



Malaysian limestone orchids status: diversity, threat and conservation

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Key words

conservation
diversity
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threat

Abstract To date, a total of 288 species from 96 genera were identified from the limestone areas in Perlis and Padawan-Bau, Sarawak, of which many of these are restricted to limestone habitat and either endemic to Perlis or to Sarawak. Knowledge and data obtained from the field observation over the past 8 years leads us to report that at least 15 species endemic to limestone has become rare in the wild in Perlis, Bau and Padawan Sarawak. This was mainly attributed by: i) lack of emphasis by the government on understanding and protecting biodiversity in this kind of habitat; ii) lack of scientists willing to do research in dangerous and disaster prone limestone habitat; and iii) lack of knowledge and awareness among local communities on the importance of conserving and utilizing their natural resources in a sustainable manner.

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INTRODUCTION

Orchids are the largest flowering plant family in Malaysia (including Sabah and Sarawak) with about 2 000 species, of which 700 are recorded from limestone. Threats to orchids on limestone include small-scale logging (extracting timber by the locals for building materials), quarrying, land clearance for traditional farming, and collecting for trade, especially of genera such as *Paphiopedilum* and *Phalaenopsis*. International legal protection is provided by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Biological Diversity (CBD), national legislation by the Forest Ordinance 1954, Wildlife Protection Ordinance 1990, Wildlife Enactment 1997, Wild Life Protection Ordinance 1998 (Sarawak).

Two major limestone hills areas of Malaysia were identified for orchid diversity study, located in Perlis and Sarawak.

Perlis (6°15' N, 100°6' to 100°23' E) is the smallest northernmost state in Peninsular Malaysia. It has two monsoons: warm and dry (23–36 °C) from January to April, and wet and slightly cooler (23–32 °C) from September to December. The average annual rainfall is 1 735 mm. The rainfall peak is in October and the lowest in April–May (Meteorology Department Malaysia, years 2002–2004). In age, the Perlis limestones range from Cambrian to late Triassic (Jasin & Harun 2002).

Padawan is in the Kuching district, Sarawak, Borneo (1°10' N 110°16' E). It has a hot and humid climate throughout the year, with temperatures of 23.1–31.6 °C, and an average annual rainfall of 4 090 mm (Malaysian Meteorological Service Database 2002, Mineral and Geoscience Department Database 2002). In age, the Padawan limestones range from Upper Jurassic to Upper Cretaceous (Wilford 1965).

MATERIAL AND METHODS

In both areas limestone hills and some adjacent landscape features were selected for this survey (Table 1). In Sarawak, two rivers were included that flow through the limestone hills and valleys. In Perlis Gunung Perlis was included in full, as there is no distinct boundary between the limestone and granite parts that form the mountain.

This study is based on material in KEP, KLU, SAR, SING and UKMB, as well as from field observations. Identification down to species level of most material was possible, because the orchid flora of Peninsular Malaysia is described in three subsequent accounts: Ridley (1924), Holttum (1964), Seidenfaden & Wood (1992). The exploration of the Borneo orchids is less far advanced. Only checklists have been published: Ridley (1896), Masamune (1942) and Beaman et al. (2001). The following have also been used for identification: Dressler (1981), Comber (1990, 2001), Vermeulen (1991), Pridgeon (1992), Chan et al.

Table 1 List of sites visited in both areas.

Perlis	Padawan
Bukit Bintang	Gunung Baju
Bukit Chabang	Gunung Bangan
Bukit Genting Hantu	Gunung Batu Putih
Bukit Gua Ikan	Gunung Bekap
Bukit Mata Ayer	Gunung Bewang
Bukit Merah	Gunung Braang
Bukit Rongkit	Gunung Ganjing
Bukit Teluk Tapu	Gunung Gayu
Bukit Wang Pisang	Gunung Mangan
Bukit Wang Mu	Gunung Manok
Gunung Perlis (granite)	Gunung Mentawa
	Gunung Mesih
	Gunung Papak
	Gunung Regu
	Gunung Rinu
	Gunung Serrad
	Gunung Timungan
	Gunung Timurang
	Gunung Tuang
	Sungai Abang (a river)
	Sungai Serin (a river)

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Table 2 List of orchid species collected from Perlis Limestone Area.

Taxa	Bukit Rongkit	Bukit Merah	Bukit Bintang	Bukit Genting Hantu	Bukit Wang Mu	Bukit Teluk Tapu	Bukit Gua Ikan	Bukit Wang Tangga	Bukit Wang Pisang	Bukit Mata Ayer	Bukit Chabang	Gunung Perlis
<i>Acampe rigida</i>		+										
<i>Aerides odorata</i> .	+	+			+							
<i>Agrostophyllum</i> sp.												+
<i>Apotasia nuda</i>												+
<i>Ascocentrum miniatum</i>	+	+				+	+					
<i>Ascocentrum</i> sp.									+			
<i>Biermannia ciliata</i>									+			
<i>Bulbophyllum dentiferum</i>					+							
<i>Bulbophyllum lilacinum</i>	+											
<i>Bulbophyllum microglossum</i>						+						
<i>Bulbophyllum mutabile</i>												+
<i>Bulbophyllum purpurascens</i>	+	+					+	+				
<i>Bulbophyllum taeniophyllum</i>												+
<i>Bulbophyllum</i> sp. 1	+		+									+
<i>Bulbophyllum</i> sp. 2												+
<i>Calanthe</i> sp.	+											+
<i>Ceratostylis radiata</i>												+
<i>Ceratostylis subulata</i>												+
<i>Chamaeanthus</i> sp.									+			
<i>Cleisostoma discolor</i>						+						
<i>Cleisostoma subulatum</i>	+											
<i>Cleisostoma williamsonii</i>			+									
<i>Coelogyne trinervis</i>	+								+			
<i>Coelogyne</i> sp. 1		+										
<i>Coelogyne</i> sp. 2												+
<i>Coelogyne</i> sp. 3							+					
<i>Cymbidium aloifolium</i>	+			+		+	+				+	
<i>Cymbidium ensifolium</i> ssp. <i>haematodes</i>	+			+		+						
<i>Cymbidium lancifolium</i>												+
<i>Cymbidium</i> sp. 1	+											
<i>Dendrobium acerosum</i>	+											
<i>Dendrobium aloifolium</i>		+										
<i>Dendrobium anosmum</i>					+							
<i>Dendrobium concinnum</i>		+										
<i>Dendrobium crumenatum</i>	+											
<i>Dendrobium hughii</i>												+
<i>Dendrobium indivisum</i>					+			+				
<i>Dendrobium indivisum</i> var. <i>pallidum</i>	+	+										
<i>Dendrobium kentrophyllum</i>												+
<i>Dendrobium leonis</i>	+	+						+				
<i>Dendrobium linguella</i>		+						+	+			
<i>Dendrobium salaccense</i>		+		+					+			
<i>Dendrobium secundum</i>	+	+							+			
<i>Dendrobium setifolium</i>												+
<i>Dendrobium trinervium</i>				+	+	+						
<i>Dendrobium truncatum</i>									+			
<i>Dienia ophrydis</i>		+							+			
<i>Eria densa</i>												+
<i>Eria floribunda</i>												+
<i>Eria javanica</i>		+	+	+					+			
<i>Eria mucronata</i>				+					+			
<i>Eria nutans</i>												+
<i>Eria ochracea</i>									+			
<i>Eria ornata</i>	+	+		+								
<i>Eria tenuiflora</i>												+
<i>Eria</i> sp.												+
<i>Eulophia andamanensis</i>			+	+								+
<i>Flickingeria angustifolia</i>												+
<i>Flickingeria bancana</i>												+
<i>Flickingeria convexa</i>												+
<i>Flickingeria fimbriata</i>	+											
<i>Flickingeria pallens</i>	+											
<i>Flickingeria xantholeuca</i>				+								
<i>Flickingeria</i> sp. 1	+											
<i>Flickingeria</i> sp. 2				+								
<i>Flickingeria</i> sp. 3		+										
<i>Flickingeria</i> sp. 4			+									
<i>Flickingeria</i> sp. 5	+											
<i>Gastrochilus hainanensis</i>		+										
<i>Gastrodia javanica</i>												+
<i>Grosourdya incurvicalar</i>									+			
<i>Grosourdya muscosa</i>												+

Table 2 (cont.)

Taxa	Bukit Rongkit	Bukit Merah	Bukit Bintang	Bukit Genting Hantu	Bukit Wang Mu	Bukit Teluk Tapu	Bukit Gua Ikan	Bukit Wang Tangga	Bukit Wang Pisang	Bukit Mata Ayer	Bukit Chabang	Gunung Perlis
<i>Habenaria carnea</i>	+	+	+						+			
<i>Habenaria reflexa</i>				+					+			
<i>Kingidium deliciosum</i>	+	+	+	+			+		+			
<i>Liparis aurita</i>									+			
<i>Liparis cespitosa</i>												+
<i>Liparis viridiflora</i>		+										
<i>Luisia</i> sp.	+											
<i>Macodes petola</i>												+
<i>Malaxis calophylla</i>									+			
<i>Malaxis prasina</i>									+			
<i>Malaxis</i> sp. 1									+			
<i>Malaxis</i> sp. 2									+			
<i>Malaxis</i> sp. 3												+
<i>Nephelaphyllum pulchrum</i>												+
<i>Nervilia plicata</i>				+					+			
<i>Nervilia punctata</i>									+			
<i>Oberonia ensiformis</i>		+										
<i>Oberonia langbianensis</i>	+											
<i>Oberonia</i> sp.		+										
<i>Panisea uniflora</i>									+			
<i>Paphiopedilum niveum</i>	+	+	+									
<i>Pennilabium struthio</i>									+			
<i>Pholidota imbricata</i>	+	+				+			+			+
<i>Pholidota recurva</i>												+
<i>Pholidota</i> sp.	+											
<i>Podochilus lucescens</i>	+	+	+	+	+				+			
<i>Polystachya concreta</i>	+											
<i>Pomatocalpa andamanica</i>	+	+			+	+			+			
<i>Pomatocalpa spicata</i>					+				+	+		
<i>Porpax</i> sp.									+			
<i>Renanthera</i> sp.												+
<i>Renantherella histrionica</i>	+	+		+								
<i>Spathoglottis plicata</i>					+							
<i>Stereosandra javanica</i>												+
<i>Taeniophyllum intermedium</i>												+
<i>Tainia speciosa</i>												+
<i>Thelasis pygmaea</i>		+	+						+			
<i>Thelasis rhomboglossa</i>	+											
<i>Thrixspermum pensile</i>												+
<i>Trichoglottis bipunctata</i>				+	+		+					
<i>Trichoglottis cirrhifera</i>	+	+			+	+	+					
<i>Trichotosia gracilis</i>												+
<i>Tropidia curculigoides</i>	+			+								
<i>Tropidia</i> sp.		+										
<i>Tuberolabium</i> sp.	+											
Total number of taxa	36	30	10	17	11	10	7	4	1	1	1	35

(1994), Wood & Cribb (1994), Turner (1995), Wood (1997, 2001), Julaihi (2001), Rusea et al. (2001). Wherever possible, type specimens, or images of types, were consulted from K, KEP, KLU, L, SAR, SING, UKMB.

RESULTS AND DISCUSSIONS

A total of 288 taxa in 96 genera were recorded, 117 from Perlis (Table 2) and 188 from Padawan (Table 3). *Bulbophyllum reticulatum*, *Cleisostoma discolor*, *Dendrobium truncatum*, *Dossinia marmorata*, *Eulophia andamanica*, *Habenaria carnea*, *Malaxis prasina*, *Paphiopedilum stonei*, *Phalaenopsis bellina* and *Pomatocalpa andamanica* are endemic to limestone. *Bulbophyllum reticulatum*, *Paphiopedilum stonei* and *Phalaenopsis bellina* are endemic to Sarawak. *Habenaria carnea*, *Malaxis prasina*, *Paphiopedilum niveum* and *Pomatocalpa andamanica* are endemic to the limestone area extending from southern Thailand to Langkawi island, and including Perlis. *Phalaenopsis coch-*

learis was categorized as Critically Endangered; *Bulbophyllum reticulatum*, *Paphiopedilum stonei* and *Vanda scandens* as Endangered (1997 and 2006 IUCN Red List criteria).

As for the Padawan limestones, a 3.1 km² area harboured 18 % of the total Sarawak orchids species and 40 % of the genera. In Perlis, a 0.96 km² plot harbours 12.3 % of the total Peninsular Malaysian orchid species and 35.0 % of the genera. This remarkable diversity is more difficult to explain. We suggest a varied topography and geology, and favourable climatic conditions would offer the best explanations. The number of new records in both areas is remarkably high. In Perlis a total of 62 species were identified as new records (Table 4) whilst Padawan has 73 species (Table 5).

The high number of new records in both areas can be attributed to insufficient collecting in the past. Indeed, the orchid flora of both areas studied is poorly represented in herbaria.

Increasingly, illegal collecting is a problem in both areas. On a large scale, plants are collected to be exported for sale to orchid

Table 3 List of orchid species collected from Padawan Limestone Area.

Taxa	G. Baju	G. Bangan	G. Batu Putih	G. Bekap	G. Bewang	G. Braang	G. Ganjing	G. Gayu	G. Mangan	G. Manok	G. Mentawa	G. Mesih	G. Papak	G. Regu	G. Rinu	G. Serrad	G. Timungan	G. Timurang	G. Tuang	Sg. Abang	Sg. Serin
<i>Abdominea minimiflora</i>		+																+			
<i>Acanthephippium</i> sp.				+					+												
<i>Acropsis liliifolia</i>			+				+		+		+								+		
<i>Agrostophyllum bicuspidatum</i>	+		+	+			+		+							+	+				
<i>Agrostophyllum longifolium</i>			+									+									
<i>Agrostophyllum majus</i>														+			+				
<i>Agrostophyllum sumatranum</i>				+														+	+		
<i>Agrostophyllum</i> sp.				+												+					
<i>Appendicula anceps</i>							+		+			+									
<i>Appendicula cornuta</i>									+				+						+		
<i>Appendicula pendula</i>									+						+			+			
<i>Appendicula purpurascens</i>	+								+		+		+			+					
<i>Appendicula ramosa</i>																		+			
<i>Appendicula undulata</i>	+											+					+	+			
<i>Appendicula</i> sp. 1				+																	
<i>Appendicula</i> sp. 2				+																	
<i>Appendicula</i> sp. 3												+									
<i>Arundina graminifolia</i>					+															+	+
<i>Biermannia</i> sp.																		+			
<i>Brachypeza indusiata</i>				+															+		
<i>Bromheadia finlaysonianae</i>									+												
<i>Bulbophyllum acuminatum</i>				+													+	+			
<i>Bulbophyllum apodum</i>			+	+		+					+								+		
<i>Bulbophyllum armeniacum</i>				+															+		
<i>Bulbophyllum blumei</i>	+		+				+		+			+									
<i>Bulbophyllum botryophorum</i>											+						+				
<i>Bulbophyllum compressum</i>							+		+												
<i>Bulbophyllum coniferum</i>																			+		
<i>Bulbophyllum flammuliferum</i>	+		+						+									+			
<i>Bulbophyllum flavescens</i>	+			+													+	+			
<i>Bulbophyllum gracillimum</i>				+																	
<i>Bulbophyllum longiflorum</i>	+		+				+		+												
<i>Bulbophyllum purpurascens</i>											+		+				+	+			
<i>Bulbophyllum reticulatum</i>									+				+		+		+				
<i>Bulbophyllum tortuosum</i>											+										
<i>Bulbophyllum vaginatum</i>																	+				
<i>Bulbophyllum vermiculare</i>				+																	
<i>Bulbophyllum</i> sp. 1 sect. <i>Aphanobulbon</i>																				+	
<i>Bulbophyllum</i> sp. 2				+																	
<i>Bulbophyllum</i> sp. 3	+																				
<i>Bulbophyllum</i> sp. 4							+		+												
<i>Bulbophyllum</i> sp. 5				+																	
<i>Bulbophyllum</i> sp. 6																		+			
<i>Bulbophyllum</i> sp. 7				+																	
<i>Bulbophyllum</i> sp. 8	+		+				+		+												
<i>Calanthe</i> sp.									+							+					+
<i>Cleisostoma discolor</i>				+																	+
<i>Cleisostoma nieuwenhuisii</i>																		+	+		
<i>Cleisostoma striatum</i>																		+			
<i>Cleisostoma subulatum</i>													+								
<i>Cleisostoma</i> sp. 1	+						+		+												
<i>Cleisostoma</i> sp. 2							+														
<i>Coelogyne asperata</i>																	+	+			
<i>Coelogyne dayana</i>	+		+	+					+												
<i>Coelogyne incrassata</i>	+			+					+												
<i>Coelogyne mayeriana</i>									+												
<i>Coelogyne prasina</i>											+										
<i>Coelogyne rochussenii</i>			+																		
<i>Coelogyne sanderiana</i>				+					+												
<i>Coelogyne swaniana</i>							+														
<i>Coelogyne</i> sp. 1									+												
<i>Coelogyne</i> sp. 2				+																	
<i>Coelogyne</i> sp. 3																	+				
<i>Coelogyne</i> sp. 4				+														+			
<i>Coelogyne</i> sp. 5				+					+									+			
<i>Coelogyne</i> sp. 6																+					
<i>Corybas pictus</i>				+							+							+			
<i>Corymborkis veratrifolia</i>						+															
<i>Cymbidium finlaysonianum</i>			+								+						+				
<i>Cymbidium rectum</i>											+										
<i>Cymbidium</i> sp. 1																	+				
<i>Cymbidium</i> sp. 2			+				+		+												
<i>Dendrobium acinaforme</i>				+					+												
<i>Dendrobium anosmum</i>																	+				
<i>Dendrobium clavator</i>																	+				

Table 3 (cont.)

[illegible]

Table 3 (cont.)

Taxa	G. Baju	G. Bangan	G. Batu Putih	G. Bekap	G. Bewang	G. Braang	G. Ganjing	G. Gayu	G. Mangan	G. Manok	G. Mentawa	G. Mesih	G. Papak	G. Regu	G. Rinu	G. Serrad	G. Timungan	G. Timurang	G. Tuang	Sg. Abang	Sg. Serin
<i>Pholidota</i> sp. 1				+												+					
<i>Pholidota</i> sp. 2				+												+	+				
<i>Phreatia secunda</i>				+																	
<i>Plocoglottis acuminata</i>		+																+			
<i>Plocoglottis</i> sp.																+					
<i>Plocoglottis</i> sp.			+																		
<i>Podochilus lucescens</i>	+		+	+			+			+		+				+	+	+			
<i>Podochilus</i> sp.																		+			
<i>Pomatocalpa kunstleri</i>																		+			
<i>Pomatocalpa</i> sp.									+									+			
<i>Pteroceras</i> sp.				+														+			
<i>Rhynchosstylis gigantea</i>																		+			
<i>Rhynchosstylis</i> sp.																	+				
<i>Robiquetia spatulata</i>																				+	
<i>Taeniophyllum filiforme</i>				+																	
<i>Taeniophyllum</i> sp.																		+			
<i>Thelasis capitata</i>	+			+																	
<i>Thelasis carinata</i>	+			+			+											+			
<i>Thelasis micrantha</i>	+																				
<i>Thelasis microbulbon</i>			+				+											+			
<i>Thelasis pygmaea</i>				+																	
<i>Thelasis</i> sp.																					+
<i>Thrixspermum scopia</i>																	+				
<i>Thrixspermum</i> sp. 1																	+				
<i>Thrixspermum</i> sp. 2																+					
<i>Thrixspermum</i> sp. 3																				+	+
<i>Trichoglottis retusa</i>							+											+			
<i>Trichoglottis winkleri</i>																		+			
<i>Trichoglottis</i> sp. 1												+									
<i>Trichoglottis</i> sp. 2												+									
<i>Trichotosia vestita</i>																	+			+	
<i>Tropidia graminea</i>							+														
<i>Tropidia pedunculata</i>					+			+													
<i>Tropidia</i> sp.				+																	
<i>Vanda scandens</i>						+			+												
<i>Vanilla</i> sp. 1				+																	
<i>Vanilla</i> sp. 2				+																	
Total species	34	3	30	58	2	5	36	1	40	2	21	17	15	4	3	19	33	51	10	9	7

amateurs. Collecting for use as stock material for the orchid hybrid industry is only a problem in very few species. Collecting is very efficiently done by locals with detailed knowledge of the area visited. Nurseries then buy the plants and arrange the exports to the US, Japan and Europe. Species severely threatened this way are *Bulbophyllum reticulatum*, *Dossinia marmorata*, *Paphiopedilum stonei* and *Phalaenopsis*.

Forest clearing for logging and development takes 760–900 km²/year in Peninsular Malaysia alone (Davis et al. 1986). It destroys orchid habitats on the short run, but it also changes the climate on the longer run. Shade loving ground flora (Kiew 1993) as well as the less hardy epiphytes will disappear.

In Sarawak, about 23 % of the total land area is under shifting cultivation (Kiew 1993). Among locals it is common practice to clear forest yearly for this purpose (Anonymous 1983). In Padawan, land clearance for various crops is not restricted to the foot of the hills, but may extend to the top. An additional risk is that the fire used to clear the land sweeps through the surrounding vegetation, destroying even more habitat.

Little rock quarrying is done in Padawan, yet this is a potential threat because of the increasing demand of stone and, in particular, cement. In nearby Bau quarrying is relatively well regulated and therefore has mainly a local effect. Nevertheless, it may threaten limestone species with a limited range, such as *Bulbophyllum reticulatum* and *Paphiopedilum stonei*.

Altogether, 15 limestone endemic orchids have become rare in Perlis and Padawan. More research in limestone areas is

needed to curb this trend, in spite of the notoriously difficult access to these deeply dissected, very steep limestone hills with their often knife-sharp rock outcrops. Awareness of the extraordinary biodiversity among the local communities should be fostered.

CONCLUSION AND RECOMMENDATION

The orchid diversity in both areas is very high, and conservation measures are necessary to ensure long-term survival. In situ and ex situ options are available.

In situ conservation is to be preferred because it preserves not species but ecosystems.

Unfortunately, the awareness of the need to protect nature in general and orchids in particular, is still low among Malaysians (WWF 2000). Besides, taxonomic knowledge of the local biodiversity is still inadequate. Local universities and research institutions need encouragement to generate this awareness among their students. The deficiency of taxonomic information also prevents Malaysia from using these resources for biotechnology (The New Straits Times, 11 Sept. 2002, p. 8).

Ex situ conservation could include propagation of species via tissue culture or seed. Rare and endangered limestone species such as *Bulbophyllum reticulatum*, *Paphiopedilum stonei*, *Vanda scandens* as well as *Phalaenopsis* could benefit from this. The wild populations could be replenished and the commercial market could be saturated, relieving the pressure on

Table 4 List of new records for Perlis.

No.	Species	No.	Species
1.	<i>Acampe rigida</i> (Buch.-Ham. ex Sm.) P.F.Hunt	32.	<i>Flickingeria xantholeuca</i> (Rchb.f.) Hawkes
2.	<i>Apotasia nuda</i> R.Br.	33.	<i>Gastrochilus hainanensis</i> Z.H.Tsi.*
3.	<i>Biermannia ciliata</i> (Ridl.) Garay	34.	<i>Gastrodia javanica</i> (Blume) Lindl.
4.	<i>Bulbophyllum microglossum</i> Ridl.	35.	<i>Grosourdya incurvicalar</i> (J.J.Sm.) Garay
5.	<i>Bulbophyllum mutabile</i> (Blume) Lindl.	36.	<i>Grosourdya muscosa</i> (Rolfe) Garay
6.	<i>Bulbophyllum purpurascens</i> Teijsm. & Binn.	37.	<i>Habenaria reflexa</i> Blume
7.	<i>Ceratostylis radiata</i> J.J.Sm.	38.	<i>Kingidium deliciosum</i> (Rchb.f.) Sweet
8.	<i>Ceratostylis subulata</i> Blume	39.	<i>Liparis aurita</i> Ridl.*
9.	<i>Cirrhopetalum taeniophyllum</i> (C.S.P.Parish & Rchb.f.) Hook.f.	40.	<i>Liparis cespitosa</i> (Lam.) Lindl.
10.	<i>Cleisostoma subulatum</i> Blume	41.	<i>Liparis viridiflora</i> (Blume) Lindl.
11.	<i>Coelogyne trinervis</i> Lindl.	42.	<i>Macodes petola</i> (Blume) Lindl.
12.	<i>Cymbidium ensifolium</i> (L.) Sw.	43.	<i>Malaxis calophylla</i> (Rchb.f.) Kuntze
13.	<i>Dendrobium acerosum</i> Lindl.	44.	<i>Nephelaphyllum pulchrum</i> Blume
14.	<i>Dendrobium concinnum</i> Miq.	45.	<i>Nervilia punctata</i> (Blume) Makino
15.	<i>Dendrobium hughii</i> Rchb.f.	46.	<i>Oberonia ensiformis</i> (J.J.Sm.) Lindl.*
16.	<i>Dendrobium indivisum</i> (Blume) Miq.	47.	<i>Oberonia langbianensis</i> Gagnep.*
17.	<i>Dendrobium indivisum</i> (Blume) Miq. var. <i>pallidum</i> Seidenf.	48.	<i>Panisea uniflora</i> Lindl.*
18.	<i>Dendrobium kentrophyllum</i> Hook.f.	49.	<i>Pennilabium struthio</i> Carr
19.	<i>Dendrobium setifolium</i> Ridl.	50.	<i>Pholidota imbricata</i> Hook.
20.	<i>Dendrobium truncatum</i> Lindl.	51.	<i>Pholidota recurva</i> Lindl.*
21.	<i>Dienia ophrydis</i> (J.König) Ormerod & Seidenf.	52.	<i>Polystachya flavescens</i> (Blume) J.J.Sm.
22.	<i>Eria densa</i> Ridl.	53.	<i>Pomatocalpa andamanica</i> (Hook.f.) J.J.Sm.
23.	<i>Eria floribunda</i> Lindl.	54.	<i>Spathoglottis plicata</i> Blume
24.	<i>Eria javanica</i> (Sw.) Blume	55.	<i>Stereosandra javanica</i> Blume
25.	<i>Eria mucronata</i> Lindl.	56.	<i>Taeniophyllum intermedium</i> Carr
26.	<i>Eria nutans</i> Lindl.	57.	<i>Tainia speciosa</i> Blume
27.	<i>Eria ochracea</i> Rolfe*	58.	<i>Thelasis pygmae</i> (Griff.) Blume
28.	<i>Eria tenuiflora</i> Ridl.	59.	<i>Thelasis rhomboglossa</i> Kraenzl.*
29.	<i>Flickingeria angustifolia</i> (Blume) A.D.Hawkes	60.	<i>Thrixspermum pensile</i> Schltr.*
30.	<i>Flickingeria bancana</i> (J.J.Sm.) A.D.Hawkes	61.	<i>Trichotosia gracilis</i> (Hook.f.) Kraenzl.
31.	<i>Flickingeria convexa</i> (Blume) A.D.Hawkes	62.	<i>Tropidia curculigoides</i> Lindl.

* New records for Malaysia.

Table 5 List of new records of species for Padawan, Sarawak.

No.	Species	No.	Species
1.	<i>Abdominea minimiflora</i> (Hook.f.) J.J.Sm	37.	<i>Dendrobium leonis</i> (Lindl.) Rchb.f.
2.	<i>Acriopsis liliifolia</i> (J.König) Ormerod & Seidenf.	38.	<i>Dendrobium lamellatum</i> Blume
3.	<i>Agrostophyllum bicuspidatum</i> J.J.Sm.	39.	<i>Dendrobium paniferum</i> J.J.Sm.*
4.	<i>Agrostophyllum longifolium</i> Hook.f.	40.	<i>Dendrobium rosellum</i> Ridl.
5.	<i>Appendicula anceps</i> Blume	41.	<i>Dendrobium singaporense</i> A.D.Hawkes & A.H.Heller
6.	<i>Appendicula cornuta</i> Blume	42.	<i>Dendrobium spurium</i> (Blume) J.J.Sm.
7.	<i>Appendicula purpurascens</i> Blume	43.	<i>Dendrobium truncatum</i> Lindl.
8.	<i>Appendicula ramosa</i> Blume	44.	<i>Eria jeseniana</i> J.J.Sm.
9.	<i>Appendicula undulata</i> Blume	45.	<i>Eria longissima</i> (Kraenzl.) J.J.Sm.
10.	<i>Bulbophyllum acuminatum</i> Ridl.	46.	<i>Eria nutans</i> Lindl.
11.	<i>Bulbophyllum apodum</i> Hook.f.	47.	<i>Eria obliqua</i> (Lindl.) Lindl.
12.	<i>Bulbophyllum armeniacum</i> J.J.Sm.	48.	<i>Eria ornata</i> (Blume) Lindl.
13.	<i>Bulbophyllum blumei</i> (Lindl.) J.J.Sm.	49.	<i>Eria pannea</i> Lindl.
14.	<i>Bulbophyllum botryophorum</i> Ridl.	50.	<i>Eria pseudoleiophylla</i> J.J.Wood
15.	<i>Bulbophyllum compressum</i> Teijsm. & Binn.	51.	<i>Flickingeria convexa</i> (Blume) A.D.Hawkes
16.	<i>Bulbophyllum coniferum</i> Ridl.	52.	<i>Flickingeria laciniosa</i> (Ridl.) A.D.Hawkes
17.	<i>Bulbophyllum farinulentum</i> J.J.Sm.	53.	<i>Liparis compressa</i> Lindl.
18.	<i>Bulbophyllum flammuliferum</i> Ridl.	54.	<i>Liparis latifolia</i> Lindl.
19.	<i>Bulbophyllum gracillimum</i> (Rolfe) Rolfe	55.	<i>Malaxis lowii</i> (E.Morren) Ames
20.	<i>Bulbophyllum purpurascens</i> Teijsm. & Binn.	56.	<i>Malaxis oculata</i> Kuntze
21.	<i>Bulbophyllum vaginatum</i> Lindl.	57.	<i>Oberonia ciliolata</i> Hook.f.
22.	<i>Cleisostoma striatum</i> (Rchb.f.) Garay	58.	<i>Paphiopedilum lowii</i> (Lindl.) Stein
23.	<i>Coelogyne dayana</i> Rchb.f.	59.	<i>Phalaenopsis cochlearis</i> Holtum
24.	<i>Coelogyne incrassata</i> (Blume) Lindl.	60.	<i>Pholidota longibulba</i> Holtum
25.	<i>Coelogyne mayeriana</i> Rchb.f.	61.	<i>Phreatia secunda</i> Lindl.
26.	<i>Coelogyne prasina</i> J.J.Sm.	62.	<i>Rhynchostylis gigantea</i> Ridl.
27.	<i>Coelogyne rochussenii</i> de Vriese	63.	<i>Robiquetia spatulata</i> (Blume) J.J.Sm.
28.	<i>Coelogyne sanderiana</i> Rchb.f.	64.	<i>Taeniophyllum filiforme</i> J.J.Sm.
29.	<i>Corybas pictus</i> (Blume) Rchb.f.	65.	<i>Thecostele alata</i> (Roxb.) C.S.P.Parish & Rchb.f.
30.	<i>Cymbidium finlaysonianum</i> Lindl.	66.	<i>Thelasis capitata</i> Blume
31.	<i>Cymbidium rectum</i> Ridl.	67.	<i>Thelasis carinata</i> Blume
32.	<i>Dendrobium acinaforme</i> Roxb.	68.	<i>Thelasis macrobulbon</i> Ridl.
33.	<i>Dendrobium clavator</i> Ridl.	69.	<i>Thrixspermum scopa</i> (Rchb.f. ex. Hook.f.) Holtum
34.	<i>Dendrobium crumenatum</i> Sw.	70.	<i>Trichoglottis retusa</i> Blume
35.	<i>Dendrobium gracile</i> (Blume) Lindl.	71.	<i>Trichoglottis winkleri</i> J.J.Sm.
36.	<i>Dendrobium kiauense</i> Ames & C.Schweinf.	72.	<i>Trichotosia vestita</i> (Lindl.) Kraenzl.
		73.	<i>Tropidia pedunculata</i> Blume

* New records for Malaysia.

the wild populations. Other attractive Padawan orchids, such as *Dendrobium anosmum* (both white and purple form), *Dossinia marmorata*, and *Plocoglottis acuminata* can be recommended in this respect.

Apart from the above, further enforcement of international and local laws, listed above, is advisable to ensure that limestone biodiversity is preserved for future generations.

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