BIODIVERSITAS
Volume 25, Number 6, June 2024
Pages: 2780-2787

ISSN: 1412-033X
E-ISSN: 2085-4722
DOI: 10.13057/biodiv/d250649

Short Communication: Habitat preferences of epiphytic orchids and potential pollinators in Sumber Pawon Forest, Kediri District, East Java, Indonesia

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Manuscript received: 1 February 2024. Revision accepted: 6 July 2024.

Abstract. *Putra SRT, Trisnawati I. 2024. Short Communication: Habitat preferences of epiphytic orchids and potential pollinators in Sumber Pawon Forest, Kediri District, East Java, Indonesia. Biodiversitas 25: 2780-2787.* Sumber Pawon Forest, a unique and biodiverse ecosystem in Kediri, Indonesia, is home to approximately 30,000 orchids (family Orchidaceae), which can grow terrestrial or as epiphytes. A diversity of different taxa has been recorded as orchid pollinators. The distribution of epiphytic orchids in this forest is determined by habitat preferences including vertical distribution zone and host tree's characteristics. This research, conducted in the captivating Sumber Pawon Forest, aims to determine habitat preferences influencing the abundance of epiphytic orchids and provide a review of potential epiphytic orchid pollinators. The data were collected by systematic sampling method. Analysis of epiphytic orchids' habitat preferences was done using the ordination method. The study found 3 epiphytic orchids and 5 species of host trees, revealing new insights into their distribution. Epiphytic orchids include *Cymbidium* sp., *Dendrobium crumenatum*, and *Rhynchostylis retusa*. The host trees include *Alstonia scholaris*, *Artocarpus elasticus*, *Bischofia javanica*, *Ficus elastica*, and *Samanea saman*. Epiphytic orchids were mainly found in zone 4 rather than in zone 5. The characteristics of host trees, which are preferentially selected by epiphytic orchids, include tree height (ranging from 28.65 to 33.65 meters), large DBH (ranging from 165.61 to 175.80 meters), and closed canopy cover (ranging from 51% to 75%). One of the pollinator taxa (named Hymenoptera) was found to pollinate epiphytic orchid species, adding to our understanding of their ecological interactions.

Keywords: Epiphytic orchids, host trees, pollinator conservation, vertical distribution zone

Abbreviations: PLNA: Pollinia, ATR CP: Anther Cap, PLNR: Pollinaria, CLMN: Column

INTRODUCTION

Approximately 30,000 species of orchids (family Orchidaceae) can grow terrestrial as lithophytes or epiphytes (Ray et al. 2022; Kindlmann et al. 2023). In Indonesia, epiphytic orchids have been found in nearly 5,000-6,000 species distributed along lowland and highland tropical forests (Prapitasari and Kurniawan 2022). The diversity of epiphytic orchids is influenced by environmental factors such as elevation, light availability, and humidity (Choden et al. 2021; Aini et al. 2022). Epiphytic orchids grow on host trees and possess ecological values to maintain nutrient and water cycle, i.e. increasing water retention and absorbing water in the tree canopy (Petean et al. 2018; Spicer and Woods 2022), which create suitable environmental factors for animal habitats like insects and other vertebrates (Adhikari et al. 2016; Gotsch et al. 2016; Yang et al. 2016). The flower of epiphytic orchids provides a nectar source for many pollinators. The diversity of taxa has been recorded as orchid pollinators like insects, mammals, and birds (Zariman et al. 2022; Ackerman et al. 2023). However, the pollination biology of these species is not yet well understood, underlining the urgent need for this research. The life cycle of epiphytic orchids has a minimal geographical distribution. It is crucially dependent on other organisms, possibly due to highly specialized relationships with other taxa, including mycorrhizal fungi, host trees, and pollinators (Rasmussen and Rasmussen 2018; Zhang et al. 2018; Kurniawan et al. 2020). Moreover, Global IUCN Red List assessments have been conducted on over half of epiphytic orchids (56.5%) from 28,484 orchid species that were found to be threatened with extinction (Gale et al. 2018). The existence of epiphytic orchids is commonly threatened by deforestation, over-exploitation, road construction, and forest fires (Wraith and Pickering 2018; Choden et al. 2021; Besi et al. 2023).

Many studies have been focused on epiphytic orchids' composition and diversity in Indonesia. It is well-known that the preferential habitat of epiphytic orchids is in highland tropical forests (Fardhani et al. 2015; Febriandito and Soetopo 2019; Kurniawan et al. 2020). Fardhani et al. (2020) reported that in the mountain forests of Mount Sanggara (1,903 masl), the differences in host tree height and canopy depth influence the epiphytic orchid community. Prapitasari and Kurniawan (2021) research on Mount Gede Pangrango (1,100-1,400 masl) revealed differences in the habitat preferences for growing epiphytic orchids depending on the host tree characteristics. However, the relationship between epiphytic orchids and their host trees and pollinators is still limited, mainly in

lowland forests. Therefore, to gather more information, this study aims to determine the habitat preferences of epiphytic orchids and their potential pollinators in lowland tropical forests, especially East Java, still needs to be completed.

Sumber Pawon Forest, Kediri, East Java (200-250 masl) is a protected area for flora, fauna, and ecosystems according to the criteria for Environmental Strategic Areas in Government Regulations Number 15/2010. Sumber Pawon Forest has been utilized as a natural tourism area and is considered a conservation site by the Regional Government as an Essential Ecosystem Area based on Law Number 23/2014 to protect its biodiversity (Setiono 2021; Steni 2021). Due to epiphytic orchids' complex biology and association with other organisms, they present challenges in their conservation. Therefore, an inventory of epiphytic orchids, host trees, and their potential pollinators is important to develop *in-situ* conservation strategies to preserve target species along their original habitat (Liu et al. 2015; Zhang et al. 2015; Fay 2018). This study provides more insights into the habitat preferences of epiphytic orchids, which influence their abundance. In addition, this study's limitation is that it reviews the potential pollinators of epiphytic orchids related to studies of pollinator visitation.

MATERIALS AND METHODS

Study site

This research was conducted from December 2021 to March 2022 in the Sumber Pawon Forest, Tempurejo Village, Wates Sub-district, Kediri District, East Java Province, Indonesia. Sumber Pawon Forest is a lowland tropical forest (200-250 masl) with a mixed vegetation forest type and an area of ± 13 ha. The Sumber Pawon Forest has been made into an Alas Karetan Natural Tourism Area because of its attraction and uniqueness, by having hundred year old rubber trees (*Ficus elastica*). It has the Pawon spring used by local people for irrigation and once experienced habitat fragmentation due to land conversion into sugar cane fields. In this research, 9 sampling points were created according to the presence of epiphytic orchids on the host tree. These sampling points located at: 7°53'25.03"S and 112°8'55.54"E (point 1); 7°53'21.40"S and 112°8'53.77"E (point 2); 7°53'22.99"S and 112°8'52.11"E (point 3); 7°53'26.04"S and 112°8'53.10"E (point 4); 7°53'24.77"S and 112°8'50.17"E (point 5); 7°53'27.26"S and 112°8'51.98"E (point 6); 7°53'32.26"S and 112°8'55.70"E (point 7); 7°53'38.20"S and 112°09'07.23"E (point 8); and 7°53'44.11"S and 112°9'15.17"E (point 9) (Figure 1).

Tools and materials

The research tool includes a GPS Garmin eTrex 10, Haga Altimeter, sewing meter, roll meter, raffia rope, camera Canon 60D sigma 70-300 mm F/1.4-5.6 DG Macro Lens, binoculars, and an observational data form. The materials were epiphytic orchids, host trees, and only pollinator species from the literature.

Epiphytic orchids data collection on host trees

Vegetation analysis

Data collection on epiphytic orchids on host trees used systematic sampling with a combination of roaming methods along the observation route based on the presence of epiphytic orchid species at the study point (Adhikari et al. 2015). The observation path was made using a 50-m-long line transect, and then a 10 x 10 m plot was made with a distance of 10 m for each 3 plot in one line. The plot placement was in alternating order; if the first plot is on the left side, the second plot will be on the right side, etc.

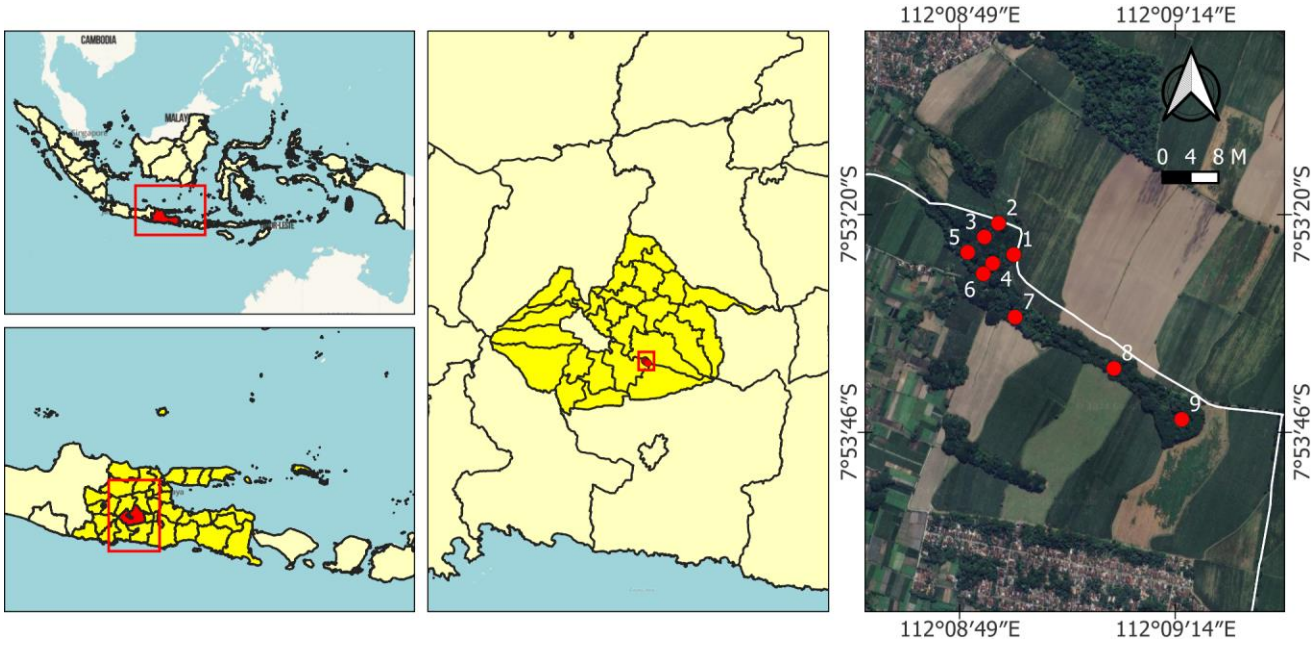


Figure 1. Location map of data sampling in Sumber Pawon Forest, Kediri, East Java, Indonesia

Vertical distribution zones of epiphytic orchids

The epiphytic orchids' vertical distribution zone on host trees refers to Johansson (1974). The zoning area divided into five zones: Zone 1: trunk base (1/3 of the main trunk); Zone 2: main trunk to first branch (2/3 of the top of the main trunk); Zone 3: basal part of the branch (1/3 of the total trunk length); Zone 4: middle part of the branch (next 1/3 of the middle part); and Zone 5: outermost part of the branch (1/3 of the outermost part of the branch) (Wangdi 2016; Rasmussen and Rasmussen 2018) (Figure 2).

Host trees characteristic

Bark texture, DBH, tree height, and canopy cover parameters determined the characteristics of the host tree. Bark texture was measured based on visual estimation adapted from Hernández-Pérez et al. (2018) and Adhikari et al. (2021), categorized into 2 classes: smooth (lacking peeling or cracks) or rough (fissured, with longitudinal grooves and ridges). The host tree trunk circumference measures DBH (diameter breast height), and tree height is determined with the CGQ1 Haga Altimeter. Canopy cover is determined by analyzing the openness of the tree canopy with the GLAMA (Gap Light Analysis Mobile Application) application. Canopy cover was categorized into 4, including very closed (>75%), closed (51%-75%), open (26%-50%), and very open (0%-25%) (Behie et al. 2019; Diana and Andani 2020).

Identification of epiphytic orchids and host trees

The epiphytic orchid species and the number of individuals and their host trees were identified *in-situ* using field guides. Plant identification was collected and documented by photograph for taxonomic determination. Plant specimens and photographs were compared to field guides: Orchids of Java Vol. 2 (Handoyo 2019) for orchids and Trees of Southeast Asia (Guan 2019) for the host tree. While, the nomenclature was accessed using The Plant List (https://www.theplantlist.org/) to obtain the accepted name.

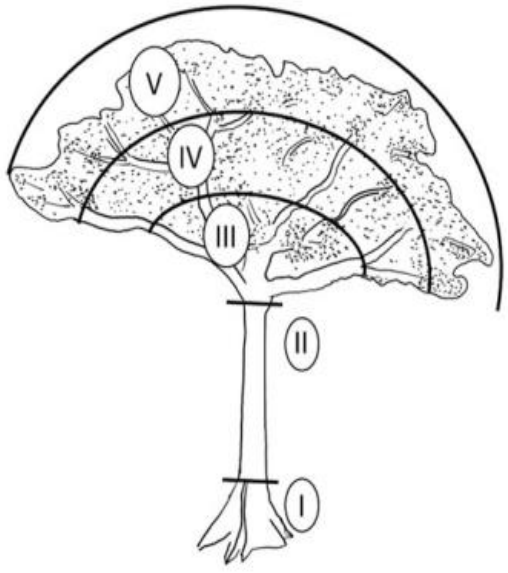


Figure 2. Growth spot zonation of epiphytic orchids on the host (adapted from Johansson (1974) in Zotz 2016)

Potential pollinators in epiphytic orchids

Literature studies, including journals and articles, determine potential pollinator species in epiphytic orchids. The literature includes published journals referring to Leong and Wee (2013), Buragohain et al. (2015), Pal et al. (2019), and Adit et al. (2022). *In-situ* photographs took orchid pollinator documentation from references with a camera Sony digital camera model- DSC-HX 7V (16.2 mega-pixels) (Leong and Wee 2013; Buragohain et al. 2015; Adit et al. 2022). The pollinator species in epiphytic orchid flowers were determined according to visits and the successful pollinia attachment to pollinator insects (Ray et al. 2022). The results from various literature were compiled as a pollinator composition table with epiphytic orchid species in the Sumber Pawon Forest.

Data analysis

The ordination method was used in combination with CANOCO Windows 4.5 program. This method visualizes the relationship between composition variables and species abundance on the host tree's vertical distribution zone of epiphytic orchids (Timsina et al. 2021). The correlation and PERMANOVA test used the SPSS version 16.0 application to determine whether each characteristic parameter of the host tree, including bark texture, trunk DBH, tree height, and canopy cover, affected the abundance of epiphytic orchids.

RESULTS AND DISCUSSION

Composition and vertical distribution zone

The study result, shows 3 epiphytic orchids and 5 host trees (Table 1). There are variations of epiphytic orchids on host trees, i.e., *Dendrobium crumenatum* can grow on 5 different host trees. However, some epiphytic orchids only grow on 1 host tree species, i.e., *Cymbidium* sp. and *Rhynchostylis retusa*. Host tree preference shows that epiphytic orchids do not have particular specifications for the host tree species in their habitat, so their associations are not always specific (Trimanto and Danarto 2020). Several factors that influence the habitat of epiphytic orchids depend on the microclimate, such as light intensity, temperature, and humidity created by the canopy cover of the host tree. These can create the vertical distribution zone of epiphytes on host trees (Benítez et al. 2015; Hernández-Pérez et al. 2018).

Table 2 shows the most abundant epiphytic orchids on the host tree was Zone 4, consisting of 372 individuals and 2 epiphytic orchid species. The next zone is occupied by Zone 3, with 236 individuals and 2 epiphytic orchid species. Zone 4 (the middle part of the branch) and Zone 3 (the basal part of the main branch) support the growth of orchids (Figure 3). However, in this study, the microclimate measurements were not observed. Therefore, according to Fardhani et al. (2020), Zone 4 and Zone 3 provide suitable microclimate conditions that are covered by canopy leaves, which are not directly exposed to sunlight and have the potential to cause drought. Zone 4 and Zone 3 also have horizontal branches, allowing the accumulation of humus (Petean et al. 2018).

Table 1. Composition of epiphytic orchids and host trees

Epiphytic orchids	Total of host tree	Host trees
Cymbidium sp. Sw.	1	*Ficus elastica* Roxb.
Dendrobium crumenatum Sw.	5	*Alstonia scholaris* (L.) R.Br., *Artocarpus elasticus* Reinw. Ex Blume, *Bischofia javanica* Blume, *Ficus elastica* Roxb., *Samanea saman* (Jacq.) Merr.
Rhynchostylis retusa (L.) Blume	1	*Samanea saman* (Jacq.) Merr.

Table 2. Vertical distribution zone of epiphytic orchids on host trees

Epiphytic orchids	Common name	Vertical distribution zone					Total of epiphytic orchids
		1	2	3	4	5	
Cymbidium sp. Sw.	Boat orchid	0	30	14	0	0	44
Dendrobium crumenatum Sw.	Pigeon orchid	0	0	222	369	20	611
Rhynchostylis retusa (L.) Blume	Foxtail orchid	0	0	0	3	0	3
Number of individuals		0	30	236	372	20	658
Number of species		0	1	2	2	1	

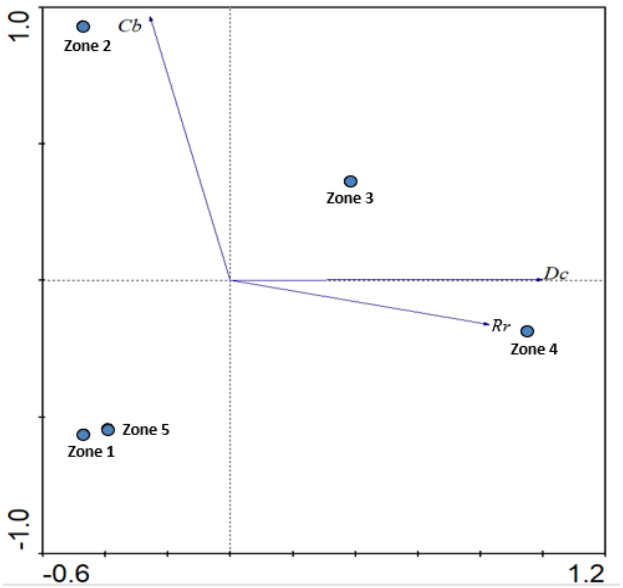


Figure 3. PCA (Principal Component Analysis) ordination diagram of epiphytic orchid vertical distribution zone (= Code of vertical distribution point (zone 1-5); : Code of epiphytic orchid species; Cb: *Cymbidium* sp.; Dc: *Dendrobium crumenatum*; Rr: *Rhynchostylis retusa*)

Meanwhile, Zone 2 and 5 both contained 1 epiphytic orchid species. Zone 2 is occupied by *Cymbidium* sp., as it has lower light intensity than the tree canopy zone (Zones 3, 4, and 5). *Cymbidium* sp. can grow better with moist conditions and less sunlight (Soorae 2018). The next zone with the fewest orchid individuals is Zone 5, the outermost branching zone. Fardhani et al. (2020) reported that Zone 5 has canopy conditions with higher temperatures, easily exposed to wind and rain. In addition, the challenge for maintaining the attachment of epiphytic orchid seedlings to the host tree and avoiding detachment from trunk bark; secured seedlings have to germinate roots for attachment to the host tree, and growing seedlings have to increase their population size to sustain from numerous of mechanical disturbances by rainfall, wind, or arboreal animals (Tay et al. 2023). Zone 1 had no epiphytic orchid species located at the trunk base. Nurfadilah (2015) states they have difficulty accessing more sunlight, which alters their photosynthesis process.

Host trees characteristic

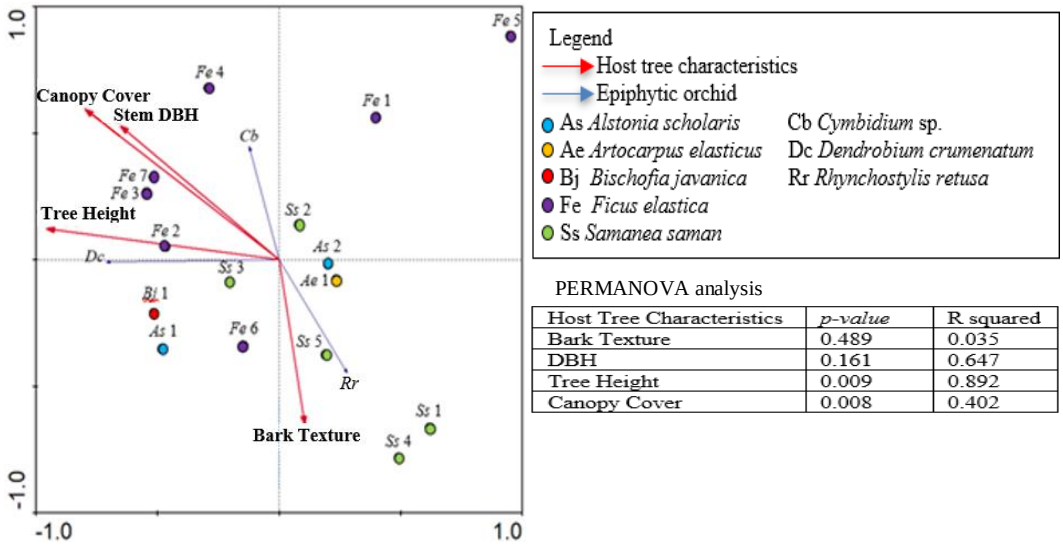
The tendency of habitat preferences between host tree characteristics, species, and orchid abundance is shown in Figure 4, illustrated using an RDA (Redundancy Analysis) diagram. We found 3 host tree species with rough bark texture and 2 with smooth bark texture (Table 3). The relationship between smooth and rough bark textures showed no closeness between epiphytic orchids abundance and host tree (p-value > 0.05) (Table 4). This result follows from a previous study conducted by Duarte and Gandolfi (2017), that the bark roughness of host trees was unrelated to epiphyte abundance and development. Tay et al. (2023) also stated that the substrate roughness of host tree to epiphyte richness and abundance were likely flawed due to many factors to consider, such as different bark types, ontogenetic stages, and root adhesion mechanisms. The ordination data closeness of DBH and tree height predicted that the host tree influences epiphytic orchids' abundance. We found *F. elastica* has the biggest DBH (162.88 ± 11.83 cm) and highest tree (30.51 ± 3.94 m) (Table 3) and shows a significant effect (p-value < 0.05) on epiphytic orchids' abundance (Table 4). The greater DBH and tree height influenced the abundance of the epiphytic orchids, especially on *F. elastica*. As stated by Wagner and Zotz 2020 and Ai et al. 2023, epiphytic orchid occupancy and abundance per tree generally increase with tree size because larger surface areas provide a more variable microhabitat, better bark quality and greater exposure to humidity and light. The ordination of canopy cover was close to *Cymbidium* sp. and *D. crumenatum*, especially on *F. elastica* was categorized as a closed canopy (51-75 %) (Figure 4). We found 3 species of tree with a closed canopy, i.e., *B. javanica* (62.09 ± 0 %), *F. elastica* (60.24 ± 9.32 %), and *A. scholaris* (53.95 ± 4.64 %). Otherwise, opened canopy cover (26-50 %), i.e., *A. elasticus* (47.85 ±

0 %) and *S. saman* (44.1 ± 12.24 %) (Table 3). This study shows that canopy cover significantly affects the number of epiphytic orchids (p-value < 0.05) (Table 4). The canopy cover indicates the light intensity that penetrates the tree branches. A dense tree canopy can maintain the humidity and water availability needed by epiphytic orchids to grow (Gotsch et al. 2015; Trimanto and Danarto 2020). Otherwise, an opened canopy cover causes epiphytic orchids to be exposed directly to sunlight, making them susceptible to drying out (Parra-Sánchez et al. 2023). Therefore, canopy cover and tree size strongly influenced relative humidity and/or light availability (Mitchell et al. 2021). According to Timsina et al. 2016, microclimate factors such as humidity and light availability that are created by host tree characteristics play a critical part in determining epiphyte abundance and vertical distribution zone.

Composition of epiphytic orchids potential pollinator species

There were 4 species of potential epiphytic orchid pollinators found in the literature review, including bees (Order: Hymenoptera) (Table 5 and Figure 5). Based on the review, we found *Apis cerana*, *A. mellifera*, *Xylocopa aestuans*, and *X. violacea* in the same Family: Apidae. *D. crumenatum* was only visited by *A. cerana* (Leong and Wee 2013); *Cymbidium* sp. visited by *A. cerana*, *A. mellifera*, and *X. aestuans* (Pal et al. 2019; Adit et al. 2022). *R. retusa* is only visited by *X. violacea* (Buragohain et al. 2015).

Research on pollinators and epiphytic orchids is still limited in Southeast Asia; it has been examined and developed to a certain extent. The potential pollinators from various studies in the Asian region can be found in Sumber Pawon Forest, East Java, Indonesia. Based on the review, Hymenoptera or bees can pollinate orchids (Table 5). Bees can fly up to 23 km/day, thus becoming the important pollinators of many plants, such as orchids. Nearly 700 orchid species were pollinated by males, intending to collect odor compounds to attract female bees (McDonald et al. 2022). Labellum is a vital component of orchids visited by pollinators. The labellum acts as a resting place or a deceptive sexual organ (Şeker et al. 2016).



PERMANOVA analysis

Host Tree Characteristics	*p-value*	R squared
Bark Texture	0.489	0.035
DBH	0.161	0.647
Tree Height	0.009	0.892
Canopy Cover	0.008	0.402

Figure 4. RDA (Redundancy Analysis) and PERMANOVA analysis of epiphytic orchid and host tree characteristics. Number notation at host tree code to determine each host tree's difference

Table 3. Host tree characteristic

Tree species	Common name	Bark texture	DBH (cm)	Tree height (m)	Canopy cover (%)
Alstonia scholaris (L.) R.Br.	Blackboard tree	Rough	153.2 ± 2.86	29.15 ± 2.5	53.95 ± 4.64
Artocarpus elasticus Reinw. Ex Blume	Terap tree	Smooth	112.74 ± 0	27.65 ± 0	47.85 ± 0
Bischofia javanica Blume	Bishop wood	Rough	154.46 ± 0	29.65 ± 0	62.09 ± 0
Ficus elastica Roxb.	Rubber fig	Smooth	162.88 ± 11.83	30.51 ± 3.94	60.24 ± 9.32
Samanea saman Merr.	Trembesi	Rough	119.49 ± 9.28	26.05 ± 1.74	44.1 ± 12.24

Table 4. P-value and correlation coefficient of host tree characteristic

Host tree characteristic	p-value	Indicator	Correlation coefficient	Indicator
Bark Texture	0.489	No statistical significance	-0.187	No correlation
DBH	0.004	Statistical significance	0.681	Strong correlation
Tree Height	0.001	Statistical significance	0.816	Very strong correlation
Canopy Cover	0.001	Statistical significance	0.851	Very strong correlation

Table 5. Composition of epiphytic orchid potential pollinator

Pollinator	Order	Epiphytic orchid	Source
Apis cerana Fabricius	Hymenoptera	*Cymbidium* sp Sw., *D. crumenatum* Sw.	Leong and Wee (2013); Adit et al. (2022)
Apis mellifera Linnaeus		*Cymbidium* sp Sw.	Pal et al. (2019).
Xylocopa aestuans Linnaeus		*Rhynchostylis retusa* (L.) Blume	Buragohain et al. (2015)

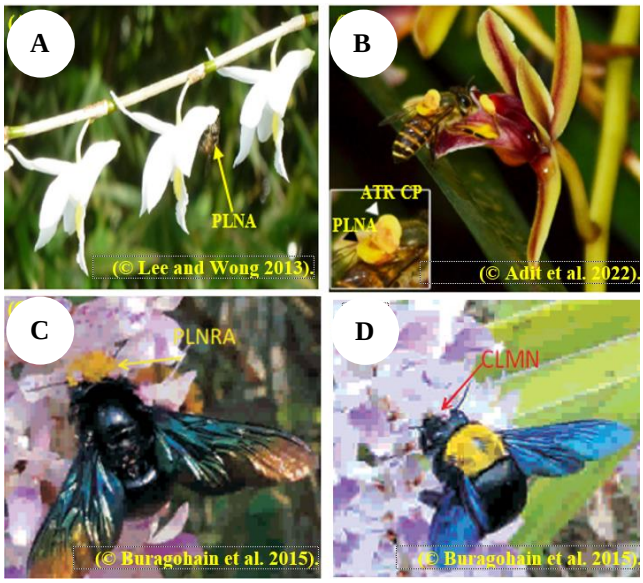


Figure 5. Pollination of epiphytic orchid by pollinator: A. Pollination by *A. cerana* at *D. crumenatum* (Leong and Wee 2013); B. Pollination by *A. cerana* at *Cymbidium* sp. (Adit et al. 2022); C. Pollination by *X. violacea* in *R. retusa.*; D. Pollination by *X. aestuans* in *R. retusa* taken with Sony digital camera model-DSC-HX 7V (16.2 mega-pixels) (Buragohain et al. 2015). (PLNA: Pollinia, ATR CP: Anther cap, PLNR: Pollinaria, CLMN: Column)

In addition, the contrasting color of petals, flower number, flower size, floral architecture, and floral scent can attract insects to visit and determine the attractiveness of the flower or pollination effectiveness (Pal et al. 2019; Wu et al. 2020). A byproduct of pollination, bees receive rewards from nectar and pollen as a food source (Nicholls and Ibarra 2017; Pal et al. 2019; Basari et al. 2021). Bees easily access and pollinate epiphytic orchids by using trees as nests for their habitat (Ray et al. 2022; Eeraerts and Isaacs 2023). Leong and Wee (2013) reported that *A. cerana* flies from flower to flower *D. crumenatum* on trees (Figure 5A). *D. crumenatum* has a fragrant aroma and white petals, which attract bees to feed on nectar. Pal et al. (2019) and Adit et al. (2022) reported that *A. cerana* could pollinate *Cymbidium* sp., indicated by the presence of pollinia and anther cap, which is attached to the thorax (Figure 5B). Buragohain et al. (2015) found that *R. retusa* was pollinated by *X. aestuans* and *X. violacea* to get nectar (Figure 5C and 5D). In addition, potential orchid pollinators aside from bees have been recorded, such as moths, butterflies, flies, wasps, beetles, and birds (Zariman et al. 2022; Ackerman et al. 2023). Based on this review, all epiphytic orchid species found in the Sumber Pawon Forest can potentially be a nectar source for insect species.

Recommendation of conservation strategy

Sumber Pawon Forest is a natural tourism area threatened by illegal logging and exploitation of natural resources. Sumber Pawon Forest was close to settlements and highways and experienced land conversion into sugar cane fields. The local government's designation of the Sumber Pawon Forest as an Alas Karetan Natural Tourism Area is a conservation effort examined primarily for monitoring illegal logging and woody over-exploitation. According to Sunarno et al. (2020), this initiative aims to invite and trigger local communities to maintain the sustainability of natural areas because, with tourists, it is easy to monitor tree loggers. By working with local communities, conservationists could better understand natural resource's ecological and cultural significance and develop effective conservation strategies (Droissart et al. 2023). Several efforts to implement host trees, epiphytes, and pollinator conservation have yet to be implemented in Sumber Pawon Forest. Table 1 shows a minimal number of epiphytic orchids due to habitat loss. This small sample size of epiphytic orchids was also found in another lowland tropical forest, Indonesia, which experienced land conversion, i.e., Sumber Ubalan Forest, Kediri by Fitri and Santoso (2014) with 6 species; and Rawa Aopa Watumohai National Park Area by Marwah et al. (2021) with 7 species and very low abundance only 22 individuals. A low number of species and abundance in lowland tropical forests may represent a remnant habitat of orchids due to deforestation (Kurniawan et al. 2018). The epiphytic orchid long-term

management planning is crucial to conserving host trees for orchid and pollinator habitats. The conservation effort can also be done by protecting host trees and tree planting activities to prevent increased land conversion. According to Reiter et al. (2016), efforts to conserve orchid and pollinator habitat must be accompanied by the enrichment of individual epiphytic orchid species, especially indigenous species. As reported by Pemberton (2010) and Koju et al. (2023), habitats rich in plant diversity are essential for preserving the existence of pollinators. Because the pollinator of the epiphytic orchid is symbiotic with other plant taxa, such as food plants and host plants, it is necessary to enrich local plant diversity to provide food and habitat for an orchid pollinator.

In conclusion, this study reported 3 species of epiphytic orchids and 5 species of host trees. The most abundant distribution of epiphytic orchids on host trees is in Zone 4. The selected host tree suitable for epiphytic orchids is *F. elastica*, and the common pollinator on epiphytic orchids is Hymenoptera. The conservation of epiphytic orchids in Sumber Pawon Forest had a low species number, so further research on the enrichment of individuals and species of indigenous lowland epiphytic orchids is vital to increasing the diversity of orchids and supporting many pollinators.

ACKNOWLEDGEMENTS

The authors express gratitude to the Indonesian Collaborative Research (RKI) 2022-2023 and the local community and government of Essential Ecosystem Area Sumber Pawon, East Java, Indonesia, for their financial support and permission to access the sampling locations for this research.

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