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Gingers Species Diversity and Distribution along a Natural Trail of Lojing Highlands, Kelantan

Suganthi Appalasamy^{1,4*}, Sarmila Rathamanalan¹, Shalini Arsogah¹, Sutati Harni¹, Koh Kay Sam¹, Nazahatul Anis Amaludin¹, Boon Jia Geng², Jayaraj Vijaya Kumaran¹, Nivaarani Arumugam¹ & Sreeramanan Subramaniam³

¹ Universiti Malaysia Kelantan, Faculty of Earth Science, Department of Natural Resources and Sustainability, 17600, Jeli, Kelantan, Malaysia.

² Universiti Malaysia Kelantan, Faculty of Bioengineering and Technology, 17600, Jeli, Kelantan, Malaysia.

³ Universiti Sains Malaysia, School of Biological Sciences, 14300 Minden, Pulau Pinang, Malaysia.

⁴ Institute of Food Security and Sustainable Agriculture, Universiti Malaysia Kelantan, 17600, Jeli, Kelantan, Malaysia.

E-mail: suganthi.a@umk.edu.my

Abstract. The ginger flora at Lojing Highlands, Kelantan is understudied and poorly recorded. A study was done in this tourist frequented area to determine the diversity of Zingiberaceae. Ginger samples were collected along the natural trail of Lojing Highlands. A total of 18 species from 7 genera of gingers were recorded in Lojing Highlands, Kelantan, namely *Alpinia* (3 species), *Wurfbainia* (1 species), *Etilingera* (6 species), *Hornstedtia* (1 species), *Geostachys* (1 species), *Globba* (4 species), *Zingiber* (2 species). Raising plantation crops and anthropogenic pressures around this highland could affect the diversity and abundance of the wild gingers population.

1. Introduction

There are only a few studies reported on the wild ginger species in Kelantan, Malaysia and diversity information in this state on wild gingers are considered still in need of extensive findings and diversity study. In the past few years, a multitude of new species and genera had been discovered in lowland and highland areas of Malaysia where extensive research had been carried out [1,2,3,4,5,6,7,8]. Around 200 ginger species of the family Zingiberaceae belonging to 19 genera had been reported in Peninsular Malaysia [9]. However, no report was found published and many species remain undescribed and unreported for Zingiberaceae in Kelantan.

Lojing Highlands is situated within the south-western corner of Kelantan state with an area size of 1817 km² and located at the altitude of 800 to 1000 meters above sea level (a.s.l.). This area (Figure 1) [10] is a highland tropical rainforest which is rich of fauna and flora and populated by indigenous people, the Temiars.

The highland is categorized as an upper dipterocarp forest. However, the rapid conversion of large scale forest land to agricultural area for fruit and vegetable farm development at Lojing Highlands has led to the loss of wild ginger diversity [11]. Wild gingers in this highland was found to be growing along the natural trail and these trails are frequently used by the guides and visitors enroute to watch



Rafflesia kerri Meijer blooming. Past observations by the authors for wild gingers along this natural trail has shown that some of the previously recorded gingers were cut down to make the trail wider and unobstructed by these wild gingers. Hence, opening of forest land for farms and anthropogenic pressures causes the depletion of the population of wild gingers and as a result, concerns had been raised about the possibility of wild gingers diversity loss at the study area. The loss of these wild gingers could also impact the Temiars as they use these gingers as food and medicinal plant in their daily lives. Moreover, there is no preliminary studies that has been done on diversity of wild ginger species in Lojing Highlands, Gua Musang district, Kelantan. Thus, over time, there will be no published records of the existence, diversity and abundance of wild ginger species at these areas which this study aimed to report.

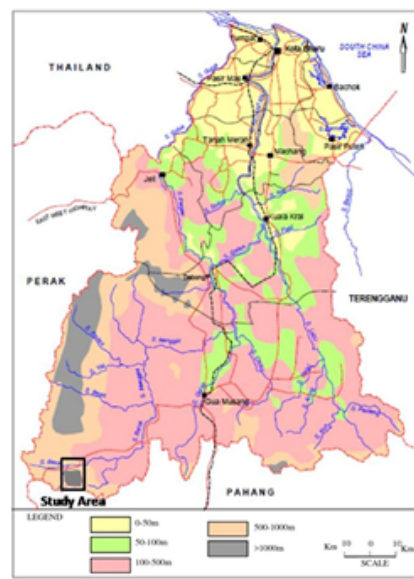


Figure 1. General topography area of Gua Musang, Kelantan with indication of study area near Kampung Jedip, Lojing, Kelantan in black square [10].

2. Methodology

Sampling was conducted in the month of July in 2017 along the nature trail which is around 2.1 km long. The designated trail was found near Kampung Jedip which is located near Sungai Denkong (Denkong River), Lojing Highlands, Jajahan Gua Musang, Kelantan (Figure 1) [10]. This trail is commonly used by the indigenous people ie. the Temiars and the visitors to this highland. Ginger plants along the trail was observed and their morphological characteristics and natural habitats were recorded. The living plants were collected for planting in Universiti Malaysia Kelantan Jeli Campus greenhouse and plant parts were also collected for herbarium specimen preparation. The latitude and longitude of the sampling area were recorded using Global Positioning System (Garmin GPSMAP 64s). The dried herbarium specimens were deposited in Muzium Sumber Asli of Universiti Malaysia Kelantan Jeli Campus. Specimens were identified by referring to descriptions by [1,2,7,12,13,14,15,16].

3. Results and Discussion

A total of 18 Zingiberaceae species were sampled along the 2.1 km natural trail of Lojing Highlands, Kelantan which were categorized into seven genera (Table 1) (Figure 2). The distribution of wild gingers found along the natural trail was shown in Figure 2. The diversity of Zingiberaceae was comprised of *Alpinia* (3 species), *Wurfbainia* (1 species), *Etingera* (6 species), *Hornstedtia* (1 species), *Geostachys* (1 species), *Globba* (4 species) and *Zingiber* (2 species) as tabulated in Table 1.

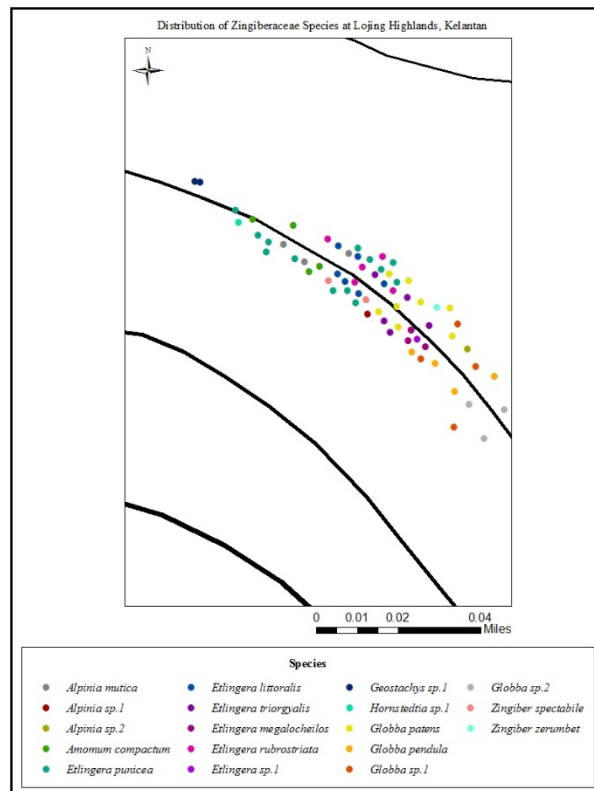


Figure 2. The diversity and distribution of Zingiberaceae species along natural trail of Lojing Highlands, Kelantan.

A cluster of *Hornstedtia* sp. 1 plant was found at the altitude of 843 m a. s. l. Only one individual of that species was found along the study area. The leaves are soft and shiny and the apex of the leaves is caudate and it is about 45 cm long. The most abundant genus found along the natural trail of Lojing Highlands, Kelantan is *Etlingera*. Six species of *Etlingera* had been found and five species which are *E. punicea* (Roxb.) R. M. Smith, *E. littoralis* (Koenig) Giseke, *E. triorgyalis* (Bak.) R. M. Smith, *E. megalochelios* (Griff.) A. D. Poulsen and *E. rubrostriata* (Holttum) C. K. Lim had been identified successfully due to their inflorescence. *E. punicea* was the most abundant as the plants were observed all along the trail. *E. punicea*, locally known by the Temiars as *Chalong*, can grow up to 7 m tall and more likely to grow in wet soil. *Etlingera littoralis*, locally known as *Kedungkel*, has red inflorescences with slightly yellow on the margin while *E. megalochelios* has entirely red inflorescences. *Etlingera triorgyalis* was found at the altitude of 893 m a. s. l. The leaves have strong pepper smell when crushed. *Etlingera rubrostriata* can be easily identified even if there is no inflorescences due to the maroon oblique pattern on the leaves. Being locally known as *Apus Tapi*, *Etlingera* sp. was spotted at the altitude of 893 m above sea level. The leaves are coarse and the apex of the leaves are cirrhose.

Four species of *Globba* were found at Lojing Highlands, Kelantan and only two of it had been identified. These plants were spotted at relatively higher altitudes (850 – 1000 m) near the streams and a small waterfall in the study area. This genus is well known for its unusual inflorescences as they hang out on the air from the bracts, thus, the plant is commonly known as ‘Dancing Ladies Ginger’. *Globba patens* Miq. known as *Merian Biasa* has striking yellow flowers with red dots along with caudate leaf apex. *Globba pendula* locally known as *Halia Hutan* is one of the common wild ginger found in this trail. Only a few clumps of *Globba* sp.1 and *Globba* sp.2 were observed along the trail. The leaves of *Globba* sp.1 is ovate while those of *Globba* sp.2 is narrowly lanceolate.

Alpinia mutica can be easily recognised due to the presence of fruits and inflorescences. The fruits turn from green to yellow when they are ripe. Locally known as *Chengkenam*, the plant can grow up to two metres tall. *Alpinia mutica*, *Alpinia* sp.1 and *Alpinia* sp.2 can be found widely at 800 to 950 m a. s. l. in Lojing Highlands, Kelantan. There are only one species of *Wurfbainia* found at the elevation of 843 m. *Wurfbainia compacta* grows in a clump and requires partial shade. Each inflorescence consists up to two fruits. The smooth fruits are considered matured when the corolla had shed and feels hard when touched. It is unsure if this species was introduced to this highland by the local Temiars.

Table 1. Species, local name by the Temiar people and habitat of wild gingers found along natural trail of Lojing Highlands, Kelantan.

Species	Collector's Number	Local Name	Habitat
<i>Alpinia mutica</i> Roxb.	SR 43, 46, 50	Chengkenam	Humid evergreen forest
<i>Alpinia</i> sp.1	SR 04	Apus yep	Under forest canopy
<i>Alpinia</i> sp.2	SR 62	Apus selindin	Under forest canopy
<i>Amomum compactum</i> Sol. ex Maton / <i>Wurfbainia compacta</i> (Sol. ex Maton) Škorničk. & A.D. Poulsen	SR 48, 49, 55, 56	Apus	Damp and shady area
<i>Etilingera punicea</i> (Roxb.) R. M. Smith	SR 26, 27, 32, 33, 34, 44, 45, 47, 51, 52, 53, 54, 57	Chalong	Humid evergreen forest
<i>Etilingera littoralis</i> (Koenig) Giseke	SR 35, 38, 39, 41, 42,	Kedungkel	Humid evergreen forest
<i>Etilingera triorgyalis</i> (Bak.) R.M. Smith	SR 18, 19, 20, 21, 63	Apus darat	Wet slopes
<i>Etilingera megalocheilos</i> (Griff.) A. D. Poulsen	SR 15, 16, 17,	Apus darat	Wet slopes
<i>Etilingera rubrostriata</i> (Holtum) C.K.Lim	SR 23, 25, 28, 30, 31	Apus darat	Damp and higher altitude areas
<i>Etilingera</i> sp.	SR 14,	Apus tapi	Humid evergreen forest
<i>Geostachys</i> sp.	SR 59, 60	Apus darat	Humid evergreen forest
<i>Hornstedtia</i> sp.	SR 58	Apus darat	Near riverbanks
<i>Globba patens</i> Miq.	SR 09, 11, 18, 22, 36, 37, 64, 65	Merian Biasa	Along the streams
<i>Globba pendula</i> Miq.	SR 05, 06, 12, 14	Apus hutan	Near riverbanks
<i>Globba</i> sp.1	SR 07, 08, 10, 13	Apus sungai	Near riverbanks
<i>Globba</i> sp.2	SR 01, 02, 03,	Apus sungai	Along the streams
<i>Zingiber</i> sp.1	SR 61	Apus darat	Humid evergreen forest
<i>Zingiber spectabile</i> Griff.	SR 24, 40	Apus darat	Humid evergreen forest

Two species of *Zingiber* was found at Lojing Highlands, Kelantan which are *Zingiber spectabile* Griff. and *Zingiber* sp.1 *Zingiber spectabile* was only spotted at two places between the elevations of 850 m to 870 m. The plant can reach up to 5 m tall and is well known for its inflorescence which resembles a beehive. The bracts changes colour from yellow to red when it matures and its flower only lasts for a day. A young clump of *Zingiber* sp.1 was found at the height of 894 m. Only one individual of this species was spotted at the study area in Lojing Highlands.

Only 18 species were found along this natural trail and other trails could not be explored at the time of the sampling as the forest was covered with giant bamboos in clumps and new trails had to be made to explore through the dense thorny bushes of rattans. This resulted in some of species were found

only once (single clump) along this natural trail. However, the number of flowering species in this natural trail (18 species) was higher than the number of flowering Zingiberaceae species (six species) recorded in natural trails of Pangkor Island Forest Reserves [17]. This could be attributed to the month of sampling in which the microclimate played a vital role in influencing flowering of certain wild ginger plant as discussed in [17]. [18] have reported 64 species from 13 genera found along the 15 km long nature trail and 4 km forest trail in Tawau Hills Park, Sabah. This number was much higher compared to this study outcome which could be due to the trail length covered during the sampling. A much longer trail or inclusion of multiple different trails in Lojing Highlands should be included in future for a comprehensive reporting on Zingiberaceae species diversity. Repeated sampling at different month (raining season and drought season) could also present a wholesome diversity data of flowering wild ginger species in this highland.

4. Conclusion

This study had listed 18 ginger species found along the natural trail of Lojing Highlands, Kelantan. However only ten specimens were identified till species level owing to the presence of inflorescence which is an important morphology character in species identification in Zingiberaceae. More sampling at different temporal and spatial points are needed for further identification and description about the wild ginger species and their uses among indigenous people in Kelantan.

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