The Potential of Central Kalimantan’s Local Orchid as Material Source for Genetic Improvement

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Abstract. Central Kalimantan Province with total area of 15,380,000 ha or about 7.93 % of Indonesian areas consists of coastal regions and forest areas has potential biodiversity such as Orchidaceae. This region has various type of lands involving peat lands, swamplands with acid sulphate soils and up lands. The existence of orchid in Central Kalimantan’s forest can be found scattered in forest areas with high diversity life, form and uses. The methodology used include exploration and collection and they were conducted at six districts, i.e. East Barito, South Barito, North Barito, East Kotawaringin and Murung Raya, starting from March 2016 until December 2018. The objective of this study was as follows: (1). The exploration process, (2). The ex-situ and in-situ conservation, (3). The characterization process, (4). The documentation process. The results of these activities shown that there are several ex situ collection of 8 accessions of medicinal plants that can be used as a source of material for genetic improvement. The orchid plant’s conservation can be conducted through in-situ and or ex-situ. In-situ conservation can be conducted through managing forest areas as the natural habitat of the material for genetic improvement, while for ex-situ conservation, it can be managed outside of the native habitats. Appropriate utilization and research activities are important in conservation of the material for genetic improvement in Central Kalimantan

1. Introduction
Indonesia as one of the “mega diversity” countries which has natural wealth and is a matter of pride for our country. The consequence is that we are required to safeguard and preserve this wealth from extinction that occurs due to genetic erosion, illegal logging, deforestation, an increase in human settlements due to population growth and the opening of increasing plantation areas. The current destruction of tropical forests is closely related to the loss of several types of flora. This loss can reach 35-50% [1]. This situation continues to result in the extinction of site-specific genetic resources that are endemic in tropical forests [2,3].

Central Kalimantan Province with an area of 15,380,000 hectares or about 7.93% of the total area of Indonesia. The province consists of 61,140 ha of coastal areas, 1,533,492 ha of public water areas and 17,785,431 ha of land areas. The land area is divided into agroecology, namely wetlands (tidal and lowlands) and dry land. The existence of differences in existing agroecology, of course, each region will have different genetic resources between the existing agro-ecologies with specific locations where various existing plant genetic resources are grown.
The uniqueness of a species is certainly different between regions so that its existence must be preserved to prevent extinction through the collection, characterization, and conservation of existing plant genetic resources in-situ and ex-situ. This activity is one of the plant breeding activities to reproduce and collect genetic material that can be used to improve plant traits through natural crossovers or through tissue culture propagation and others. Any orchid that has bad characteristics, such as a short flower life phase, less attractive flower color can be improved through hybridization and other activities. So that local orchids can compete with other flowers in domestic markets and foreign markets. Kalimantan is the third largest island in the world. This island is considered as a fruit island but also can be referred to as Lamb orchid island (1991) in Chan et al. (1994) has estimated that 2,500-3,000 species of orchids are found in Kalimantan or 75% of the Malesian orchid plant [4]. Based on this, 30-40% of them are estimated to be endemic to this island. According to Wood and Cribb in Chan et al (1994), it was noted that more than 1,400 types of orchids are found in Kalimantan [4]. Orchid species in Indonesia have unique characteristics and can only be found on certain islands in Indonesia such as the black orchid (Coelogyne pandurata Lindl.) and the pearl orchid (Coelogyne asperata) which are only found on the island of Borneo in Galimbing (2011) Coelogyne is the largest clan, consisting of about 150 species, spread across the Himalayas and southern China to Sri Lanka and Malaysia. Most have beautiful flowers and are developed as commercial flowers. Obtained information of potential orchids which have high economic value was developed as genetic material in plant breeding. The results of improvement for these plants in the nature can then produce local orchid varieties that can be marketed and developed nationally or even internationally.

2. Materials and Methods

2.1. Location
This study was conducted in North Barito Regency, West Kotawaringin, Murung Raya and East Barito for 2 years (2016-2018).

2.2. Materials
Collected data was used as basic information of local orchid plants in various non-governmental organizations (NGOs) and government agencies. Exploration was conducted through collecting plant material involving local orchid habitats, create passport data, record soil types, pH and location points using GPS device. Conservation and preservation was conducted through planting ex-situ and in-situ with recorded plant growth and development.

2.3. Research procedures
Characterization was conducted through measuring qualitative characters (shape and color of flowers, seeds, leaves, stems, hilum and feathers and quantitative (plant height and other characters). The materials used in this study involved plant exploration equipment, GPS, local orchids. measurement of local orchids using International Plant Genetic Resources Institute (IPGRI) manuals and manuals from the Indonesian Ornamental Plants Research Institute. The characters observed included qualitative and quantitative characters such as the shape of flowers, stems, leaves, roots and their habitat. the crops resulting from exploration are planted by ex-situ and in-situ.

3. Results and Discussion
This orchid has high economic value because it has the potential to be a crossbreeding. Black orchids and pearl orchids are orchids whose status is protected, so efforts are needed to produce new types and varieties to increase the diversity of Coelogyne orchids (Table 1). Research to produce new varieties can be carried out by carrying out interspecific crosses, namely crosses between genera [7].
| Explanation | Coelogyne pandurate (Anggrek Hitam) | Coelogyne asperata (Anggrek Mutiara) | Grammatophyllum speciosum (Anggrek Tebu) | Phalaenopsis cornucervi (Anggrek Bulan Loreng) | Paraphalaenopsis laykocii (Anggrek Ekor Tikus) |
|-------------|------------------------------------|-------------------------------------|----------------------------------------|---------------------------------------------|-----------------------------------------------|
| Origin      | East Barito                         | South Barito                        | East Kotawaringin                       | North Barito                                | Murung Raya                                   |
| Growth Type | Sympodial                           | Sympodial                           | Monopodial                              | Sympodial                                   | Monopodial                                    |
| Leaf character | Light green leaf color, lanceolate shape and pointed leaf tips. Repetition of thick leaves on the underside of leaves with symmetrical type. The surface texture of leaves is bare, leaf tips are symmetrical | Light green leaf color, lanceolate shape and pointed leaf tips. Repetition of thick leaves on the underside of leaves with symmetrical type. The surface texture of leaves is bare, leaf tips are symmetrical | Dark green leaf color, pointed ribbon shape, double leaf arrangement, bare leaf surface texture, symmetrical leaf tips. 15.5 cm long, 2.1 cm wide | Dark green leaf color, lanceolate and pointed leaf tips. Double leaf arrangement, frayed leaf edge shape, baid leaf surface texture, symmetrical leaf tip | Elliptical leaf shape resembling a pencil or rat tail, the base of the flower crown tucked around the foot of the monument and the convex abaxial side of the lips. The leaves are dark green, coarse in texture, hairless and number 3 to 7 strands arranged in tight spacing |
| Root | Root type: fiber soil root, dark brown root color. Oval pseudobulb shape with a pair of leaves. Cross section of the jorong. Plant height 59.2 cm. 9.6 cm long, 5.6 cm wide and 1.6 cm thick. Prefers a humid place in primary forests around the riverbanks. Flowering all year round, flowering period 7 days | Root type: fiber soil root, dark brown root color | Root type: ground roots, fibers, light brown roots, roots sticking to the wood | Root type: fiber soil root, dark brown root color | Cylindrical roots whitish green and branched |
| Stems / Pseudobulb | Oval pseudobulb shape with a pair of leaves. Cross section of the jorong. Plant height 59.2 cm. 9.6 cm long, 5.6 cm wide and 1.6 cm thick | Egg pseudobulb round shape, slightly flattened, wrinkled, 15 cm long. Light green pseudobulb color | The color of the inner stem is green, the color of the outer stem is dark brown, the shape of the stem is straight, the stem is getting smaller and smaller, the height of the plant is 13.5-34 cm | Short stem about 5 cm | The stems are very short (up to 5 cm) not clearly visible because they are covered by leaf midribs |
| Ecology | Prefers a humid place in primary forests around the riverbanks | Prefers a humid place in primary forests around the riverbanks with an altitude of 1000 m above sea level | Like the open, full light intensity, with an altitude of 50-550 asl | Likes dark and lush forests at an altitude of 1000 m above sea level | This plant will only show good growth if it is placed in a place that is sufficiently shaded and not exposed to direct sunlight |
|--------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|
| Flower season | Flowering all year round, flowering period 7 days Flowering position Top, type of bunch flowering, twisted there is a spur. Flower jewelry of 3 sepals, 2 petals and one labellum (labellum). Flowers are lanceolate with a pointed tip. The labellum (lips) consists of keeping the sides, keeping the middle and simple calluses | Flowering in March-May with a flowering period of 7 days Flowering position Top, type of bunch flowering, twisted there is a spur. Flower jewelry of 3 sepals, 2 petals and one labellum (labellum). Flowers are lanceolate with a pointed tip. The labellum (lips) consists of keeping the sides, keeping the middle and simple calluses | Flowering at any time, especially in June and March, the flowers bloom 1.5 months | Flowering throughout the year with a long bloom of 7 days Flowering position on shoots with twisted resupinate bunch flower type. Jewelry flower petals in the shape of lanceolate with a long tapered tip of 2.2 cm. The petals are smaller than the petals of the same color. The flowers are greenish yellow and have brownish red spots. Armored Labellum 3 | Inflorescences in the form of bunches consisting of 2-10 flowers, appearing from the axillary of the leaves. The inflorescence stalk is somewhat dangling (not erect as in the Phalaenopsis species) with the bractea which is ovate (up to 1 cm long), has a sharp tip and leaves a mark after fall The white cylindrical flower stalk is about 5 cm long. Flowers 4-6 cm in diameter with thick fleshy petals and petals, slightly wavy edges and white tinge of yellow and pink. The central petals are lanceolate-oblong, tapered tip, 3-4 cm long, 1-1.5 cm wide. The side petals are round lanceolate eggs (3.5-4.5 x 1.4-1.7 cm) with a tapered tip. The crown is lanceolate (3.4 x 1.5 cm), slightly wavy with a tapered tip like a claw and fleshy. The lips are elongated (1.8 cm), yellow colored with red-brown stripes and the edges are branched. The monument is white, its length reaches 1 cm |

- Flower stalk 50 cm long, the number of flowers per bunch is 7-30 flowers, flower diameter is 7-9 cm
### Table 2. Genetic material for the improvement of plant traits.

| Explanation                        | Orchid Name                  | Coelogyne pandurate (Anggrek Hitam) | Coelogyne asperata (Anggrek Mutiara) | Grammatophyllum speciosum (Anggrek Tebu) | Phalaenopsis cornucervi (Anggrek Bulan Loreng) | Paraphalaenopsis laykocii (Anggrek Ekor Tikus) |
|------------------------------------|------------------------------|-------------------------------------|--------------------------------------|-----------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Superior properties of plants      | That the black orchid has a dark tongue color and the sepals of the tepals are light green and the pearl orchid has the characteristic of many flowering in one stalk and is fragrant | Orchid breeding is endeavored to expand genetic diversity in unique shapes and colors, favored by consumers, high frequency of flowering | Panicles can grow to 2.5–3 meters in length and about 1.5–2 cm in diameter. Each panicle has tens, even up to a hundred flowers | Mini orchid with brown red spots forming stripes is very unique | White flower color and fragrant with wavy petals. Unique leaf shape long and pointed tip with large stomata |

One of the efforts to improve the quality of orchids or get new cultivars is to cross between elders who have certain characteristics. The uniqueness of the characters of these two orchids is that the black orchid has a dark tongue color and the sepals of the tepals are light green and the pearl orchid has the characteristic of many flowering in one stalk and is fragrant [8]. Therefore, orchid breeding is endeavored to expand genetic diversity in unique shapes and colors as shown in table 1, favored by consumers, high frequency of flowering and resistance to disease-causing pathogens and environmental stresses [9].

The fertility of various types of orchids, especially orchids from Indonesia, is not widely known. Information on the fertility of an orchid species is very important to master in order to maximize seed yields as propagation material [10]. Coelogyne pandurate and Coelogyne asperata are endemic species of orchids in Kalimantan, so it can be estimated that these species are certainly unique in terms of their behavior from flowering as shown in table 2.

Paraphalaenopsis orchids such as Rat Tail Orchid are related to the Phalaenopsis clan. Morphological characters such as the elliptical leaf shape resembling a pencil or mouse's tail, the base of the flower crown tucked around the foot of the monument and the abaxial side of the convex lips are characteristics that attract plant breeders to use these orchids as a source of genetic material in improving plant properties. Paraphalaenopsis laycockii was first introduced in 1935 by M.R. Henderson under the name Phalaenopsis laycockii published in the Orchid Review. Giving the name of this type of laycockii as a tribute to John Laycock who imported this species for the first time from Central Kalimantan.

Sugarcane orchid is a type of orchid with monopodial growth, which is an orchid whose stem ends have unlimited growth with one-way upward growth. The main characteristic of sugarcane orchids is their large size. Panicles can grow to 2.5–3 meters in length and about 1.5-2 cm in diameter. Each panicle has tens, even up to a hundred, each flower about a diameter of one.

The Loreng Moon Orchid is a mini orchid with a brown to brass shape which is very attractive to form strips. The flower performance of the P. cornucervi x P. equestris cross showed only slight variations, namely bright salmon and purplish salem colors, while the similarities were multiflora, multispike, star-shaped, and small flower sizes. The advantage shown by this population is that it is very diligent in flowering and the number of flowers is very large. The plants are diligent in flowering indicated by the flowering interval of 1 year to six times, the spikes appear alternately or simultaneously up to four spikes and the highest number of buds is up to 86. P. equestris is one of the flagship species which has a multiflora character, which is very dominant inherited in the results of this cross.
4. Conclusion

Local orchids originating from Central Kalimantan that can be used as material for cutting plants involve Coelogyne pandurata, Coelogyne asperata, Grammatophyllum speciosum, Phalaenopsis cornucervi, Paraphalaenopsis laykocii. The unique characteristics of these local orchids are dominant and passed on through crosses between species with better results include fast flowering intensity, large numbers of flowers and the results of crosses can produce new orchids that are better than their parents.

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