Exploration and Inventory of Native Orchid Germplasm in West Borneo, Indonesia

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Abstract. Borneo (Kalimantan) is the third largest island in the world. It is rich with various indigenous orchid species that grow epiphytically, terrestrially, or saprophytically in the forests. Its rain forests are also home to some rare species such as some Aërides sp., Bulbophyllum sp., Cymbidium sp., Dendrobium sp., Dimorphochilus sp., Grammatophyllum sp., Paphiopedilum sp., Phalaenopsis sp., Paraphalaenopsis sp., and Vanda sp., all of which have a very high economic value. These species are endangered and some of them may have not yet been found or discovered, because of the loss of habitat resulting from fire, forest damage, illegal logging, and orchid hunting either by domestic or foreign collectors. Until recently, there are only a few records on the orchid native to West Borneo. For this reason, a research was conducted to identify and create an inventory of all orchid species that exist in West Borneo before they become extinct along with their habitat and to conserve them ex situ. This research was conducted in 10 counties and one municipal city in West Borneo, and inventory was done through exploration. Orchids found were recorded and identified into their genera and their species by visual examination of vegetative and floral characteristics, respectively. A total of 197 species of orchids from 66 genera were identified, and among those, 27 species live as terrestrials, 169 species live as epiphytes, and one species lives as both an epiphyte and terrestrial.

Orchids are members of the Orchidaceae, the largest family among flowering plants, which includes 25,000 species from 850 genera. It is estimated that 2500 to 3000 orchid species grow in the forests of Borneo (Irawati, 2002).

In their natural habitats, most orchids live as epiphytes in the forest trees. Increasing forest exploitation, either legally or illegally, and excessive logging have caused damage to the forests of West Borneo. Gold mining, wild forest fires, and illegal burning to establish a new agriculture land occur often and are some of the reasons orchids are becoming extinct. There are also economic factors contributing to the endangerment of Borneo’s orchids such as illegal collecting and selling of wild orchids by collectors (orchid lovers) and the increasing demand for orchids by neighboring countries such as Malaysia and Brunei Darussalam. These conditions point to the urgency of the need to conserve native orchids in West Borneo.

Conservancy efforts should be conducted in accordance with the following Indonesian legislations: UU No. 5 ratified in 1990, The Conservation of Biological Natural Resources and Its Ecosystem (Indonesian Ministry of the Environment, 1990); UU No. 5 ratified in 1994, The Conservation of Biological Diversity (Indonesian Ministry of the Environment, 1994); and PP No. 7 ratified in 1999, The Conservation of Flora and fauna (Indonesian Ministry of the Environment, 1999).

According to Global Forest Watch (2002), Indonesia is one of the countries experiencing the most drastic loss of forestland in the world. It was estimated in 1996 that 1 million ha of Indonesian forestland was being destroyed every year, including approximately 0.7 million ha every year during the 1990s such that it was estimated that the forests in Borneo will have completely vanished by 2010. It is as a result of these figures that the author tries to promote conservation efforts, which include conserving native orchids by ex situ processes and making an inventory and identifying native orchids in West Borneo in accordance with the legislation mentioned previously.

Materials and Methods

Time and location. The research was conducted in 3 years, from 2002 to 2005. The author explored forests in all 10 counties and one municipal city in West Borneo. The counties were Sambas, Bengkayang, Pontianak, Sekadau, Sanggau, Kapuas Hulu, Sintang, Landak, Malawi, and Ketapang and the municipal city was Pontianak City.

Materials and tools. Materials used for this research were orchid plant guidebooks.

Results and Discussion

One hundred ninety-seven orchid species from 66 genera have been identified, including some with high economic value and others with low economic value. Among these orchids, 27 species live as terrestrials, 169 species live as epiphytes in the forest, and one species lives as both an epiphyte and terrestrial (Table 1). In addition, the identification of 200 taxa is still pending, because these plants have not flowered at the time this article was written. The author found that orchid species were not uniformly distributed in West Borneo. Some species have become vulnerable, some species have become endangered, whereas others have become almost extinct. Some vulnerable species such as Aërides odorata is still abundant, especially in Sambas, Landak, and Bengkayang counties. Similarly, Arundina graminifolia and Bromheadia finlaysoniana are easily found in their habitats in many counties.
| No. | Orchid name                      | Growth classification |
|-----|----------------------------------|-----------------------|
| 1   | Acanthepipium eburneum Kraenzl.  | Terrestrial           |
| 2   | Acanthepipium ilicinum          | Terrestrial           |
|     | J.J. Wood & C.L. Chan           |                       |
| 3   | Acetopis densiflora Lindley     | Epiphyte              |
| 4   | Acetopis littifolia (Kraenzl.) Ormerod | Epiphyte     |
| 5   | Adenocentron pavoninum Rchb.    | Epiphyte              |
| 6   | Aërides odorata Lour.           |                       |
| 7   | Agrostophyllum laxum J.J. Sm.   | Epiphyte              |
| 8   | Anoectochilus albolineatus Par. et Rchb. f. | Terrestrial |
| 9   | Appendicula anceps Bl.          | Epiphyte              |
| 10  | Appendicula elegans Rchb. f.    | Epiphyte              |
| 11  | Appendicula torna Bl.           | Epiphyte              |
| 12  | Appendicula makinoi Bl.         | Epiphyte              |
| 13  | Arachnis breviscapa (J.J. Sm.) J.J. Sm. | Epiphyte     |
| 14  | Arachnis flosaeris (Lindl.) Rchb. f. | Epiphyte     |
| 15  | Arachnis hookeri (Rchb. f.) Rchb. f. | Epiphyte     |
| 16  | Arundina graminifolia (D. Don.) Hochr. | Terrestrial |
| 17  | Brachycepus indusiata (Rchb. f.) Garay | Epiphyte     |
| 18  | Brachycepus zambongensis (Ames) Garay | Epiphyte     |
| 19  | Bromheadia finlaysoniana (Lind.) Rchb. f. | Terrestrial |
| 20  | Bulbophyllum acuminatum (Ridl.) Ridl. | Epiphyte     |
| 21  | Bulbophyllum anceps J.J. Sm.    | Epiphyte              |
| 22  | Bulbophyllum auratum (Lindl.) Rchb. f. | Epiphyte     |
| 23  | Bulbophyllum beccarii Rchb. f.  | Epiphyte              |
| 24  | Bulbophyllum blumei (Lindl.) J.J. Sm. | Epiphyte  |
| 25  | Bulbophyllum bryani (Rofé) Ames | Epiphyte              |
| 26  | Bulbophyllum cirithanensis Schltr. | Epiphyte   |
| 27  | Bulbophyllum connatum Carr.     | Epiphyte              |
| 28  | Bulbophyllum dearei (Hort.) Rchb. f. | Epiphyte     |
| 29  | Bulbophyllum epicranthoes Hook. f. | Epiphyte     |
| 30  | Bulbophyllum flavescens (Bl.) Lindl. | Epiphyte    |
| 31  | Bulbophyllum gracillum (Rofé) Rolfe | Epiphyte     |
| 32  | Bulbophyllum lepidum (Bl.) J.J. Sm. | Epiphyte    |
| 33  | Bulbophyllum lobii Lindl.        | Epiphyte              |
| 34  | Bulbophyllum macranthum Lindl.  | Epiphyte              |
| 35  | Bulbophyllum macrochillum Rolfe. | Epiphyte              |
| 36  | Bulbophyllum medusae (Lindl.) Rchb. f. | Epiphyte   |
| 37  | Bulbophyllum mirum J.J. Sm.     | Epiphyte              |
| 38  | Bulbophyllum mastabale (Bl.) Lindl. | Epiphyte  |
| 39  | Bulbophyllum patens King ex Hk. f. | Epiphyte   |
| 40  | Bulbophyllum pleatatum Schltr.  | Epiphyte              |
| 41  | Bulbophyllum purpurascens T. & B. | Epiphyte       |
| 42  | Bulbophyllum retractiligneum J.J. Sm. | Epiphyte   |
| 43  | Bulbophyllum reticulatum Batem ex Hook. f. | Epiphyte   |
| 44  | Bulbophyllum reticulatum Hook. f. | Epiphyte       |
| 45  | Bulbophyllum reticulatum Hook. f. | Epiphyte       |
| 46  | Bulbophyllum vaginatum (Lindl.) Rchb. f. | Epiphyte   |
| 47  | Bulbophyllum vanvuarenii J.J. Sm. | Epiphyte     |
| 48  | Calanthe vestita Lindl.         | Terrestrial           |
| 49  | Cheloniste sulphurea (Bl.) Pf.  | Epiphyte              |
| 50  | Cheloniste sulphurea (Bl.) Pf.  | Epiphyte              |
| 51  | Cheloniste sulphurea (Bl.) Pf.  | Epiphyte              |
| 52  | Cleistostoma scortechini (Hook. f.) Garay | Epiphyte     |
| 53  | Cleistostoma simmondii (Gagnep.) Seidenf. | Epiphyte  |
| 54  | Coelogyne asperata Lindl.       | Epiphyte              |
| 55  | Coelogyne eberhardtii Gagnep.    | Epiphyte              |
| 56  | Coelogyne foersterianum Rchb. f. | Epiphyte              |
| 57  | Coelogyne mayeriana Rchb. f.    | Epiphyte              |
| 58  | Coelogyne pandurata Lindl.      | Epiphyte              |
| 59  | Coelogyne rochussenii De Vr.    | Epiphyte              |
| 60  | Coelogyne rumpii Rchb. f.       | Epiphyte              |
| 61  | Coelogyne speciosa Lindl.       | Epiphyte              |
| 62  | Coelogyne squamulosa J.J. Sm.   | Epiphyte              |
| 63  | Coelogyne squamulosa J.J. Sm.   | Epiphyte              |
| 64  | Coelogyne varicosus S.E.C. Sierra | Epiphyte      |
| 65  | Cordiglossa filiformis (Hk. f.) Garay | Epiphyte   |
| 66  | Cymbidium bicolor Lindl.        | Epiphyte              |
| 67  | Cymbidium finlaysonianum Lindl. | Epiphyte              |
| 68  | Dendrobium acrocomum Lindl.     | Epiphyte              |
| 69  | Dendrobium anomorum Lindl.      | Epiphyte              |
| 70  | Dendrobium bullens J.J. Sm.     | Epiphyte              |
| 71  | Dendrobium cinnabarinum J.J. Sm. | Epiphyte      |
| 72  | Dendrobium compressivestillum J.J. Sm. | Epiphyte   |

(Continued)
Some species with high economic value such as *Arachnis breviscapa*, *Arachnis hookeriana*, *Bulbophyllum beccarii*, *Bulbophyllum dearei*, *Coelogyne pandurata*, *Cymbidium bicolor*, *Dendrobium hallieri*, *Dendrobium singkawangense*, *Dimorphorchis lowii*, *Vanda dearei*, *Paphiopedilum kolopakingii*, and *Paphiopedilum lowii* have become endangered. Among these orchids, *Paphiopedilum lowii* still can be found in Sanggau and Sintang counties. *Bulbophyllum beccarii* and *Bulbophyllum dearei* can be found in Landak, Kapuas Hulu, and Bengkayang counties, and only a few *Vanda dearei* can be found in Landak county. On the other hand, *Arachnis breviscapa* and *Arachnis hookeriana* are very rare. Similarly, endemic *Dendrobium hallieri* and *Dendrobium singkawangense* are difficult to find as a result of high demand by the buyers. It is also difficult to cultivate these endemic species ex situ, perhaps because of the difficulties in copying the exact microhabitat, which supports its specific associated mycorrhiza.

Noteworthy taxa include two species from genus *Paphiopedilum* (*Paphiopedilum hookerianum* and *Paphiopedilum kolopakingii*), two species from the genus *Paraphalaenopsis* (*Paraphalaenopsis denevei* and *Paraphalaenopsis serpentine*), *Cymbidium bicolor*, *Dimorphorchis rossii*, and several species from genus *Phalaenopsis*, none of which are common in nature because they are highly prized by poachers or they have vanished as their habitat is destroyed. These orchids are hardly found in their habitats but are more easily found in nurseries in Java, and some big cities in Indonesia as well as some parts of the Western hemisphere. Especially, *Paraphalaenopsis serpentine* is now critically endangered, and it can only be found in Sintang county. However, the Bogor Botanical Garden in Indonesia has successfully cultivated it. Likewise, *Macodes petola*, *Anoectochilus albolineatus*, and *Ludisia discolor* have become extremely rare and critically endangered. Only a few of these plants were encountered. These orchids live in shady, moist, and humically rich habitats. Moreover, *Phalaenopsis gigantea*, *Paraphalaenopsis denevei*, and *Phalaenopsis amabilis* are also critically endangered. They have never been found in their habitats and are hardly found in the markets. The author recommends that all vulnerable, endangered, and critically endangered species should be cultivated before they become extinct. Local government intervention and participation in conservation, cultivation as well as marketing of orchids are necessary so that parties will not directly take the plants from their habitat.

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Indonesian Ministry of the Environment. 1990. Undang-Undang No. 5 Tahun 1990 Tentang: Table 1. (Continued) List of orchid species found in West Borneo, Indonesia.

| No. | Orchid name | Growth classification |
|-----|-------------|-----------------------|
| 142 | Oberonia ciliolata Hook.f. | Epiphyte |
| 143 | Oberonia patentirolla Ames & C. Schwenf. | Terrestrial |
| 144 | Paphiopedilum hookerianum Rchb.f. | Epiphyte |
| 145 | Paphiopedilum kolopakingii Fowlie | Epiphyte |
| 146 | Paphiopedilum lowii (Lind.) Stein. | Epiphyte |
| 147 | Paraphalaenopsis denevei (J.J. Sm.) Hawkes | Epiphyte |
| 148 | Paraphalaenopsis serpentine (J.J. Sm.) A.D. Hawkes | Epiphyte |
| 149 | Phalaenopsis amabilis (Lindl.) Bl. | Epiphyte |
| 150 | Phalaenopsis bellina (Rchb. f.) E.A. Crichton | Epiphyte |
| 151 | Phalaenopsis cornucervi (Breda) Bl. & Rchb. f. | Epiphyte |
| 152 | Phalaenopsis gigantea J.J. Sm. | Epiphyte |
| 153 | Phalaenopsis maculata Rchb. f. | Epiphyte |
| 154 | Phalaenopsis manii Rchb. f. | Epiphyte |
| 155 | Phalaenopsis modesta J.J. Sm. | Epiphyte |
| 156 | Phalaenopsis pantherina Rchb. f. | Epiphyte |
| 157 | Phalaenopsis sumatrana Korath. & Rchb. f. | Epiphyte |
| 158 | Pholidota imbricata Lindl. | Epiphyte |
| 159 | Pholidota ventricosa (Roxb.) Lindl. | Epiphyte |
| 160 | Plocoglottis acuminata BL. | Terrestrial |
| 161 | Plocoglottis lowii J.J. Sm. | Terrestrial |
| 162 | Pomatacalpa kunstleri (Hk. f.) J.J. Sm. | Epiphyte |
| 163 | Pomatacalpa latifolia J.J. Sm. | Epiphyte |
| 164 | Pomatacalpa naevata J.J. Sm. | Epiphyte |
| 165 | Pomatacalpa spicata Breda | Epiphyte |
| 166 | Pophyroglossum maxwelliae Ridl. | Epiphyte |
| 167 | Peroeroca clavata (Hk. f.) H. Ae. Peders | Epiphyte |
| 168 | Peroeroca pallidium (Bl.) Holtt. | Epiphyte |
| 169 | Renanthera elongata (Hk. f.) Lindl. | Epiphyte |
| 170 | Robiquetia spathulata (Bl.) J.J.Sm. | Epiphyte |
| 171 | Schoenorchis micrantha Reinw. | Epiphyte |
| 172 | Schoenorchis secundiflora (Ridl.) J.J. Sm. | Epiphyte |
| 173 | Spaghotoglottis plicata Bl. | Terrestrial |
| 174 | Taeniophyllum obtusum BL. | Epiphyte |
| 175 | Tainia paucidifolia J.J. Sm. | Terrestrial |
| 176 | Theopas secunda (Ridl.) Seidenf. | Epiphyte |
| 177 | Theogeteles alata (Roxb.) Par.& Reichb. f. | Epiphyte |
| 178 | Theleglossum carinatum Bl. | Epiphyte |
| 179 | Thelasis micrantha (Brog.) J.J. Sm. | Epiphyte |
| 180 | Thelasis obtusa Bl. | Epiphyte |
| 181 | Thrixspermum amplexicaule (Bl.) Rchb. f. | Epiphyte |
| 182 | Thrixspermum centipedu Lour. | Epiphyte |
| 183 | Trichoglottis bipencillata J.J. Sm. | Epiphyte |
| 184 | Trichoglottis cirrhifera Teijsm & Binn. | Epiphyte |
| 185 | Trichoglottis geminata (T. & Bl.) J.J. Sm. | Epiphyte |
| 186 | Trichoglottis retusa Bl. | Epiphyte |
| 187 | Trichoglottis smithii J.J. Sm. | Epiphyte |
| 188 | Trichoglottis uexkulliana J.J. Sm. | Epiphyte |
| 189 | Trichtosia aportina (Hk. f.) Krzlj. | Epiphyte |
| 190 | Trichtosia ferox Bl. | Epiphyte |
| 191 | Trichtosia gracilis Lindl. | Epiphyte |
| 192 | Vanda scandens Holtum | Epiphyte |
| 193 | Vanda dearei Rchb. f. | Epiphyte |
| 194 | Vanilla diabolica O'Byrne | Epiphyte |
| 195 | Vanilla griffithii Rchb. f. | Epiphyte |
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