

Proceedings of **Colloquium on Dered
Krian National Park**
Scientific Expedition 2016



Suggestion for Reference citation:

Aimi Syazana, S., Meekiong, K., Rohaiza, D., Syaquina, M.Y. & Miraadila, M.I. 2017. Comparison Study on Diversity of Gingers (Zingiberaceae) from Two Limestone Hills in the North Western of Sarawak. *In*: Forest Department Sarawak & Faculty of Resource Science and Technology (UNIMAS). [Meekiong, K., Azahari, O., Pungga, R.S., Wasli, M.E., Freddy, Y.K.S. & Marconi, S.J., (eds.)]. *Proceedings of Colloquium on the Dered Krian National Park – Scientific Expedition 2016*. Kuching, Sarawak. 121 – 127.

COMPARISON STUDY ON DIVERSITY OF GINGERS (ZINGIBERACEAE) FROM TWO LIMESTONE HILLS IN THE NORTH WESTERN OF SARAWAK

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Abstract

*Limestone karsts are widespread throughout the Southeast Asia and potential reservoir of biodiversity. However, this special habitat has never been clearly examined for biodiversity reservoir in the literatures. In Sarawak, majority of the karsts geological are located in the northwestern part; Bau limestone and Padawan-Serian-Tebedu limestone. The Bau limestone taxonomically has been explored since 1845 with many plant collectors such as G.D. Haviland, J.A.R. Anderson, H.N. Ridley etc. have visited here. The Padawan-Serian-Tebedu limestone areas, however, are still poorly known. Information on the gingers from the limestone habitat are still far from sufficient as no studies have been conducted in this area. Therefore, the aim of this study is to compare the diversity of ginger from the two limestone hills in the northwestern of Sarawak. Two selected limestone hills were; Gunung Payang in the Padawan-Serian Tebedu limestone areas and Gunung Doya in the Dered Krian National Park, Bau. A total of twenty-two ginger taxa representing by eleven genera were recorded from the two selected limestone hills. Seventeen taxa of ginger were recorded from Gunung Doya and 15 from Gunung Payang. Ten ginger taxa were recorded in both localities, namely *Alpinia ligulata* (K. Schum.) K. Schum., *Etingera brachychila* (Ridl.) R.M. Sm., *E. elatior* (Jack) Sm., *Globba atrosanguinea* Teijsm. & Binn., *G. brachyanthera* K. Schum., *Hornstedtia havilandii* (K. Schum.) K. Schum., *H. reticulata* (K. Schum.) K. Schum., *H. tomentosa* (Blume) Bakh.f., *Plagiostachys albiflora* Ridl. and *Zingiber acuminatum* Val. var. *borneense* R.M. Sm.*

Keywords: *Gingers, Gunung Doya, Gunung Payang, Limestone*

Introduction

Sarawak is well known with astonishing diversity of species. It is part of Borneo Island and considered as the largest state in Malaysia. The largest family under Zingiberales, Zingiberaceae is widely distributed in Sarawak. Ginger family is popular among botanists since 1800. It is widely used ever since ancient time not only because of the unique flavor and pleasant aroma but also because of their medicinal and ornamental values.

Zingiberaceae has a wide range of habitats including lowland dipterocarp forest, riverine, kerangas forest and limestone. Up to date, there are about 220 species have been recorded from Sarawak with the largest genus found is *Amomum*.

Limestone areas in Sarawak mainly located in northern west part of Sarawak; Bau limestone and Padawan-Serian-Tebedu limestone. Even though limestone is said to have rich biodiversity, this special habitat has never been clearly examined and explored for biodiversity reservoir in the literatures. Bau limestone has been explored since 1845 by G.D. Haviland, J.A.R. Anderson, H.N. Ridley and many more plant collectors. However, Padawan-Serian-Tebedu limestone area is still poorly known as there is no study of gingers conducted here. There are very few studies done on limestone before including Smith (1982) in Mulu National Park, Gobilik *et al.* (2003) and Poulsen *et al.* (2004). Thus, the aim of this study is to compare the diversity of gingers from the two limestone hills in the north western of Sarawak. Two selected limestone hills were; Gunung Payang in the Padawan-Serian Tebedu limestone areas and Gunung Doya in the Dered Krian National Park, Bau.

Materials and Methods

The diversity of gingers was sighted along the trails (foot of limestone hill) and data was recorded. Note was taken in the field. Fertile samples were collected and herbarium specimen was done. The herbarium specimens were deposited in Herbarium of Universiti Malaysia Sarawak.

Results and Discussion

A total of twenty-two gingers taxa representing by eleven genera were recorded from two selected limestone hills. Seventeen taxa of gingers were recorded from Gunung Doya and 15 from Gunung Payang (Table 1).

Ten gingers taxa were recorded in both localities, namely *Alpinia ligulata* (K. Schum.) K. Schum., *Etilingera brachychila* (Ridl.) R.M. Sm., *E. elatior* (Jack) Sm., *Globba atrosanguinea* Teijsm. & Binn., *G. brachyanthera* K. Schum., *Hornstedtia havilandii* (K. Schum.) K. Schum., *H. reticulata* (K. Schum.) K. Schum., *H. tomentosa* (Blume) Bakh.f., *Plagiostachys albiflora* Ridl. and *Zingiber acuminatum* Val. var. *borneense* R.M. Sm.

Table 1: Diversity of gingers in Gunung Doya and Gunung Payang

Species	Gunung Doya	Gunung Payang
<i>Alpinia ligulata</i> (K. Schum.) K. Schum.	/	/
<i>Amomum laxisquamosum</i> K. Schum.	/	
<i>Elettaria longituba</i> (Ridl.) Holttum	/	
<i>Etlingera brachychila</i> (Ridl.) R.M. Sm.	/	/
<i>Etlingera coccinea</i> (Blume) S. Sakai & Nagam.		/
<i>Etlingera elatior</i> (Jack) Sm.	/	/
<i>Etlingera fimbriobracteata</i> (K. Schum.) R.M. Sm.		/
<i>Etlingera foetens</i> (Blume) R.M. Sm.	/	
<i>Etlingera metrocheilolus</i> / <i>Etlingera triorgyalis</i>	/	
<i>Etlingera nasuta</i> (K. Schum.) R.M. Sm.	/	
<i>Geocharis rubra</i> Ridl.	/	
<i>Globba atosanguinea</i> Teijsm. & Binn.	/	/
<i>Globba brachyanthera</i> K. Schum.	/	/
<i>Globba muluensis</i> R.M. Sm.		/
<i>Hornstedtia havilandii</i> (K. Schum.) K. Schum.	/	/
<i>Hornstedtia phaeochoana</i> (K. Schum.) K. Schum.	/	
<i>Hornstedtia reticulata</i> (K. Schum.) K. Schum.	/	/
<i>Hornstedtia tomentosa</i> (Blume) Bakh.f.	/	/
<i>Plagiostachys albiflora</i> Ridl.	/	
<i>Scapochlamys calcicola</i> A.D. Poulsen & J. Searle	/	
<i>Zingiber acuminatum</i> Valetton var. <i>borneense</i> R.M. Sm.	/	/
<i>Zingiber coloratum</i> N.E. Br.	/	
	17	15

Comparison between two limestone hills shows that Gunung Doya is more diverse compared to Gunung Payang. This may be due to some reasons; natural disturbance, forest gaps, natural substrate, dispersion and pollination on Gunung Doya. The occurrence of gingers may have affected by desiccation, little topsoil, imbalanced nutrient supplements plus calcium toxic effect and inadequate light (Gobilik *et al.* 2003). Most of the species found were at the foot hills and at the base of the limestone hills. *Amomum laxisquamosum* found in Gunung Doya is growing well in the damp area, below the canopy at flat area whereas, *H. havilandii* can be found at alluvial soil at the base of foot hill. There are several common species that can be found at lowland forest to limestone such as *A. ligulata*, *G. atosanguinea* and *H. tomentosa*.

The number of ginger found in Gunung Doya, Bau, limestone is high compared to the number found by Poulsen *et al.* (2004). Genus *Hornstedtia* is the most diverse to be found in Gunung Doya. Several species encountered was endemic to Borneo; *G. rubra*, *H. havilandii*, and *Z. acuminatam* var. *borneense*. Most of the gingers found are well distributed in lowland dipterocarp forest to up hills however, *S. calcicola* only known from limestone area so far. Two ginger species; *E. fimbriobracteata* and *H. havilandii* also found in limestone ridge Tabin, in eastern Sabah. The occurrence of these two species

indicates that there was natural disturbance occurred in the forest before. They can be found abundantly at the logging road especially (Gobilik *et al.* 2003; Gobilik & Limbawang 2010).

Based on Table 2, Bau limestone has rich gingers diversity compared to Tabin Wildlife Reserve. However, Mulu National Park has the highest composition of gingers among the areas since the study site covered until sub-montane (Smith, 1982).

The genus *Boesenbergia* is more specious in Mulu National Park compared with other areas. This genus is a small herb on the forest floor, can be found in both alluvial and limestone areas. Common *Boesenbergia* species found in Mulu were from the group with creeping habit and have single-leaved shoots (Smith, 1982). However, the occurrence of genus *Zingiber* in Mulu is low when compared to Gunung Doya and Gunung Payang or Bau limestone. The genus *Scaphochlamys* recorded only from Dered Krian National Park and Bau limestone areas. According to Meekiong *et al.* (2010) and Mas Izzaty *et al.* (2013), the distribution of this genus in Sarawak is from northern west to central part of the state.

To conclude, the occurrence of gingers in limestone area may be affected by the soils in that particular area or any additional nutrient supplements such as calcium carbonate (CaCO_3). Besides, adaptability of the species to a certain condition is also very important.

Table 2: Comparison of gingers in Dered Krian NP, Bau limestone, Tabin Wildlife Reserve and Gunung Mulu NP.

Species	Dered Krian NP	Bau Limestone*	Tabin	Mulu NP
<i>Amomum anomalum</i> R.M. Sm.				/
<i>Amomum coriaceum</i> R.M. Sm.				/
<i>Amomum laxisquamosum</i> K. Schum	/	/		/
<i>Alpinia argentea</i> (B.L. Burt & R.M. Sm.) R.M. Sm.				/
<i>Alpinia aquatica</i> (Retz.) Roscoe			/	/
<i>Alpinia hansenii</i> R.M. Sm.				
<i>Alpinia ligulata</i> (K. Schum.) K. Schum.	/	/		
<i>Alpinia tamacuensis</i> R.M. Sm.				/
<i>Alpinia nieuwenhuizii</i> Valetton			/	
<i>Boesenbergia burttiana</i> R.M. Sm.				/
<i>Boesenbergia cordata</i> R.M. Sm.				/
<i>Boesenbergia flavorubra</i> R.M. Sm.				/
<i>Boesenbergia gracilipes</i> (K. Schum.) R.M. Sm.				/
<i>Boesenbergia grandis</i> R.M. Sm.				/
<i>Boesenbergia kerbyi</i> R.M. Sm.				/
<i>Boesenbergia orbiculata</i> R.M. Sm.				/
<i>Boesenbergia pulchella</i> (Ridl.) Merr. var. <i>attenuata</i> R.M. Sm.	/			
<i>Boesenbergia variegata</i> R.M. Sm.				/
<i>Elettaria longituba</i> (Ridl.) Holttum			/	
<i>Elettaria rubida</i> Ridl.	/	/		/
<i>Etlintera brachychila</i> (Ridl.) R.M. Sm.	/	/		
<i>Etlintera brevilabrum</i> (Valetton) R.M. Sm.			/	
<i>Etlintera fimbriobracteata</i> (K. Schum.) R.M. Sm.			/	/
<i>Etlintera littoralis</i> (J. Koenig) Giseke	/			
<i>Etlintera pyramidosphaera</i> (K. Schum.) R.M. Sm.			/	/
<i>Etlintera triorgyalis</i> (Baker) R.M. Sm.	/	/		

<i>Geocharis rubra</i> Ridl.	/			
<i>Geostachys penangensis</i> Ridl.				/
<i>Globba argentiana</i>				/
<i>Globba atrosanguinea</i> Teijsm. & Binn.	/	/		
<i>Globba bracyanthera</i> K. Schum (syn.: <i>G. affinis</i> Rendle)	/	/		
<i>Globba franciscii</i> Ridl.			/	/
<i>Globba pendula</i> Roxb.*	/			
<i>Globba tricolor</i> Ridl.	/			
<i>Hedychium muluense</i> R.M. SM.				/
<i>Hornstedtia havilandii</i> (K. Schum.) K. Schum.	/	/	/	/
<i>Hornstedtia phaeochoana</i> (K. Schum.) K. Schum.	/			
<i>Hornstedtia tomentosa</i> (Blume) Bakh.f.	/	/		
<i>Plagiostachys crocydocalyx</i> (K. Schum.) B.L. Burt & R.M. Sm.	/			
<i>Plagiostachys strobilifera</i> (Baker) Ridl.			/	
<i>Scaphochlamys calcicola</i> A.D. Poulsen & J. Searle	/	/		
<i>Scaphochlamys petiolata</i> (K. Schum.) R.M. Sm.		/		
<i>Scaphochlamys reticosa</i> (Ridl.) R.M. Sm.	/	/		
<i>Zingiber acuminatum</i> Valetton var. <i>borneense</i> R.M. Sm.	/	/		
<i>Zingiber albiflorum</i> R.M. Sm.				/
<i>Zingiber cf coloratum</i> N.E. Br.			/	
<i>Zingiber flagelliforme</i> Mood & Theilade			/	
<i>Zingiber griffithii</i> Baker	/	/		/
<i>Zingiber longipedunculatum</i> Ridl.	/			
	20	14	11	23

*Poulsen *et al.* (2004)

Acknowledgement

We would like to thank Universiti Malaysia Sarawak (UNIMAS) for the facilities and accommodation throughout the fieldtrips and partly funded our research via grant: C09/SpSTG/1360/16/2, Department of Forest Sarawak for the permit, to the SAR (Department of Forest Sarawak Herbarium) for permission to examine the specimens. Thanks also to Dr Effendi Wasli, Dr Freddy Yeo Kuok San, Dr Zinnirah Shabdin, Sekudan Tedong, Hidir Marzuki, Mohd Rizan Abdullah, Salim Arip, Nurul Amanina Md Raub, Nurul Izzati Azaman, Nor Azieya Baharudin, Muslihah Mahusin from UNIMAS and Haniza Razali, Yazid Kalbi and Yahud Wat from the Department of Forest Sarawak. Special thanks to the local communities from Kampung Mawang Riuh, Tubih Mawang and Kampung Seromah for their helps.

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