

PERLIS LIMESTONE ORCHIDS: DIVERSITY AND CONSERVATION

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ABSTRACT. Perlis, the smallest and northernmost state in Peninsular Malaysia, has 15% of the total land area but only 0.2% of the forested land. Perlis State Park, a protected biodiversity conservation area established in 1996, consists of Mata Ayer Forest Reserve and Wang Mu Forest Reserve, which cover more than 5000 ha (13.6% of the total land area in Perlis). Most of Perlis consists of limestone hills that harbor many endemic and rare species of flora. Since 1999, two botanical expeditions and many collection trips have been made to explore and document the flora, especially Orchidaceae, on these hills. As a result, 102 species of orchids have been recorded. On Bukit Pelarit, a mere 432-m-tall limestone hill, 41 species were recorded, a clear indication of high species diversity. From these expeditions, four new species have been recorded for Malaysia and 41 as new records for Perlis.

Key words: Perlis, Malaysia, Orchidaceae, diversity, conservation

INTRODUCTION

Perlis is the northernmost state in Peninsular Malaysia, bordered by Thailand in the north and Kedah in the south. It is ca. 80,302 ha in size with 12,048 ha of total forested land (TABLE 1). Seven permanent forest reserves, totally ca. 10,232 ha, make up 90.5% of the total forested area in Perlis as shown in TABLE 2 (Rahimatsah et al. 2002). Wang Mu Forest Reserve, Bukit Bintang Forest Reserve, Mata Ayer Forest Reserve, and Kurong Batang Forest Reserve are in the Nakawan Range, which is part of the Setul Formation. Nakawan Range, the oldest and longest continuous limestone range in Peninsular Malaysia, dates from the Ordovician–Devonian periods (450–350 million years ago). The Setul Limestone formation in Perlis, located where Perlis borders on Thailand, extends to the eastern part of the Langkawi Islands and north into

Thailand, where it is known as Tung Song Formation (Jasin & Harun 2002).

Perlis is the only state in Peninsular Malaysia that experiences a seasonal monsoon climate. Its semi-deciduous forests, known as white meranti-gerutu seasonal forests, serve as an indicator of monsoon climate and are not found in other states. Influenced by northern and dry monsoon elements, the plants of Perlis, especially orchids, are unlike those in the other states of Peninsular Malaysia. The flora has a high number of endemic and rare species, including *Eria ornata* (Bl.) Lindl., *Paphiopedilum niveum* (Reichb.f.) Stein., and *Habenaria carnea* N.E. Br. (Wong 2002).

Perlis State Park, established in 1996, consists of three forest reserves (TABLE 2) that comprise ca. 15% of the total forest reserves in the state (FIGURE 1). They are managed to conserve and protect biodiversity in a way that assures the

TABLE 1. A comparison of forested area in Peninsular Malaysia and Perlis (ha) as of 1999 (Rahimatsah et al. 2002).

Land category	Peninsular Malaysia (ha)	Perlis (ha)
Total land area	13,153,308	80,302
Type of forest		
Permanent forest estate (PFEs)	4,853,646	10,902
National park, wildlife, and bird sanctuaries	645,217	68
State land forest	387,090	1078
Other forested areas	52,115	—
Total forested area	5,938,068	12,048

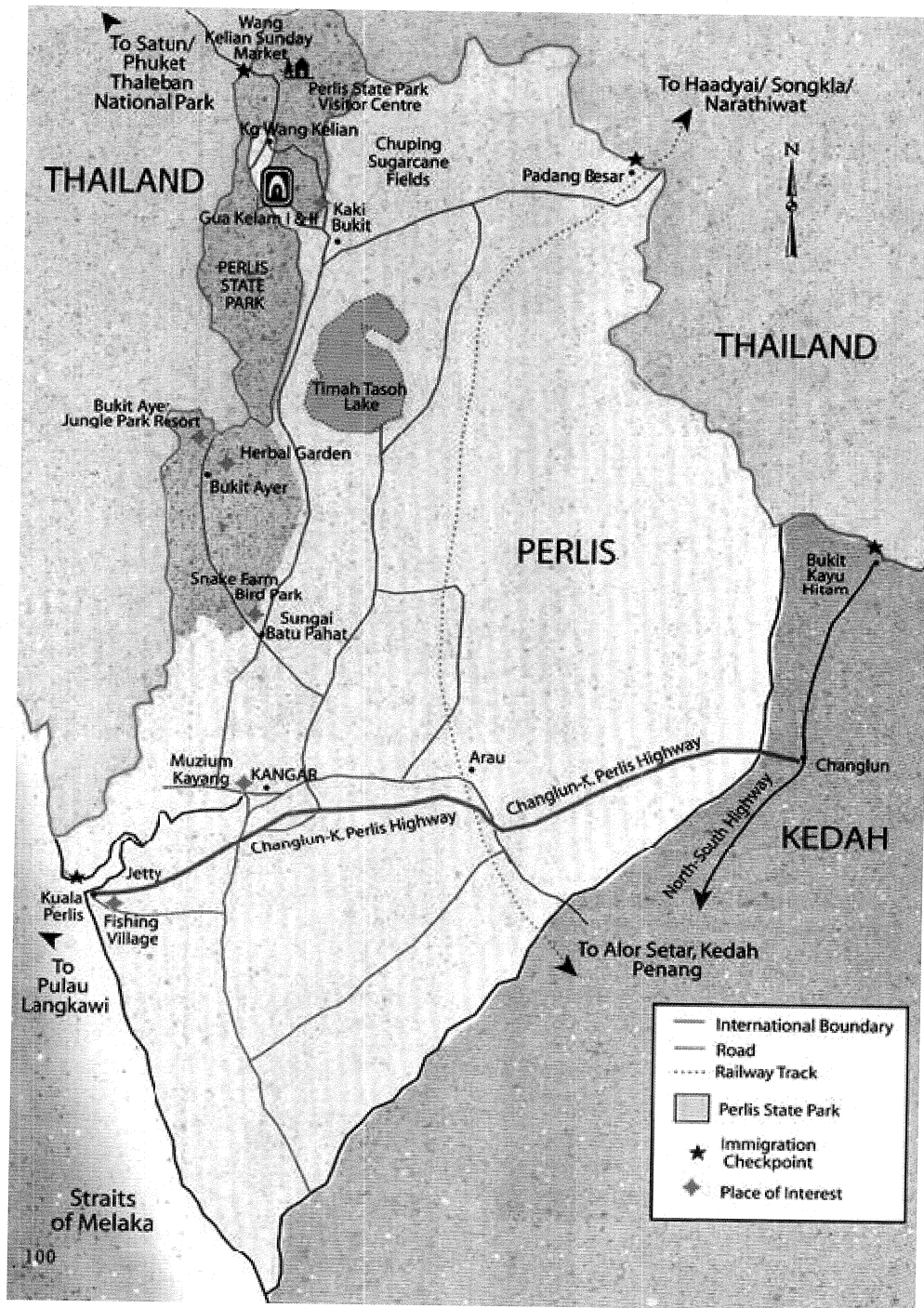


FIGURE 1. Map of Perlis, Malaysia, showing the area gazetted for Perlis State Park (Rahimatshah et al. 2002).



FIGURE 2. Selected endemic species and new records* for Perlis and Malaysia. Photos by author. I. *Habenaria carnea*. II. *Paphiopedilum niveum*. III. *Nephelaphyllum pulchrum*. IV. *Kingidium deliocosum*. V. *Gastrochilus obliquus*.* VI. *Malaxis acuminata*.*

sustainable use of the biological resources (Latiff et al. 2001). The park is distinct in that more than 70% of the area is limestone hills that provide various limestone microhabitats for flora and fauna.

METHODS AND MATERIALS

Since 1999, the authors have conducted botanical expeditions to collect scientific samples

TABLE 2. Forest reserves of Perlis.

Forest reserve	Area (ha)
Mata Air Forest Reserve	2516
Bukit Bintang Forest Reserve	2785
Bukit Tong-Tong Forest Reserve	48
Rimba Mas-Mas Forest Reserve	52
Wang Mu Forest Reserve	2859
Kurong Batang Forest Reserve	1816
Bukit Papan Forest Reserve	156
Total	10,232

Source: Latiff et al. 2001.

of Orchidaceae on the limestone hills of Perlis. Seven major limestone hills were visited during these trips, which complement the work by scientific expeditions to Wang Kelian in 1999 and Wang Mu in 2000 to document the flora of Perlis State Park. The collections are part of limestone flora diversity and conservation studies. The collecting trips were carried out during both the dry and warm season January–April and the wet season September–December. Herbarium collections of the orchids and other limestone flora are maintained in the herbarium of the Biology Department, Faculty of Science and Environmental Studies, at the University Putra Malaysia. All species were identified based on Holttum (1957), Teo (1985), Seidenfaden (1985), Seidenfaden and Wood (1992), Chan et al. (1994), Wood (1997), Beaman et al. (2001), and Comber (2001).

RESULTS

A total of 102 species in 49 genera have been recorded since 1999. To date, only 63 species

TABLE 3. List of orchid species collected since 1999 in Perlis State Park. Asterisk (*) = new record for Perlis; ** = new record for Malaysia.

Genus	Species
<i>Acampe</i>	<i>Acampe rigida</i> (Buch.-Ham. ex Sm.) P.F. Hunt*
<i>Aerides</i>	<i>Aerides odorata</i> Lour.* <i>Aerides</i> sp.
<i>Anoetochilus</i>	<i>Anoetochilus</i> sp.
<i>Appendicula</i>	<i>Appendicula lucida</i> Ridl. <i>Appendicula</i> sp.
<i>Ascocentrum</i>	<i>Ascocentrum miniatum</i> (Lindl.) Schltr.
<i>Bulbophyllum</i>	<i>Bulbophyllum dentiferum</i> Ridl.* <i>Bulbophyllum taeniophyllum</i> (C.S.P. Parish) Hook.f.* <i>Bulbophyllum</i> sp. 1 <i>Bulbophyllum</i> sp. 2
<i>Calanthe</i>	<i>Calanthe</i> sp. 1 <i>Calanthe</i> sp. 2
<i>Ceratostylis</i>	<i>Ceratostylis</i> sp. 1 <i>Ceratostylis</i> sp. 2
<i>Cleisostoma</i>	<i>Cleisostoma discolor</i> Lindl.* <i>Cleisostoma williamsonii</i> (Reichb.f) Garay <i>Cleisostoma</i> sp.
<i>Coelogyne</i>	<i>Coelogyne</i> sp. 1 <i>Coelogyne</i> sp. 2 <i>Coelogyne</i> sp. 3 <i>Coelogyne</i> sp. 4
<i>Cymbidium</i>	<i>Cymbidium lancifolium</i> Hook.* <i>Cymbidium</i> sp. 1 <i>Cymbidium</i> sp. 2 <i>Cymbidium</i> sp. 3
<i>Dendrobium</i>	<i>Dendrobium acerosum</i> Lindl.* <i>Dendrobium aloifolium</i> (Blume) Rchb.f.* <i>Dendrobium anosmum</i> Lindl.* <i>Dendrobium calicopsis</i> Ridl.* <i>Dendrobium concinnum</i> Miq.* <i>Dendrobium crumenatum</i> Sw.* <i>Dendrobium indivisum</i> (Bl.) Miq.* <i>Dendrobium kentrophyllum</i> Hook.f.* <i>Dendrobium leonis</i> (Lindl.) Reichb.f. <i>Dendrobium linguella</i> Rchb.f.* <i>Dendrobium secundum</i> (Bl.) Lindl. <i>Dendrobium setifolium</i> Ridl.* <i>Dendrobium trinervium</i> Ridl.* <i>Dendrobium</i> sp. 1 <i>Dendrobium</i> sp. 2 <i>Dendrobium</i> sp. 3 <i>Dendrobium</i> sp. 4 <i>Dendrobium</i> sp. 5
<i>Didymoplexiella</i>	<i>Didymoplexiella ornata</i> (Ridl.) Garay*
<i>Dienia</i>	<i>Dienia ophrydis</i> (Koen.) Ormerod & Seidenf.*
<i>Eria</i>	<i>Eria floribunda</i> Lindl.* <i>Eria ornata</i> (Bl.) Lindl.* <i>Eria</i> sp. 1 <i>Eria</i> sp. 2
<i>Eulophia</i>	<i>Eulophia andamanensis</i> Rchb.f. <i>Eulophia graminea</i> Lindl.
<i>Flickingeria</i>	<i>Flickingeria angustifolia</i> (Bl.) Hawkes* <i>Flickingeria convexa</i> (Bl.) Hawkes* <i>Flickingeria fimbriata</i> (Blume) A.D. Hawkes* <i>Flickingeria pallens</i> (Ridl.) A.D. Hawkes* <i>Flickingeria</i> sp. 1 <i>Flickingeria</i> sp. 2
<i>Gastrochilus</i>	<i>Gastrochilus obliquus</i> (Lindl.) Kuntze** <i>Gastrochilus</i> sp.
<i>Gastrodia</i>	<i>Gastrodia javanica</i> (Blume) Lindl.*

TABLE 3. Continued.

Genus	Species
<i>Grosourdyia</i>	<i>Grosourdyia muscosa</i> (Rolfe) Garay*
<i>Habenaria</i>	<i>Habenaria carnea</i> N.E. Br. <i>Habenaria reflexa</i> Blume*
<i>Kingidium</i>	<i>Kingidium deliocosum</i> (Rchb.f.) H.R. Sweet*
<i>Liparis</i>	<i>Liparis</i> sp. 1 <i>Liparis</i> sp. 2
<i>Ludisia</i>	<i>Ludisia discolor</i> (Ker Gawl.)*
<i>Luisia</i>	<i>Luisia curtisii</i> Seidenf.*
<i>Malaxis</i>	<i>Malaxis acuminata</i> D. Don** <i>Malaxis</i> sp.
<i>Nephelaphyllum</i>	<i>Nephelaphyllum pulchrum</i> Bl.*
<i>Nervilia</i>	<i>Nervilia plicata</i> (Andr.) Schltr.
<i>Oberonia</i>	<i>Oberonia</i> sp. 1 <i>Oberonia</i> sp. 2 <i>Oberonia</i> sp. 3
<i>Paphiopedilum</i>	<i>Paphiopedilum niveum</i> (Reichb.f.) Stein <i>Paphiopedilum</i> sp.
<i>Phalaenopsis</i>	<i>Phalaenopsis cornucervi</i> (Breda) Blume & Rchb.f.*
<i>Pholidota</i>	<i>Pholidota imbricata</i> Hook.* <i>Pholidota</i> sp. 1
<i>Phreatia</i>	<i>Phreatia</i> sp.
<i>Podochilus</i>	<i>Podochilus lucescens</i> Blume <i>Podochilus</i> sp.
<i>Polystachya</i>	<i>Polystachya concreta</i> (Jacq.) Garay & H.R. Sweet
<i>Pomatocalpa</i>	<i>Pomatocalpa maculosa</i> (Lindl.) J.J. Sm. var. <i>andamanica</i> (Hook.f.) Watthana in ed.** <i>Pomatocalpa spicata</i> Breda*
<i>Renanthera</i>	<i>Renanthera</i> sp.
<i>Renantherella</i>	<i>Renantherella histrionica</i> (Reichb.f.) Ridl.
<i>Smitinandia</i>	<i>Smitinandia micrantha</i> (Lindl.) Holttum
<i>Spathoglottis</i>	<i>Spathoglottis plicata</i> Blume*
<i>Stereosandra</i>	<i>Stereosandra javanica</i> Blume
<i>Tainia</i>	<i>Tainia speciosa</i> Blume
<i>Taeniophyllum</i>	<i>Taeniophyllum filiforme</i> J.J. Sm.* <i>Taeniophyllum</i> sp.
<i>Thelasis</i>	<i>Thelasis pygmae</i> (Griff.) Blume* <i>Thelasis</i> sp. 1
<i>Thrixspermum</i>	<i>Thrixspermum pensile</i> Schltr.**
<i>Trichoglottis</i>	<i>Trichoglottis bipunctata</i> (C.S.P. Parish & Rchb.f.) T. Tang & F. T. Wang*
<i>Trichotomia</i>	<i>Trichoglottis cirrhifera</i> Teijsm. & Binn. <i>Trichotomia gracilis</i> (Hook.f.) Kraenzl.* <i>Trichotomia</i> sp.
<i>Tropidia</i>	<i>Tropidia cucurlioides</i> Lindl.*
<i>Vandopsis</i>	<i>Vandopsis</i> sp.

could be identified at species level, and the remaining specimens could only be identified to genus because of insufficient materials. Bukit Pelarit, a mere 432-m-tall limestone hill, has yielded 41 orchid species from 29 genera (Mohd Noor 2002). All specimens without flowers are kept under cultivation in a greenhouse in the Department of Biology, University Putra Malaysia.

A total of 41 taxa, representing 73.2% of the 63 species that have been identified to species, are new records for Perlis (TABLE 3, FIGURE 2). Four species are new records for Malaysia. Thought to be the Thailand Element (Kiew

1993), they are *Gastrochilus obliquus* (Lindl.) Kuntze, *Malaxis acuminata*, *Pomatocalpa maculosum* (Lindl.) J.J. Sm. var. *andamanica* (Hook.f.) Watthana ined. (S. Watthana pers. comm.) and *Thrixspermum pensile* Schltr.

Significant Discoveries

One of the remarkable findings of these studies is the discovery of the endemic and rare white slipper orchid, *Paphiopedilum niveum*, along the trail on the north side of Bukit Rongkit, which is a new locality for *P. niveum* in

addition to Wang Pisang and Bukit Pelarit in Perlis State Park (Go et al. 2002). *Paphiopedilum niveum* was firstly discovered in the Langkawi Islands, Malaysia, where the orchid's population is decreasing rapidly as the result of over-collection by fisherman and destruction of the orchid's natural habitat (Go et al. 2002). Thus the discovery of the *P. niveum* population on Bukit Rongkit provides a new chance to sustain the existence of this precious species in the wild.

The endemic species, *Habenaria carnea*, found in Perlis State Park, was previously recorded as restricted to limestone hills in the Langkawi Islands, Perlis, and Peninsular Thailand. The *H. carnea* found in the park appeared in two forms—some bearing brown leaves and others bearing green leaves with whitish dots. It was observed that as plants began to produce inflorescence, leaf color began to change from brown to green. When the plant is in full bloom, the leaves are entirely green with whitish dots. At first, the young brown-leafed plants were thought to be a different species, because *H. carnea* previously was described as having green leaves with whitish dots (Seidenfaden & Wood 1992). This new information is valuable for future identification of sterile materials.

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