cultivated by many people is the Vandaceous genus. Orchid Vanda has a wide distribution area in Indonesia [3]. The development of vanda orchids in Indonesia is still very limited because in general Vanda orchids are sold in the market directly from the forest [4]. This condition is feared to have an impact on the level of preservation as reported by Muharyati *et al.* [5], that the existence of Vanda orchids began to be threatened with extinction and even some of its species have been classified as CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) in the appendix II category. The extinction was also supported by the existence of forest destruction due to natural disasters and human activities [6]. Therefore, efforts are needed to preserve conservation by conducting conservation in situ and ex situ, for example in the orchid nursery Experiment owned by Research Institutions and Universities.

Conservation activities begin with exploration and characterization of Vanda orchids species with the aim of knowing the level of diversity and superiority. This activity is an initial effort to collect native germplasm resources from Indonesian species that will be used as elders in conventional

plant breeding activities as well as biotechnology by combining various levels of diversity including intra species, inter species, segregation and mutant plants [7], [8], [9]. One example is the assembly of new superior varieties from Vanda orchids by The Indonesian Ornamental Crop Research Institute using Vanda tricolor orchids as their parents to pass on the fragrance of flowers to the results of their crosses [10].

Characterization of Vanda orchid morphology according to Nurmalinda *et al* [11] includes the shape of the stem which is straight, slender, and not tubular. Flower stalks come out from the sides of the stem alternately. The length of the flower stalk is about 50 cm in size with the number of flowers ranging from 5 to 15 flowers. Based on the leaf shape Vanda orchids are divided into three groups, namely (a) Terer/pencil of Vanda which is terrestrial with direct sunlight requirements, (b) Strap leaves of Vanda that are epiphytic with little shade and (c) Semiteret of Vanda which is semi-intermediates Vanda from the combination of the two previous types of vanda with direct sunlight requirements.

Therefore, the basic knowledge of Vanda orchid morphology diversity is important to know because it is related to breeding activities for conservation or agribusiness purposes. This research activity aims to find out information about the decline of natural Vanda orchid characters that are still very little reviewed and known by many people. Based on the results of this characterization will be obtained information about various superior properties in these plants which can be used as propagation materials and parent broods in plant breeding so that the combination of these properties will appear on the breeding results.

2. Methods

This research activity was carried out in May to November 2018 at the Plant Laboratory and Bioscience Laboratory - State Polytechnic of Jember, Jember, East Java, Indonesia at an altitude of 90 m above sea level. The tools used in this study include rulers, shovel runners, scissors, colling boxes, stationery, sprayers and cameras. The material used is 14 types of Vanda sp. from various regions in Indonesia, media, fertilizers, pesticides and vitamins. The experimental design in this study used a completely randomized design with treatment of fourteen Vanda sp orchids from various regions with three replications.

Variable qualitative observations of Vanda orchid morphology refer to the orchid characterization guide from the Ornamental Crops Research Institute [12] including general crop performance (leaf cross section), leaf performance (leaf shape; leaf tip shape; leaf edge shape; surface texture of leaves and leaf symmetry) (Table1). Analysis data use NTSYS programme Version 2.0.

3. Result and Discussion

Characterization is an activity in the conservation of germplasm to determine morphological properties that can be used to distinguish between accessions, assess the magnitude of genetic diversity, identify varieties, assess the number of accessions and so on. Orchid stems were observed based on the type of growth. There are 2 types of orchid growth, namely monopodial and simpodial. The monopodial stem is a stem that extends upwards and there is only one stem, while the sympodial stem is the stem towards the side and in one plant there are more than one stem. The type of growth in all orchids from this study (Vanda species) is monopodial [7]. In this study, an analysis based on the morphological characters of 14 Vanda orchid assays was carried out from several regions (**Table 1**). The Fourteen types of Vanda orchids include Vanda Feotida (**Figure 1**), Vanda Scandens (**Figure 2**), Vanda Tricolor Sumbing (**Figure 3**), Vanda Helvola (**Figure 4**), Vanda Tri Color Dieng (**Figure 5**), Vanda Tri Color Cianjur (**Figure 6**), Vanda Purva (**Figure 7**), Rhynchostylis Retusa (**Figure 8**), Vanda Devoogtii (**Figure 9**), Vanda Arculata (**Figure 10**), Vanda Arades (**Figure 11**), Vanda Limbata (**Figure 12**), Vanda Celebica (**Figure 13**), and Vanda Merbabu (**Figure 14**). The character is scoring and the results of scoring are then analyzed using NTSYST to get a similarity coefficient. After obtaining the similarity coefficient, a dendogram was arranged to determine the classification of the

orchid types. The dendogram from the grouping results is presented in **Figure 15**. The character grouping occurred probably due to the influence of environmental factors in which the vanda orchid was obtained, as stated by [13], according to the results of his research on wild orchids in Thailand.

Figure 1. Vanda Feotida

Figure 2. Vanda Scandens

Figure 3. Vanda Tricolor Gunung Sumbing

Figure 4. Vanda Helvola

Figure 5. Vanda Tricolor Dieng, Central Java

Figure 6. Vanda Tricolor Cianjur, West Jawa

Figure 7. Vanda Purva

Figure 8. V. Rhynchostylis Retusa

Figure 9. Vanda Devogtii

Figure 10. Vanda Arculata

Figure 11. Vanda Arades

Figure 12. Vanda Limbata

Figure 13. Vanda Celebica

Figure 14. Vanda Tri Colour Merabu, Central Java

Table 1. Types and origin of collections from 14 accessions of Vanda sp.

No	Accession	Location of Accession Origin
1	Vanda Feotida	Pagar Alam, North Sumatra
2	Vanda Scandens	Kalimantan
3	Vanda Tricolor Gunung Sumbing	Gunung Sumbing, Central Java
4	Vanda Helvola	West Java
5	Vanda Tri Color Dieng	Dieng, Central Java
6	Vanda Tri Color Cianjur	Cianjur, West Jawa
7	Vanda Purva	East Java
8	Rhynchostylis Retusa	East Java
9	Vanda Devoogtii	East Java
10	Vanda Arculata	Sulawesi
11	Vanda Arades	East Java
12	Vanda Limbata	East Java
13	Vanda Celebica	Pasuruan, East Java
14	Vanda Gunung Merbabu	Gunung Merbabu, Central Java

In **Figure 15** shows that dendogram is divided into two main branches in the simple matching coefficient kooefesien between 0.33 - 1.00 that is group I at 0.67 and group II at 0.39 where the division of this group is based on 13 Vanda orchid morphology character identified (cross section of leaf, leaf shape, leaf composition, leaf edge, leaf surface texture, leaf symmetry, rooting type, leaf length, leaf width, leaf thickness and flower position). In detail the classification of Vanda orchids from the exploration of several areas can be seen in **Table 2.**

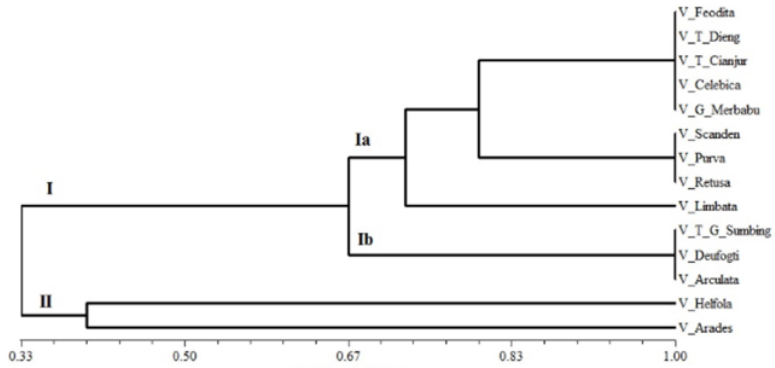

Figure 15. Dendrogram Similarity coefficients of 14 Vanda orchid accessions based on morphological character.
(information: V_Feodita = Vanda Feotida, V_Scanden = Vanda Scandens, V_T_G_Sumbing = Vanda Tricolor Gunung Sumbing, V_Helvola= Vanda Helvola, V_T_Dieng = Vanda Tri Color Dieng, V_T_Cianjur = Vanda Tri Color Cianjur, V_Purva = Vanda Purva, V_Retusa = Vanda Rhynchostylis Retusa, V_ Deufogti = Vanda Devoogtii, V_Arculata = Vanda Arculata, V_ Arades = Vanda Arades, V_ Limbata = Vanda Limbata, V_Celebica = Vanda Celebica, and V_Merbabu = Vanda Gunung Merbabu)

The separation of this group was due to very clear differences in character, Vanda helfola and Vanda arades were in group II. Explanation of differences in the cross-sectional characters of Vanda helfolia leaves with tridentate character, Vanda arades classified as bilaterally compressed while others (group I) are included in teret. In the character shape of Vanda helfola leaves classified as elliptic, Vanda arades is classified as oblong leaf shape, while Vanda group 1 is generally linear. In the Vanda helfola leaf tip character is tridentate character, Vanda arades has retuse character, while Vanda group 1 is generally emorginate. Furthermore, the length of Vanda helfola leaves and Vanda arades were relatively short (15-17 cm) compared to the length of Vanda orchid leaves belonging to group I (22 - 38 cm).

Table 2. Orchid accession groups based on dendrogram

Main group	Sub group	Accession
I	Ia	Vanda feotida, Vanda tricolor Dieng, Vanda tricolor Cianjur, Vanda celebica, Vanda Gunung Merbabu, Vanda scaden, Vanda purva, Rhynchostylis Retusa, Vanda limbata
	Ib	Vanda tricolor Gunung Sumbing, Vanda daufogti dan Vanda arculata
II		Vanda Helfola dan Vanda Arades

In group I it was divided into two sub-groups: sub-group 1a on the coefficient of diversity 0.73 and sub-group 1b on the coefficient of diversity 0. 67. Subgroup 1a consisted of three other types of groups, namely the first group (V. feodata, V. Dieng tricolor, V. tricolor Cianjur, V celebica, V Gunung Merbabu); Second group (V scanden, V purva, V retusa); and the third group is Vanda limbata. The character equation that unites groups is growth type, leaf cross section, flower position, leaf shape, leaf tip, leaf arrangement, leaf edge, leaf surface texture, leaf symmetry, rooting type, leaf length, leaf width, leaf thickness. Sub group I b consists of Vanda tricolor Sumbing mountain; Vanda

daufogti and Vanda arculata. Similar to group 1a, the two types of Vanda from group I have unifying character similarities, namely growth type, leaf cross section, flower position, leaf shape, leaf tip, leaf arrangement, leaf edge, leaf surface texture, leaf symmetry, root type, leaf length, leaf width, leaf thickness.

4. Conclusion

Exploration results from 14 types of Vanda orchids have similarity values based on morphological characters that are quite high from 0.22 to 1.00. The lowest value is found in Vanda Helfola and Vanda Arades. The highest values were found in Vanda feotida, Vanda tricolor Dieng, Vanda tricolor Cianjur, Vanda celebica, Vanda Gunung Merbabu, Vanda scaden, Vanda purva, Rhynchostylis Retusa. Dendogram results of grouping based on similarity coefficients are divided into two main groups, the first group consists of Vanda groups which are in coefficients of 0.67 - 0.73 and the second group consists of Vanda groups at coefficients 0. 39. The first group is divided into two subgroups namely Vanda which grouped on diversity coefficients 0.73 and Vanda which grouped on the coefficient of diversity 0. 67.

The relationship between Vanda orchids based on the distribution area still needs to be expanded by using characters in addition to using qualitative characters, quantitative, anatomical, cytology to molecular level, so that more comprehensive data will be obtained.

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