

Diversity and Nature Tourism Potential of Orchids in Labis Forest Reserve (West Endau-Rompin), Johor

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Abstract

Orchids, a popular tropical plant, are being explored for their beauty and durability. However, concerns over over-collection and negative impacts on local communities have led to the development of orchid tourism, including gardening, ecotourism, and volunteer tourism. This research explores the Labis Forest Reserve's orchid flora to boost nature-based tourism and conservation efforts. The study collected orchid species from three sites: Taka Melor Amenity Forest, Labis Forest Reserve, and Sungai Bantang Eco Park. A total of 39 orchids from 16 genera were collected at Labis Forest Reserve. A species checklist was generated, and suitable areas for orchid tourism were identified. The majority of species are epiphytic and grow on trees or along riversides. Sungai Bantang Eco Park is abundant with orchid species, particularly the genus *Coelogyne*, which has over 200 species spread across Asia. A survey was conducted to evaluate public awareness and interest in orchid tourism, with respondents showing moderate awareness of specific orchids like *Bromheadia finlaysoniana* and *Pomatocalpa spicata*. The survey also suggested improvements to orchid-based tourism, such as social media presence, better plant care, and educational programs.

1. Introduction

Orchids are a family of higher plants found in tropical areas with significant annual rainfall and little seasonal change [1]. They have two growth patterns: sympodial and monopodial, and can live in terrestrial, epiphytic, lithophytic, or saprophytic environments [2]. They are in high demand worldwide for their beauty and durability, with *Phalaenopsis*, *Dendrobium*, and *Cymbidiums* being the top exporting genera. Top exporting countries include the Netherlands, Thailand, Taiwan, and Singapore [3]. However, the growing demand for orchids has raised concerns about over-collection and negative impacts on local communities and ecosystems [4]. Orchid tourism can be proposed through *in-situ* and *ex-situ* conservation, such as Garden Tourism, Orchid-focused Ecotourism, and Orchid-focused Volunteer Tourism [5]. Numerous tourist attractions are built around the exhibition of orchid specimens in botanical gardens and nurseries, such as Tourist attractions in Malaysia include several orchid gardens and nurseries, such as the Perdana Botanical Garden Kuala Lumpur, the Kuching North City Hall Orchid Garden, and the Gunung Jerai Botanical Park. These gardens showcase a variety of orchid species, including the Borneo Orchid Collection, which has 75,000 species in 65 genera [6]. The Royal Floria Putrajaya Festival, held annually since 2010, attracts 500,000 visitors and features over 10,000 orchids [7,8].

Ecotourism has a significant impact on local resources, revenue, behaviors, and development efforts, with the overall effect shaped by factors such as the type and quantity of tourists and destination characteristics [9, 10, 11].

The Labis Forest Reserve in Malaysia, known for its rich dipterocarp forest and diverse landscape, is a sanctuary for native orchid species with significant tourist attraction potential. However, there is a lack of essential baseline data for fostering orchid tourism. This research is the first detailed exploration of the orchid flora in the Labis Forest Reserve, contributing to the broader botanical diversity of Peninsular Malaysia. By identifying attractive orchid species and areas requiring conservation, the study aims to boost nature-based tourism and enhance conservation efforts, benefiting both environmental protection and the tourism industry.

The study aims to fill these gaps by generating a preliminary species checklist of orchids in Labis Forest Reserve, assessing the potential for orchid-based nature tourism in the area, and mapping out suitable areas for orchid tourism. The study encompasses the Labis Forest Reserve area bordering the Endau-Rompin Johor National Park, focusing on hiking trails, waterfall sites, and other recreational areas. Orchids collected from these locations will be identified to genus and species level to compile an inventory. The species will be evaluated based on criteria including reliability of sightings and morphological attractiveness, as per the amended UNDP Guidelines [12].

2. Methodology

2.1 Study site

The study was conducted in the Labis Forest Reserve area, located west of Endau-Rompin in the Labis district, in Johor state of Peninsular Malaysia Fig. 1. The collection of orchids for this study was done in three different sites: Melor Amenity Forest, Labis Forest Reserve, and Sungai Bantang Eco Park. Taka Melor Amenity Forest, located close to Kampung Tenang in Labis, Johor, the orchid collection was conducted on 1 August 2023. In the Labis Forest Reserve, a low dipterocarp forest established in 1959, took place on 1 and 8 August 2023, focusing on orchid collection along streams and hiking trails. Furthermore, in Sungai Bantang Eco Park, orchid collections were conducted on 30 November 2023.



Fig. 1 Map showing the location of the sampling site Labis Forest Reserve in Johor

2.2 Specimen collection

The orchid searching and collecting were carried out along the hiking trail, waterfall sites, and other recreational areas. The orchid samples that were found were observed, photographed, and collected. Data that was collected during the sampling for instance date of collection, elevation, microhabitat, coordinates, climatic conditions, and botanical description. Furthermore, the flowering materials were collected using secateurs, labelled, and stored in zip-lock bags. A handled Global Positioning System (GPS) was used to mark and record the locations of each sampling site.

2.3 Preparation and identification of herbarium voucher specimen

The orchid specimens were sorted according to their size to decide the method used for preparing herbarium voucher specimens. For small plants, the entire plant from the shoot to the root was taken as a specimen meanwhile the floral and vegetative components of large plants may adequately describe the plants that were used. Each specimen that was collected was placed between newspaper sheets, layer one on top of the other, and

pressed with cardboard in a wooden press. The pressed specimens then were dried in an oven at 45°C for two to three days before the examination. The dried specimens were taken out from the oven before being mounted onto herbarium sheets.

In the case of orchid samples that had flowers, spirit voucher specimens were used and images of the flowers were taken to document their color. It is important to retain the delicate, three-dimensional flower components when creating a spirit specimen. Representative flowers or inflorescences that were collected were kept in glass jars with labels filled with a wet collection solution made up of 70% industrial ethanol spirit and 30% distilled water. In the case of non-flowering materials, the live plants were taken and grown *ex-situ* in the greenhouse of the UTHM Pagoh Campus. An assessment was carried out on the orchid's potential as a nature tourism product once it produced flowers for identification. The floral organs of orchids were inspected visually. The properties of the studied floral organ were compared to dichotomous keys, drawings, and pictures from Seindenfaden et al. [1992] and Ong et al. [2011], internet resources, and other orchid references.

2.4 Orchid tourism survey

A comprehensive online survey was conducted to evaluate the public's awareness and interest in orchid tourism, using platforms such as social media and email. The survey targeted 100 respondents, including students from UTHM and various universities, travel agency personnel, and nature enthusiasts. A Likert scale is a type of psychometric instrument that is often used in research investigations to assess respondents' attitudes, views, or perceptions. A statement or question is usually followed by a number of possible answers, most of which range from (1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree, (5) Strongly agree. After choosing the response that most accurately expresses their opinion, participants' answers are given numerical values for analysis.

The survey was structured into three segments. The first part gathered demographic information like gender, age, race, education, employment status, income level, and previous visits to nature tourism areas, ensuring data reliability. The second section delved into respondents' understanding of orchid tourism, exploring their knowledge of orchids as a nature tourism product, the frequency of participation in nature-based tourism activities, and specific orchids that have the potential to be key attractions in the Labis Forest Reserve. The final part of the survey focused on interest constructs, assessing factors influencing tourism destination choices, pull and push factors for engaging in orchid tourism, and gathering additional insights through an open-ended question. The survey, primarily featuring closed-ended questions, aimed to gauge respondents' willingness to engage in orchid tourism and their perception of orchids as a significant component of nature-based tourism.

3. Results and discussion

3.1 Orchid species

A total of 39 orchids from 16 genera were collected from Labis Forest Reserve (Fig. 2). According to the checklist (Table 1), 36 orchids are epiphytes, while three orchids have terrestrial growth forms. The first identification could only be completed up to the genus level because the majority of the orchids gathered for the inventory were not in flower. Later on, the non-flowering orchids were moved *ex-situ* to the UTHM Herbs Garden, where they were maintained as a living collection to track future flowering and identify species. It took five months to get the blooms on the non-flowering orchids to blossom. Some orchids produced healthy blooms after five months of culture, however other orchids did not.



A: *Pteroceras* sp 1



B: *Dendrobium* sp 1



C: *Pomatocalpa spicata*



D: *Corymborkis* sp 1



E: *Apostasia* sp 1



F: *Pteroceras* sp 2



G: *Pteroceras* sp 3



H: *Bromheadia finlaysoniana*



I: *Bulbophyllum* sp 1



J: *Coelogyne* sp 1



K: *Coelogyne* sp 2



L: *Coelogyne* sp 3



M: *Dendrobium* sp 2



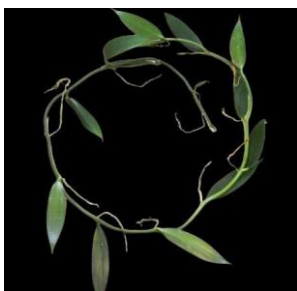
N: *Cleisostoma* sp 1



O: *Bulbophyllum* sp 2



P: *Dendrobium* sp 3



Q: *Vanilla* sp 1



R: *Trachoma* sp 1



S: *Agrostophyllum stipulatum*



T: *Agrostophyllum stipulatum*



U: *Bulbophyllum* sp 3



V: *Coelogyne* sp 4



W: *Thecopus* sp 1



X: *Bulbophyllum* sp 4

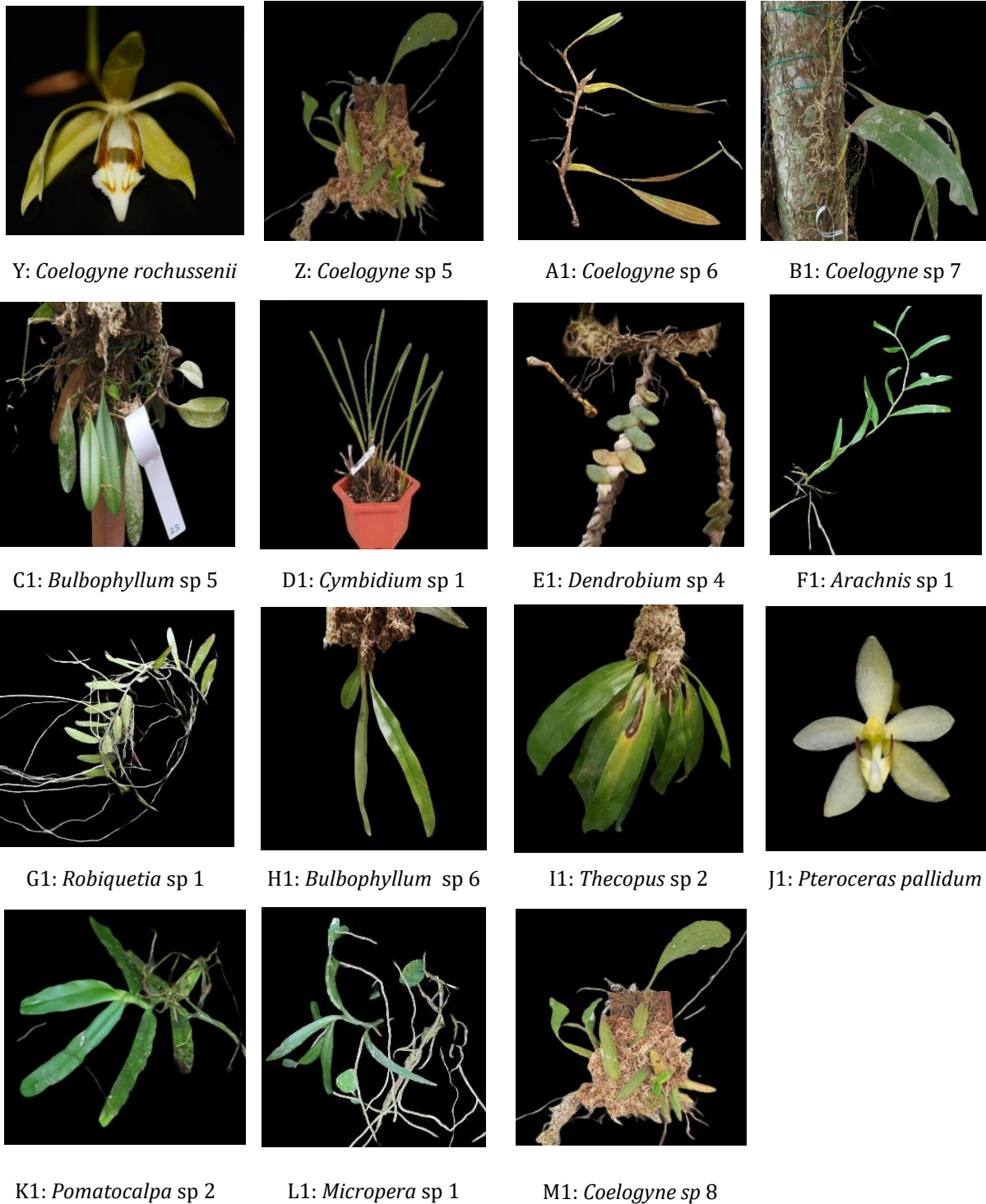


Fig. 2 39 orchids from 16 genera were collected from Labis Forest Reserve

Table 1 A checklist of orchid species that have been gathered in Labis Forest Reserve, as well as information on their vernacular name, growing habits and distribution status. EP (Epiphytes), TR (Terrestrial)

Site	Genus	Species	Vernacular name	Growth habits	Distribution
Taka Melor	<i>Pteroceras</i>	1. sp 1	Necklace orchid	EP	India, China and Malesia

	<i>Dendrobium</i>	2.	sp 1		TR	Tropical and Subtropical Asia to Pacific and New Zealand
	<i>Pomatocalpa</i>	3.	<i>Pomatocalpa spicata</i>	Bladder orchid	EP	East Himalaya, Hainan, Malesia
	<i>Corymborkis</i>	4.	sp 1		EP	Tropical and Subtropical
Hutan Simpan Labis	<i>Apostasia</i>	1.	sp 1	Grass orchid	TR	Tropical and Subtropical Asia to North Australia
	<i>Pteroceras</i>	2.	sp 2	Sage orchid	EP	India, China and Malesia
		3.	sp 3	Sage orchid	EP	
	<i>Bromheadia</i>	4.	<i>Bromheadia finlaysoniana</i>	Pale reed orchid	TR	Indo-China, Philippines, Malaysia, Singapore, Indonesia, Papua New Guinea
	<i>Bulbophyllum</i>	5.	sp 1		EP	Africa, Southern Asia, Latin America, West Indies
		6.	sp 2			
	<i>Coelogyne</i>	7.	sp 1	Necklace orchid	EP	China to Tropical Asia and West Pacific
		8.	sp 2	Necklace orchid	EP	
		9.	sp 3	Necklace orchid	EP	
	<i>Dendrobium</i>	10.	sp 2		EP	Tropical and Subtropical Asia to Pacific and New Zealand
		11.	sp 3		EP	
	<i>Cleisostoma</i>	12.	sp 1		EP	Tropical & Subtropical Asia to W. Pacific
	<i>Vanilla</i>	13.	sp 1	Vanilla	EP	Tropical America, Tropical Asia, New Guinea, West Africa
Sungai Bantang	<i>Trachoma</i>	1.	sp 1		EP	Tropical & Subtropical Asia to NE. Australia.
	<i>Agrostophyllum</i>	2.	<i>Agrostophyllum stipulatum</i>		EP	Indo-China, Malesia to Solomon Island
		3.	<i>Agrostophyllum stipulatum</i>		EP	
	<i>Bulbophyllum</i>	4.	sp 3		EP	Africa, Southern Asia, Latin America, West Indies
		5.	sp 4		EP	
		6.	sp 5		EP	
		7.	sp 6		EP	
	<i>Coelogyne</i>	8.	<i>Coelogyne rochussenii</i>	Necklace orchid	EP	Thailand, Malaysia, Singapore, Sumatra, Borneo, Philippines and Sulawesi.
		9.	sp 4	Necklace orchid	EP	China to Tropical Asia and West Pacific
		10.	sp 5		EP	
		11.	sp 6		EP	

		12.	sp 7		EP	
		13.	sp 8		EP	
	<i>Cymbidium</i>	14.	sp 1	Boat orchid	EP	Tropical to Subtropical Asia to Australia
	<i>Dendrobium</i>	15.	sp 4		EP	Tropical and Subtropical Asia to Pacific and New Zealand
	<i>Arachnis</i>	16.	sp 1		EP	Central Himalaya to Nansei-shoto and Malesia.
	<i>Robiquetia</i>	17.	Sp 1		EP	Tropical and Subtropical Asia and W. Pacific
	<i>Pteroceras</i>	18.	<i>Pteroceras pallidum</i>		EP	Indo_China to Malesia
	<i>Pomatocalpa</i>	19.	sp 2		EP	East Himalaya, Hainan, Malesia
	<i>Micropera</i>	20.	sp 1		EP	SE. Tibet to Tropical Asia and W. Pacific
	<i>Thecopus</i>	21.	sp 1		EP	Indo-China to West Malesia
		22.	Sp 2		EP	

3.2 Potential of orchids-based tourism in Labis Forest Reserve

A survey was conducted to evaluate the potential of orchid-based tourism in Labis Forest Reserve. An online questionnaire was distributed and about 100 respondents participated where it provided enough information to assess the orchid tourism potential of the study site.

3.2.1 Demographic profile

The survey results indicate that the majority of respondents are young adults, with 58 falling within the 18 to 30 years age range, and educationally, most of them, numbering 51, hold a Bachelor's Degree. Economically, a significant portion, 52 respondents, are categorized in the lower income bracket of "Less than RM 1500." Furthermore, a substantial majority, comprising 76 participants, have experience visiting nature tourism areas, demonstrating a strong inclination towards engaging with natural sites like forest reserves and eco-parks.

Table 2 Demographic profile

Question	Answer option	Frequency	Percentage (%)
Age	Less than 18 years old	1	0.9
	18 - 30 years old	58	54.2
	31 - 40 years old	22	20.6
	41 - 50 years old	14	13.1
	Above 50 years old	12	11.2
Gender	Male	44	41.1
	Female	63	58.9
Education Level	Secondary school (SPM/PMR/PT3)	6	5.6
	STPM/Diploma/Foundation/Matriculation	25	23.4
	Bachelor Degree	51	47.7
	Master Degree	13	12.1
	Doctor of Philosophy	12	11.2
Income level	Less than RM 1500	52	48.6
	RM 1501 - RM 2500	28	26.2
	RM 2501 - RM RM 3500	14	13.1
	RM 3501 and above	13	12.1
Experience	Yes	76	71

visiting nature tourism area	No	31	29
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3.2.2 Level of understanding of orchid-based tourism

The analysis in Table 3 reveals that the most common response, from 54 respondents, is "Somewhat familiar / Agak mengenali." with Orchid-Based Tourism. The analysis shows that 51 respondents answered "Yes / Ya," indicating that they are aware that orchid-based tourism specifically involves activities centered around orchid gardens and destinations. This suggests a reasonable level of understanding among a significant portion of the sample about what orchid-based tourism entails. The analysis shows that "Photography opportunities / Peluang untuk mengambil gambar" is the most popular interest, chosen by 40 respondents.

Table 3 Part 2: Level of understanding of orchid-based tourism

Question	Answer option	Frequency	Percentage (%)
Familiarity with the concept of Orchid-Based Tourism	Very familiar	21	19.6
	Somewhat familiar	54	50.5
	Not familiar	32	29.9
Awareness about the specific nature of orchid-based tourism.	Yes	51	47.7
	Not sure	37	34.6
	No	19	17.8
Interests of respondents in activities related to orchids	Photography opportunities	40	37.4
	Guided tours in the nature areas	24	22.4
	Orchid conservation and gardening workshops	27	25.2
	Purchasing orchid-based souvenirs and handicraft	16	15

Table 4 focuses on respondents' preferences and opinions regarding different orchid species in various contexts: aesthetic appeal, attractiveness for tourism, and suitability for conservation displays. The orchids considered are *Pteroceras pallidum*, *Pomatocalpa spicata*, *Bromheadia finlaysoniana*, *Agrostophyllum stipulatum*, and *Coelogyne rochussenii*. In question 1, respondents chose orchids based on morphological appearance. *Bromheadia finlaysoniana* was the most popular, indicating its strong aesthetic appeal, followed by *Pomatocalpa spicata* and *Pteroceras pallidum*. After that, *Bromhaedia finlaysoniana* once again topped the list of choices when it came to orchids for a tourism environment, indicating that people saw it as a popular tourist destination. *Pomatocalpa spicata* was also preferred, indicating that tourist situations find it appealing. Conversely, when considering the orchids' appropriateness for conservation displays, the choices were spread more equally. While *Pomatocalpa spicata* and *Bromheadia finlaysoniana* remained common, *Pteroceras pallidum* and *Coelogyne rochussenii* also caught a lot of attention.

Table 4 Preferences and opinions regarding different orchids

Question	Answer option	Frequency	Percentage
I am attracted with the morphological appearances of this flower	<i>Pteroceras pallidum</i>	18	16.7
	<i>Pomatocalpa spicata</i>	21	19.4
	<i>Bromheadia finlaysoniana</i>	42	38.9
	<i>Agrostophyllum stipulatum</i>	11	10.2
	<i>Coelogyne rochussenii</i>	15	13.9
In my opinion, this orchid is the most captivating for a tourism setting	<i>Pteroceras pallidum</i>	18	16.7
	<i>Pomatocalpa spicata</i>	27	25.0
	<i>Bromheadia finlaysoniana</i>	36	33.3

	<i>Agrostophyllum stipulatum</i>	15	13.9
	<i>Coelogyne rochussenii</i>	11	10.2
I found that this orchid are suitable as a display at the orchid-based tourism area	<i>Pteroceras pallidum</i>	21	19.4
	<i>Pomatocalpa spicata</i>	24	22.2
	<i>Bromheadia finlaysoniana</i>	25	23.1
	<i>Agrostophyllum stipulatum</i>	15	13.9
	<i>Coelogyne rochussenii</i>	22	20.4

3.2.3 Level of interest of orchid-based tourism

Table 5 contains ratings on a scale from 1 to 5, assessing respondents' knowledge and attitudes towards different aspects of orchid-based tourism. These aspects are the importance of orchid-based tourism for economic growth, environmental conservation, and education; the prioritization of conservation efforts and sustainable practices in orchid-based tourism destinations; and the interest in seeking educational opportunities about orchids and their conservation in the context of orchid-based tourism. Most respondents recognize the importance of orchid-based tourism for economic growth, environmental conservation, and education, as indicated by high ratings (4 and 5) from a combined total of 75 respondents. This suggests a strong awareness of the multifaceted benefits of orchid-based tourism. The prioritization of conservation efforts and sustainable practices in orchid-based tourism is also highly valued, with the highest number of respondents (52) giving it a rating of 5. Overall, 77 respondents rated this aspect 4 or 5, highlighting a widespread acknowledgment of the importance of sustainability in tourism. Interest in educational opportunities related to orchids and their conservation is similarly high, with 68 respondents rating this aspect 4 or 5.

Table 5 Knowledge and attitudes towards different aspects of orchid-based tourism

Question	Answer option	Frequency	Percentage (%)
Orchid-based tourism is important for economic growth, environmental conservation, and education	Strongly disagree	10	9.3
	Disagree	9	8.3
	Neutral	13	12.0
	Agree	32	29.6
	Strongly agree	43	39.8
It is important for orchid-based tourism destinations to prioritize conservation efforts and sustainable practices	Strongly disagree	9	8.3
	Disagree	8	7.4
	Neutral	13	12.0
	Agree	25	23.1
	Strongly agree	52	48.1
I would like to seek out educational opportunities or information and their conservation when engaging in orchid-based tourism	Strongly disagree	10	9.3
	Disagree	10	9.3
	Neutral	19	17.6
	Agree	27	25
	Strongly agree	41	38.0

Table 6 focuses on respondents' perceptions and interests in various aspects related to orchids and orchid-based tourism. These aspects include the interest in the morphological appearances of orchids, the appeal of orchid-based tourism, and the interest in the medicinal uses of orchids. Respondents show a strong interest in the morphological appearances (such as shape, color, organ) of orchids, with 73 respondents giving a rating of 4 or 5. The idea of orchid-based tourism is perceived as appealing, again with a majority (71 respondents) rating this aspect 4 or 5. Interest in the medicinal uses of orchids, such as the use of *Bromheadia finlaysoniana*'s flowers as a heart tonic, is also notably high. A total of 76 respondents rate their interest as 4 or 5, indicating a substantial curiosity or attraction to the medicinal properties of orchids.

Table 6 Perceptions and interests in various aspects related to orchids and orchid-based tourism.

Question	Answer option	Frequency	Percentage (%)
I am interested in the morphological appearances of the orchids	Strongly disagree	7	6.5
	Disagree	12	11.1
	Neutral	15	13.9
	Agree	33	30.6
	Strongly agree	40	37.0
I found that the idea of orchid-based tourism is appealing	Strongly disagree	8	7.4
	Disagree	14	13.0
	Neutral	14	13.0
	Agree	31	28.8
	Strongly agree	40	37.0
I am interested to know the medicinal use of orchids that are widely used such as <i>Bromhaedia finlaysoniana</i> 's flowers as a heart tonic	Strongly disagree	6	5.5
	Disagree	7	6.5
	Neutral	18	16.7
	Agree	31	28.7
	Strongly agree	45	41.7

Table 7 reflects the respondents' experiences and preferences related to orchid-based tourism. These aspects include interest in guided tours about orchids and their conservation, the desire to see unique orchid species at tourist sites, and the willingness to pay for rare and unique orchid species. Question 1 shows there's a notable interest in guided tours that provide information about orchids and their conservation, with 63 respondents rating this aspect 4 or 5. The desire to see orchid species that are unique to the tourist site is even more pronounced, with 68 respondents giving this aspect a rating of 4 or 5. When it comes to willingness to pay for rare and unique orchid species, opinions are more varied. A total of 44 respondents rate their willingness as 4 or 5, indicating a fair number of respondents are open to spending more for unique or rare orchids. However, there's also a significant proportion who are less inclined to spend a large amount, as reflected in the lower ratings.

Table 7 Experiences and preferences related to orchid-based tourism.

Question	Answer option	Frequency	Percentage (%)
I am interested in a guided tour that provides information about orchids and their conservation in Labis Forest Reserve	Strongly disagree	12	11.1
	Disagree	11	10.2
	Neutral	21	19.4
	Agree	33	30.6
	Strongly agree	30	27.8
I would like to see orchid species that cannot be found anywhere except on the tourist site	Strongly disagree	11	10.2
	Disagree	10	9.3
	Neutral	18	16.7
	Agree	22	20.4
	Strongly agree	46	42.6
I am willing to pay a huge amount of money to buy rare and unique species of orchids	Strongly disagree	11	10.2
	Disagree	17	15.8
	Neutral	35	32.4
	Agree	20	18.5
	Strongly agree	24	22.2

3.3 Evaluation of tourism potential in Labis Forest Reserve

The survey highlights a diverse understanding of Orchid-based Tourism among respondents, with a significant number exhibiting a moderate level of awareness, suggesting a varied exposure to this niche sector. While a majority are aware of activities centered around orchid gardens, a considerable number remain unsure or unaware, revealing potential gaps in knowledge that could be addressed through targeted educational efforts. Notably, preferences for specific orchids, such as *Bromheadia finlaysoniana* and *Pomatocalpa spicata*, indicate a resonance with respondents for both aesthetic appeal and perceived suitability for tourism. The wide range of orchid preferences highlights the diverse appeal of these species in the context of orchid-based tourism and conservation. The preferences had a number of orchid-related attractions, the most well-liked of which is photography. Orchids are popular for their aesthetic appeal, conservation efforts, guided tours, and the sale of souvenirs with orchid themes. This wide variety of interests emphasizes the value of preserving orchids' natural beauty as well as their potential for growth and marketing in the tourist industry focused on orchids. This diversity of preferences provides useful information for individuals working in this business, pointing to possible areas for growth and marketing to appeal to a diverse consumer base.

Participants' knowledge, attitudes, and opinions about orchid-based tourism and other topics are revealed by the survey. The first section emphasizes the value of sustainable practices and conservation initiatives for the environment, the economy, and education. Programs for teaching on orchids and their preservation are likewise of interest. This suggests a thorough comprehension of the role and importance of orchid-based tourism. The subsequent segment exhibits a keen interest in the morphologies of orchids, the appeal of traveling with orchids in mind, and an inquisitiveness regarding the medicinal uses of orchids. The respondents are drawn to orchid-based travel because of its aesthetic qualities and their interest in the medicinal applications of these plants. This common interest demonstrates how captivating and involving orchids can be for people in a variety of settings. The opinions expressed in the third segment range from mild to slightly positive on a variety of orchid- and tourism-related subjects. These results point to a positive and well-rounded view of orchid-based tourism, highlighting areas of particular interest as well as the potential for more participant involvement and educational opportunities. The unique and educational orchid tourism experiences that respondents are drawn to include guided tours and viewing endangered orchid species. Their varying willingness to pay for unique and rare orchids, however, indicates that not all tourists may be more willing to part up their cash.

The last open-ended question received a wide range of ideas and viewpoints for improving orchid-based tourism. The importance of more social media presence, better orchid plant care and marketing, and instructional programs like seminars and films are among the major issues. A wide range of suggestions are put up by the respondents, including holding massive orchid carnivals, erecting monuments dedicated to orchids, offering orchid seedlings for sale to visitors, and incorporating regional art and culture into the travel experience. The preservation of endangered orchid species and recommendations for sustainable methods are highlighted, with an emphasis on conservation. The possibilities for culinary experiences, health items, merchandising with orchid themes, and the application of technology in teaching and cultivation research are all highlighted in the responses. The variety of suggestions indicates a keen interest in developing orchid-based tourism through interactive, educational, and conservation-focused initiatives, aligning with sustainable practices and community engagement.

3.4 Identification of potential areas suitable for orchid tourism in Labis Forest Reserve

In this study, orchid species were sampled at three study sites, including the Taka Melor Amenity Forest, Labis Forest Reserve, and Sungai Bantang Eco Park. The majority of orchid species collected from the study areas grow epiphytically attached to trees and terrestrially, reside along riversides.

Table 1 shows that a total of 39 orchids from 16 genera were collected from Labis Forest Reserve where 36 orchids are epiphytes, while three orchids have terrestrial growth forms. Sungai Bantang Eco Park was found abundant with orchid species compared with the number of orchid species in Taka Melor Amenity Forest and Labis Forest Reserve. The reason for this is that in contrast to Taka Melor Amenity Forest and Labis Forest Reserve, orchid species in Sungai Bantang Eco Park were more visible. The genus *Coelogyne* was found to have the greatest number of orchid species reported on the checklist, followed by the *Bulbophyllum*. With over 200 species, the vast genus *Coelogyne* is spread throughout a pantropical region that includes the Himalayas, Sri Lanka, India, Southern China, and all of South East Asia up to Papua New Guinea. The majority of species are epiphytic, meaning they grow on the huge trees seen in primary forests. This poorly known group of orchids found in Peninsular Malaysia has a good number of small to large flowers that are fragrant and usually have a short flowering period [13].

Sungai Bantang Eco Park is a popular destination for orchid-based tourism due to its diverse orchid species and rich biodiversity. The park's lush surroundings offer a vibrant tapestry of colors and patterns, making it a popular destination for both outdoor enthusiasts and orchid enthusiasts. One notable orchid species is *Coelogyne rochussenii*, known for its striking combination of colors and patterns on its elegantly flowing flowers.

This species outperforms common species like *Bromheadia finlaysoniana* in botanical tourism due to its exceptional shape and relative rarity. The unique morphology of *Coelogyne rochussenii* creates a unique visual experience, drawing nature lovers and plant enthusiasts seeking something special. Unlike common species like *Bromheadia finlaysoniana* and *Pomatocalpa spicatum*, *Coelogyne rochussenii* offers a unique and exclusive experience with a rare botanical wonder. Sungai Bantang Eco Park is a top choice for those who appreciate the diversity and beauty of orchids in a breathtaking natural environment.

Coelogyne rochussenii orchids are epiphytic and sympodial plants with an oval bulb, oblong leaves, and pointy apex [14]. They bloom all year round in Peninsular Malaysia, with a distinct peak lowering season in January [15, 16]. The orchid's distinctive features include short and broad leaves, narrowly cylindrical pseudobulbs, and a mild jasmine scent [15]. The distinctive features of *Coelogyne rochussenii*, which set it apart from the other seven members of the Tomentosae section found in Peninsular Malaysia, include its short and broad leaves, which are borne laterally on specialized non-leafy shoots, and its narrowly cylindrical, strongly ribbed pseudobulbs that abruptly contract at the apex [16]. Create a customized travel package with a *Coelogyne rochussenii* theme to highlight the orchid's distinctive qualities in Sungai Bantang Eco Park. Start with tours of the natural environment for orchids led by knowledgeable guides. Emphasize the beauty of delicate white or cream-colored blooms with beautiful patterns and a pleasant scent. Involve guests in educational seminars that explore the development patterns, life cycle, and importance of conservation efforts for *Coelogyne rochussenii*. Workshops on practical cultivation provide insights into ideal growth conditions and the significance of environmentally friendly methods. During guided photography workshops, capture the beauty of the orchid while adhering to conservation guidelines. Interactive displays highlight the structure of the orchid, highlighting its pseudobulbs, leaves, and blooms to illustrate its significance to the park's environment. Finally, provide visitors with unique *Coelogyne rochussenii* mementos, such as artwork or tiny potted orchids, to encourage them to bring home a physical memento of their trip and to raise awareness for conservation.

4. Conclusion

In conclusion, this study has provided important new information on the diversity of orchids in Labis Forest Reserve especially with regard to rare and critically endangered orchids that are in need for conservation. The connections shown between issues about ecotourism and sustainability and demographic characteristics including age, gender, education level, and citizenship status suggest that these factors have a big influence on people's perceptions and understandings.

Overall, the findings highlight the importance of focused educational and promotional measures to increase awareness and support for sustainable tourism practices. It emphasizes how crucial it is to take demographics into account when creating and executing awareness initiatives. To guarantee the sustained relevance of sustainability measures in the orchid-based tourism sector and to create inclusive viewpoints, future research should stress the participation of a wide range of stakeholders, including local populations. Investigating efficient communication techniques can help local communities and industry stakeholders have meaningful conversations that foster mutual understanding and transparency.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

Study conception and design: Umirul Akmalissa Rahmat **data collection:** Umirul Akmalissa Rahmat, Yap Jing Wei, Salman Faris Zaharin, Mohd. Ilham Norhakim Lokman,; **analysis and interpretation of results:** Umirul Akmalissa Rahmat, Muhammad Haqim Mohamad Zakariah **draft manuscript preparation:** Umirul Akmalissa Binti Rahmat, Yap Jing Wei. All authors reviewed the results and approved the final version of the manuscript.

References

- [1] Seidenfaden, G., & Wood, J. J. (1992). *The Orchids of Peninsular Malaysia and Singapore*. Olsen & Olsen.

- [2] Prakash Chhetri, Abigail Rai Chamling, Rajesh Joshi, Devendra Kumar, & Sandeep Rawat. (2022). Monograph Orchids of Prakriti-kunj. G B Pant National Institute of Himalayan Environment.
- [3] Schiff, J. L. (2018). History of orchids. In *Rare and Exotic Orchids* (pp. 1–27). Springer International Publishing. https://doi.org/10.1007/978-3-319-70034-2_1
- [4] Fay, M. F. (2018). Orchid conservation: how can we meet the challenges in the twenty-first century? *Botanical Studies*, 59(1). <https://doi.org/10.1186/s40529-018-0232-z>
- [5] Pickering, C., & Ballantyne, M. (2012). Orchids: an example of charismatic megafauna tourism? In *The Routledge Handbook of Tourism and the Environment* (pp. 192– 199). Routledge. <https://doi.org/10.4324/9780203121108.ch18>
- [6] *Orchid Park*. (2023). Dewan Bandaraya Kuching Utara. <https://dbku.sarawak.gov.my/page-0-411-98-tid.html>
- [7] Perbadanan Putrajaya. (2023). Festival Bunga Dan Taman Floria Diraja Putrajaya 2022. Perbadanan Putrajaya.
- [8] Surga Route. (2022). Segala Yang Anda Perlu Tahu Berkenaan Royal Floria Putrajaya 2022 ; Aktiviti Menarik, Harga Tiket, Lokasi & Masa Terbaik Untuk Lawat. Surga Route. <https://surgaroute.com/2022/segala-yang-anda-perlu-tahu-berkenaan-royal-floria-putrajaya-2022-aktiviti-menarik-harga-tiket-lokasi-masa-terbaik-untuk-lawat/>
- [9] K.C., A. (2018). Tourism and its role in environmental conservation. *Journal of Tourism and Hospitality Education*, 8, 30–47. <https://doi.org/10.3126/jthe.v8i0.20009>
- [10] Lemma, A. F. (2014). *Tourism impacts: evidence of impacts on employment, gender, income*. <http://partnerplatform.org/eps-peaks>
- [11] Jain, K., & Ventures, E. (2020). Environmental and socio-economic impacts of ecotourism: A review. *International Journal of Innovative Research and Advanced Studies*, 7(6), 175–178. www.ijiras.com
- [12] J. A. McNeely, J. W. Thorsell, & H. Ceballos-Lacsurain. (1992). *Guidelines: Development of National Parks and Protected Areas for Tourism*. World Tourism Organization
- [13] Yoh, K. H. (2019). *Systematic studies of orchid genus Coelogyne in Peninsular Malaysia* [Doctoral]. Universiti Putra Malaysia.
- [14] Heriansyah, P., & Marlina, G. (2021). Characterization and potential of *Coelogyne rochussenii* orchids from Bukit Rimbang and Bukit Baling Wildlife Sanctuary as explant source. *Jurnal Sylva Lestari*, 9(1), 64. <https://doi.org/10.23960/jsl1964-75>
- [15] Lok, A. F. S. L., Ang, W. F., Chong, K. Y., Yeo, C. K., & Tan, H. T.-W. (2011). Rediscovery in Singapore of *Coelogyne rochussenii de vriese* (Orchidaceae) . *Nature in Singapore*, 4, 49–53.
- [16] Ong, P. T. (2016). The pollination of *Coelogyne rochussenii*. *The Orchid Review*, 124(1315), 148–153.