

Genetic Resources Exploration of Temanggung Wild Orchid in Arabica Coffee Agroforestry : A Conservation Effort and Initial Step in Plant Breeding

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ABSTRACT

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Wild orchids represent valuable genetic resources that are increasingly threatened by habitat loss and environmental disturbance. This study aimed to explore, identify, and evaluate the morphological diversity and phenetic relationships of wild orchid species occurring in arabica coffee based agroforestry systems on the slopes of Mount Sindoro, Temanggung Regency, Central Java, Indonesia. Field exploration was conducted from December 2025 to January 2026 in three sub-districts, resulting in the identification of ten wild orchid species, comprising seven epiphytic and three terrestrial orchids. A total of 35 vegetative and reproductive morphological characters were observed and scored. Phenetic similarity analysis was performed using the UPGMA clustering method with the NTSYSpc software. The results revealed a wide range of morphological variation among the species, reflected by similarity index values ranging from 0.1143 to 0.9429, indicating high diversity. Cluster analysis separated the orchids into two major groups, with several closely related subgroups, particularly among species within the same genus. Notably, *C. purpureum* and *C. ophrydis* exhibited very high morphological similarity despite distinct floral coloration, suggesting close genetic relationships. The presence of diverse orchid species within coffee agroforestry systems highlights the role of agroforestry in maintaining native flora and providing opportunities for in situ conservation. These findings provide essential baseline data for orchid conservation strategies and serve as an initial reference for future breeding and genetic studies of wild orchids in Java

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1. Introduction

Flowering plants originating from the *Orchidaceae* family, are plants that have high genetic diversity as well as having a unique genetic differentiation pattern and are spread geographically[1]. This ornamental plant is familiarly known as an orchid. Orchids are ornamental plants that have high aesthetic and economic value, so that many people have an interest in collecting them[2]. Efforts to collect orchids, especially wild orchids, are often not balanced by conservation efforts, especially those carried out by irresponsible individuals or those who take/exploit them from nature on a large scale. Although natural/wild orchids have less attractive flower patterns and qualities when compared to orchids that have been domesticated or hybridized through plant breeding. Wild orchids have their own uniqueness in the form of strong resistance,

attractive aroma, and uniqueness that domesticated orchids do not have[3]. so this type of orchid has its own fans/collector.

Current conditions, which involve rampant illegal logging, conversion of forest land, forest fires, invasion by invasive flora species, and climate change. Threaten the biodiversity, existence, and survival of wild orchids[4]. Due to the loss of their natural habitat and changes in environmental conditions that trigger abiotic stress. There is a conflict of interest between fulfilling food needs, availability of agricultural locations, and specific growing conditions for plants, resulting in coercion to plant cultivated/plantation crops in the forest. A strategic to reduce the negative impacts of this, is to implement agroforestry[5]. Agroforestry systems, such as combining natural tree stands and cultivated plants such as Arabica coffee and spice plants under tree stands, are able to maintain biodiversity and maintain environmental conditions[6]. With this method, at least it still provides an opportunity and maintains the existence of native flora, especially orchids.

When viewed from a geographical perspective, Indonesia has genetic wealth in the form of orchid species biodiversity. It is estimated that there are 5000-6000 species of orchids spread across Indonesia, this number is almost 25% of the total number of orchids in the world[7]. However, according to information from the IUCN (International Union for Conservation of Nature), several orchid species are threatened with extinction. Wild orchid species need to be explored and studied for their kinship, with the aim of being able to carry out conservation and plant breeding to increase diversity. Identification and exploration of wild orchids can be reviewed based on phenotypic and genotypic characters [8]. The database obtained is important to use as a basis for consideration in order to plant conservation and breeding strategies. In simple terms, kinship relationships can be identified phenotypically through the morphological characteristics of the species being compared[9].

Morphological characterization of wild orchids is important for selecting orchid germplasm varieties[10], especially to obtain orchids with superior and attractive characteristics. This can be used as parent material for plant breeding activities. Either simply through artificial crossbreeding to obtain hybrids, through biotechnology, or simply for domestication. Orchid morphological information is important for determining the position of the parent plant to be used, because the advantages of orchids can be seen through the characteristics of the flowers, color, shape, freshness duration and aroma[11]. Orchid species that have too different morphological similarities and the more distant the kinship tend to have low cross-breeding success[12].

Temanggung Regency is one of the largest coffee-producing regions in Indonesia[13], particularly Robusta and Arabica coffee. Arabica coffee requires specific altitudes, especially in the highlands ranging between 1000-1600 meters above sea level [14]. Some Arabica coffee plantations reach forest areas in the mountains (Mount Sindoro and Sumbing) which have quite high altitudes. The existence of an agroforestry system will certainly affect the cycles and dynamics that occur in the forest[15], it also have an impact on wild orchids that grow in this habitat. Moreover, wild orchids from Java have not been identified and explored further, so there are still opportunities for further research. There has not even been any research that specifically discusses the exploration of wild orchids on Mount Sindoro. Therefore, it is important to conduct research and exploration of wild orchids in agroforestry areas, with the aim of identifying existing orchids, especially for the purpose of increasing diversity through plant breeding and conservation to maintain orchid biodiversity.

2. Method

The research was conducted in Temanggung Regency, specifically on Arabica coffee agroforestry land located on the slopes of Mount Sindoro in the Bansari, Ngadirejo, and Kledung sub-districts. The study was conducted from December 10, 2025, to January 12, 2026. The materials used in this study were 10 orchid species discovered during the exploration (Figure 1). The tools used are a dagger, digital altimeter, magnifying glass, camera with telephoto and macro lenses, GPS (Global Positioning System), ruler, tweezers, and an orchid description book by agricultural research and development agency germplasm commission (2004) and also Ornamental Plant Research Center, Ministry of Agriculture, Indonesia (2007).

The research conducted was exploratory descriptive research, where orchid sampling was carried out to obtain morphological character data (vegetative and reproductive), both qualitative and quantitative characters. The morphology observed includes the roots, stems, leaves and flowers, a total of 35 morphological characters were observed. The morphological data obtained will then be converted into a scoring form according to the specified character groups. The data obtained will be presented in a morphological character table and the scoring data will be subjected to similarity analysis using the clustering method with the UPGMA (Unweighted Pair Group Method with Arithmetic mean) method through the SimQual subprogram, using the NTSYSpc (Numerical Taxonomy and Multivariate Analysis System) application series 2.02i.

2.1. Exploration and Search for Orchids in Arabica Coffee Agroforestry

Orchid exploration is carried out by directly exploring the coffee agroforestry land using different routes and exploration points, with the hope of being able to explore the location evenly. Exploration was carried out in 5 main habitats according to the type of epiphytic and terrestrial orchids, on land, cliffs, rocks, fallen tree, and trees/host plants. The search was carried out carefully, some types of terrestrial orchids are difficult to identify because the posture of the plants is lower than the vegetation that covers the surface of the ground.

2.2. Observation of Morphological and Habitat Characters

Orchids that have been found will then be identified morphologically without taking them from their original growing place (if possible). The location where the orchid was found will be marked with coordinates using GPS and the altitude of the place will also be recorded. Descriptive observations were also carried out to obtain information regarding the condition of the habitat/environment and information on environmental damage that threatens the orchid population found.

3. Results and Discussion

Based on research that has been carried out, 10 species of wild orchids were found in the agroforestry area, 7 of which are epiphytic orchids which consists of *Luisia javanica*, *Pholidota imbricata* (Roxb.) Lindl., *Dendrobium crumenatum* Sw., *Rhynchostylis retusa*, *Acriopsis lilifolia* (Koen.) Ormerod., *Aerides odorata*, and *Taeniophyllum hasseltii*. the remaining 3 are terrestrial orchids which consists of *Calanthe triplicata*, *Crepidium purpureum*, and *Crepidium ophrydis*. 6 orchids were found in the coffee agroforestry land in Bansari sub-district, 2 in Kledung sub-district, and the remaining 2 in Ngadirejo sub-district (Table 1).

Table 1. Origin of wild orchid species

No.	Species	Location Coordinates	Sub-District	Altitude	Type
1.	<i>Luisia javanica</i>	7°17'16"S 110°01'22"E	Bansari	1.658,43	Epiphytic
2.	<i>Pholidota imbricata</i> (Roxb.) Lindl.	7°19'00"S 110°01'17"E	Kledung	1.735,34	Epiphytic
3.	<i>Dendrobium crumenatum</i> Sw.	7°15'35"S 110°00'43"E	Ngadirejo	1.398,22	Epiphytic
4.	<i>Rhynchostylis retusa</i>	7°17'24"S 110°01'35"E	Bansari	1.564,6	Epiphytic
5.	<i>Acriopsis lilifolia</i> (Koen.) Ormerod.	7°15'40"S 110°00'37"E	Ngadirejo	1.454,42	Epiphytic
6.	<i>Aerides odorata</i>	7°17'18"S 110°01'20"E	Bansari	1.720,73	Epiphytic
7.	<i>Taeniophyllum hasseltii</i>	7°18'56"S 110°01'16"E	Kledung	1.740,16	Epiphytic
8.	<i>Calanthe triplicata</i>	7°17'23"S 110°01'18"E	Bansari	1.628,86	Terrestrial
9.	<i>Crepidium purpureum</i>	7°17'25"S 110°01'18"E	Bansari	1.699,49	Terrestrial
10.	<i>Crepidium ophrydis</i>	7°17'24"S 110°01'17"E	Bansari	1.706,73	Terrestrial

The discovery of orchid species in various locations, indicate that wild orchids have specific growing environmental requirements. This can be seen that even in the same place but at different altitudes not too significant, there are orchid species that dominate. Different altitudes will affect different abiotic environmental conditions[16]. Information on ideal altitude and environmental conditions that are affected by altitude is important to study in order to provide optimal environmental conditions for ex situ conservation, if the original environmental conditions have been damaged and require a long time to be restored. However, ex situ conservation has

weaknesses in the form of high costs, suppressing the increase in biodiversity, inbreeding depression, and accumulation of detrimental alleles[17].

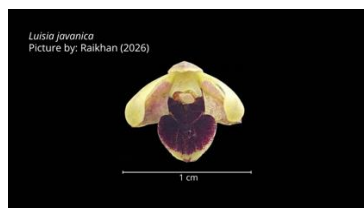
3.1. Morphological Characters

Morphological characterization of flora is an important initial step in mapping the genetic diversity of populations in a particular geographic zone. Good characterization and inventory of orchid species in the forest will facilitate conservation activities, germplasm collection, plant breeding, and also for the purposes of biodiversity education. Some conditions and dynamics of orchid populations in nature can be used as an condition indicator of the forest environment[18]. Well-maintained orchid populations indicate that the habitat continues to support orchid reproduction/population. variations in morphological characters and species diversity in nature, indicating good genetic diversity and resources[19]. Morphological characterization that has been carried out on 10 orchid species (Table 2) in flowering condition, has a variety of morphological characters in each character observed, both in vegetative and reproductive organs, both in qualitative and quantitative characters.

Table 2. Morphological characters of 10 wild orchid species

Character	1	2	3	4	5	6	7	8	9	10
Habitat	Epiphytic	Epiphytic	Epiphytic	Epiphytic	Epiphytic	Epiphytic	Epiphytic	Terrestrial	Terrestrial	Terrestrial
Growth type	Monopodial	Sympodial	Sympodial	Monopodial	Sympodial	Monopodial	Monopodial	Sympodial	Sympodial	Sympodial
Root type	Aerial roots	Adhesive roots	Adhesive roots	Adhesive roots	Adhesive roots	Aerial roots	Aerial roots	Terrestrial roots	Terrestrial roots	Terrestrial roots
Pseudobulb	Absent	Present	Present	Absent	Present	Absent	Absent	Present	Present	Present
Pseudobulb (longitudinal)	Absent	Oblong	Lanceolate	Absent	Ovate	Absent	Absent	Ovate	Ovate	Ovate
Pseudobulb (transverse)	Absent	Linear	Lanceolate	Absent	Lanceolate	Absent	Absent	Lanceolate	Linear	Linear
Pseudobulb size	Absent	Medium	Very Large	Absent	Very small	Absent	Absent	Large	Medium	Small
Leaf shape	Absent	Oblong	Oblong	Linear	Linear	Oblong	Absent (Aphyllous)	Elliptic	Elliptic	Elliptic
Leaf apex	Acute	Acute	Retuse	Praemorse	Acute	Retuse	Absent	Acuminate	Acuminate	Acuminate
Leaf edges	Entire	Entire	Entire	Entire	Entire	Entire	Absent	Undulate	Undulate	Undulate
Leaf surface texture	Glabrous	Glabrous	Glabrous	Glabrous	Glabrous	Glabrous	Absent	Pilose	Glabrous	Glabrous
Leaf arrangement	Duplicate	Duplicate	Duplicate	Duplicate	Duplicate	Duplicate	Absent	Convolute	Convolute	Convolute
Leaf Symmetry	Symmetric	Symmetric	Symmetric	Asymmetric	Symmetric	Symmetric	Absent	Symmetric	Symmetric	Symmetric
Trichomes	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Present	Absent	Absent
Inflorescence type	Fasciculate	Racemose	Racemose	Racemose	Paniculate	Racemose	Racemose	Racemose	Racemose	Racemose
Resupination	Resupinate	Non-resupinate	Resupinate	Resupinate	Resupinate	Resupinate	Resupinate	Resupinate	Non-resupinate	Non-resupinate

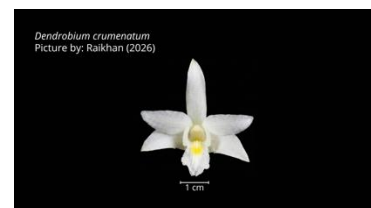
Flower shape	Stellate	nate Circular	Stellate	Circular	Stellate	Stellate	Stellate	Stellate	te Stellate	te Stellate
Sepal shape	Oblong	Ovate	Lanceolate	Ovate	Oblong	Ovate	Lanceolate	Ovate	Ovate	Ovate
Petal shape	Linear	Oblong	Elliptic	Elliptic	Elliptic	Elliptic	Linear	Obovate	Linear	Linear
Sepal and petal apex	Obtuse	Obtuse	Acute	Obtuse	Obtuse	Obtuse	Acute	Acute	Acute	Acute
Sepal and petal cross-section	Concave	Concave	Straight	Concave	Straight	Concave	Straight	Concave	Straight	Straight
Callus bump	Complex	Complex	Complex	Complex	Complex	Complex	Simple	Complex	Simple	Simple
Spur	Absent	Absent	Present	Present	Absent	Present	Present	Present	Absent	Absent
Number of pollinia	Two	Four	Four	Two	Two	Four	Four	Eight	Four	Four
Pseudobulb (length)	Absent	Small	Large	Absent	Very small	Absent	Absent	Small	Medium	Small
Pseudobulb (width)	Absent	Medium	Medium	Absent	Small	Absent	Absent	Large	Small	Small
Pseudobulb (thickness)	Absent	Medium	Medium	Absent	Small	Absent	Absent	Large	Medium	Medium
Leaf length	Short	Medium	Very short	Long	Very short	Short	Absent	Very long	Very short	Very short
Leaf width	Narrow	Very broad	Medium	Medium	Narrow	Medium	Absent	Very broad	Broad	Broad
Leaf thickness	Thick	Thin	Thin	Medium	Membranous	Medium	Absent	Membranous	Membranous	Membranous
Flower length	Very short	Very short	Very long	Medium	Very short	Long	Very short	Very long	Very short	Very short
Sepal dorsal (l x w)	Very small	Very small	Very large	Small	Very small	Large	Very small	Very large	Very small	Very small
Lateral sepal (l x w)	Very small	Very small	Very large	Medium	Very small	Large	Very small	Large	Very small	Very small



A.



B.



C.

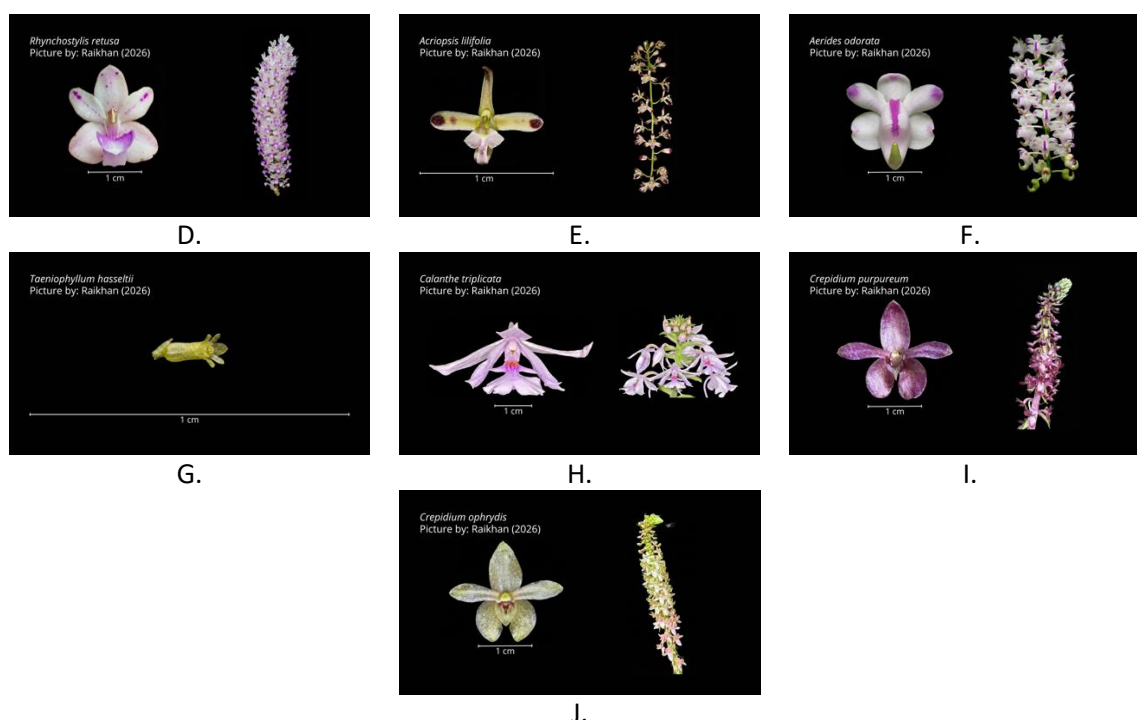


Fig. 1. Flower of: A. *Luisia javanica*, B. *Pholidota imbricata* (Roxb.) Lindl., C. *Dendrobium crumenatum* Sw., D. *Rhynchostylis retusa*, E. *Acriopsis lilifolia* (Koen.) Ormerod., F. *Aerides odorata*, G. *Taeniophyllum hasseltii*, H. *Calanthe triplicata*, I. *Crepidium purpureum*, J. *Crepidium ophrydis*

The reproductive parts, especially flowers, show different morphological characteristics, such as shape, size, color, color gradation/pattern, and flower arrangement (Fig 1). Variation in flower morphological characteristics is an important trait in orchids, apart from being a species marker because some orchids show almost similar morphological characteristics of the vegetative parts, but not the flowers and as a determinant of the aesthetic superiority of orchids[20]. Some species of orchids found have very small flowers, around 0.5-1 cm, such as *Rhynchostylis retusa*, *Acriopsis lilifolia* (Koen.) Ormerod., *Taeniophyllum hasseltii*, *Crepidium purpureum*, and *Crepidium ophrydis*. Wild orchids mostly tend to have small flowers and less attractive patterns when compared to hybrid orchids, this is caused by one of the factors of self-pollination which results in genetic segregation so that the pattern remains more stable and monotonous, as well as for pollination efficiency and because of limited resources in the environment, especially nutrients[21].

The structure and morphology of orchid flowers affect pollination success[22]. Morphological variations in flowers, besides being influenced by genes, are also formed by the presence of adaptation factors to the growing environment, association with specific pollinators, and the efficiency of pollinia transfer to the rostellum. Some species of orchids found are also able to emit an attractive aroma from their flowers, for example, like *Dendrobium crumenatum* Sw, The fragrant smell of orchid flowers is also a unique characteristic apart from its function as an attractant for pollinator[23].

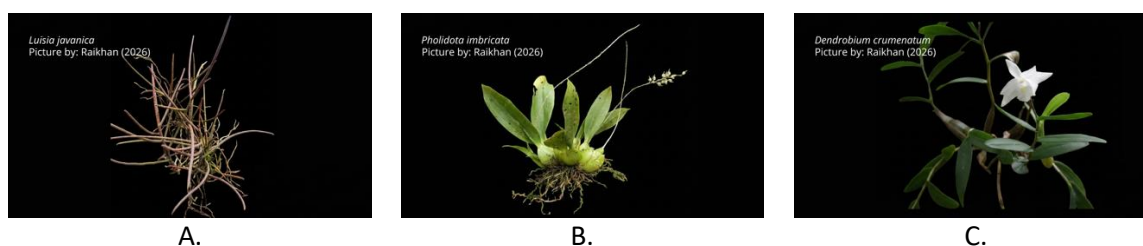




Fig. 2. Vegetative parts of: A. *Luisia javanica*, B. *Pholidota imbricata* (Roxb.) Lindl., C. *Dendrobium crumenatum* Sw., D. *Rhynchostylis retusa*, E. *Acriopsis lilifolia* (Koen.) Ormerod., F. *Aerides odorata*, G. *Taeniophyllum hasseltii*, H. *Calanthe triplicata*, I. *Crepidium purpureum*, J. *Crepidium ophrydis*

In the morphology of vegetative organs (Fig 2), differences can be clearly seen starting from the type of growth, leaves, stems, and roots. The most obvious difference is between terrestrial and epiphytic orchids. In general, the morphological differences between each species can be seen in Table 2. Epiphytic orchids mostly grow on pine (*Pinus merkusii*), mountain spruce (*Casuarina junghuhniana*), and mahogany trees (*Swietenia mahagoni*) as can be seen in Fig 3. Meanwhile, terrestrial orchids such as *Crepidium* grow and thrive on cliffs and sloping land covered by tree litter, and *Calanthe triplicata* grows on riverbanks or artificial irrigation at the edge of coffee plantations.



Fig. 3. Orchid based on the type of grow place: A. Epiphytes and B. Terrestrial

Variations in morphological characters are a common thing used to differentiate between species[24], this is very important for the purposes of selecting accessions or individuals with certain characters. Some wild orchid species have morphologically advantageous traits and physiological characteristics that are responsible for plant defense that commercial orchids do not have. These traits can be considered as determining parents to be able to produce these traits in the desired offspring. Qualitative plant traits tend not to be affected by environmental conditions

because they are controlled by one or several major genes rather than quantitative characters because it is controlled by many genes or polygenes so it is easily influenced by the environment. Morphological character database is important information in determining parent plants in plant breeding[25].

3.2. Similarity Between Species

In the 10 orchid species found, reviewed based on morphological characters, there are several similarities and differences in characters, this shows that there are several similarities in characteristics that can be used to predict kinship. The more similar the morphological characteristics between the species being compared, the more it can be understood that the species are closely related, moreover, they come from the same genus. Morphological character scoring data constructed into a phenogram (Fig 4) shows the existence of several groups of orchid species based on morphological phenetic similarities.

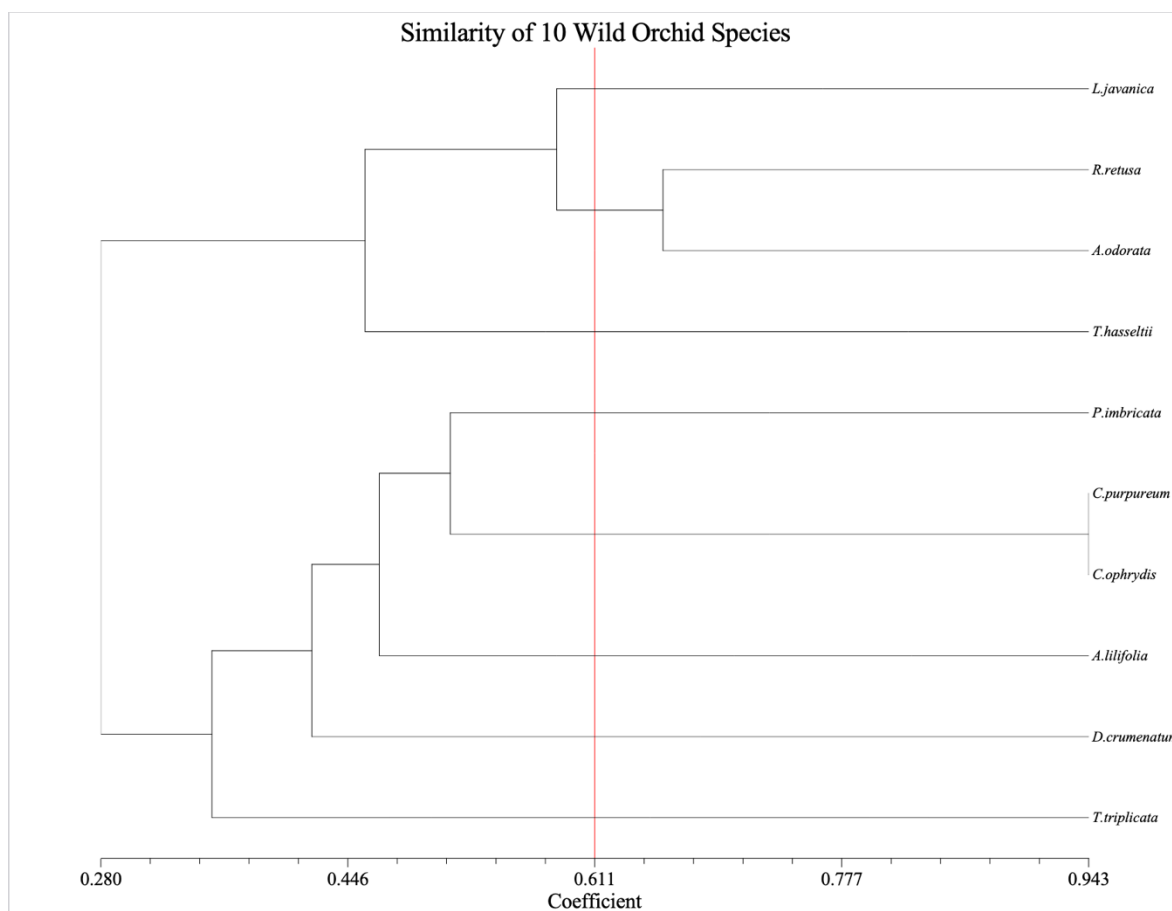


Fig. 4. Phenogram of 10 wild orchid species

separately, there are two large groups/main cluster, group 1 consists of *L.javanica*, *R.retusa*, *A.odorata*, and *T.hasseltii*. Second group consists of *P.imbricata*, *C.purpureum*, *C.ophrydis*, *A.lilifolia*, *D.crumenatum*, and *T.triplicata*. This grouping is based on similarities in morphological characteristics so that groups or branches will be formed according to similarities. There are only 2 subgroups of plants that have high similarities, namely subgroup one which consists of *R.retusa* and *A.odorata*, subgroup two is consists of *P.imbricata*, *C.purpureum* and *C.ophrydis*. Other species have high differences so that they form their own branches. *L.javanica*, *T.hasseltii*, *A.lilifolia*, *D.crumenatum*, and *T.triplicata* that do not form a subgroup can be understood to have morphological characters that have minimal similarities, this shows the existence of a variety of species with varying morphology. Orchids that are in one group or have a close kinship can be used as parents in crossbreeding, because the potential for genetic compatibility will be higher[26].

However, if the kinship and morphological similarities of an orchid are very different, then the potential for successful crossbreeding will be lower, but it will open up a higher possibility of obtaining traits that are not even found in the two parents or new variations. Selecting the right parents in orchid plants will affect the success rate of crossbreeding and the stability of the offspring[27]. The success of artificial crossbreeding is useful in increasing the diversity of orchids for agronomic purposes as well as increasing the diversity of populations that can be transferred in nature.

Table 3. Similarity matrix of 10 wild orchid species

Species	1	2	3	4	5	6	7	8	9	10
1	1.0000									
2	0.4286	1.0000								
3	0.2571	0.4857	1.0000							
4	0.5429	0.3429	0.3429	1.0000						
5	0.5429	0.4857	0.4571	0.3429	1.0000					
6	0.6286	0.3714	0.4286	0.6571	0.3143	1.0000				
7	0.5429	0.2000	0.2571	0.3714	0.2286	0.4571	1.0000			
8	0.1714	0.2571	0.3714	0.2000	0.2571	0.2857	0.1714	1.0000		
9	0.2857	0.5143	0.3714	0.1143	0.4571	0.2000	0.3143	0.4286	1.0000	
10	0.2857	0.5143	0.3714	0.1143	0.4571	0.2000	0.3143	0.4571	0.9429	1.0000

Orchid species have a high diversity index and pattern this is also in accordance with this study which can be seen in Table 2, that the lowest similarity index range is 0.1143 such as between species 4 and 9, then the highest similarity index value is 0.9429, which means the total similarity index range is 0.1143-0.9429, This very wide range of similarity indicates the existence of diversity in the species. Based on similarity, the lowest index indicates that there is high diversity in the orchid species found. The greater similarity value, the higher success of the cross but lower the variation, and if the similarity is low, the success of the cross will be low but the variation will be high.

There are interesting findings in this study, *C.purpureum* and *C.ophydis* have a high level of similarity (0.9429), but the most striking difference is in the different flower and base of the stem color, *C.purpureum* has purplish red flowers, while *C.ophydis* has greenish yellow flowers. It is predicted that these two species are very closely related and even come from the same parent but have different genotypes, but similarities in morphology do not always indicate genotypic similarities[28]. The chance of success of crossing these two species will be quite high and may produce other variations or one of the species will dominate with dominant alleles. To identify the differences between two species that have high morphological similarities, a molecular analysis method can be used using certain markers, because it would be very difficult to use morphological markers that can be influenced by the environment[29].

3.3. Dynamics and Condition of Orchid Habitat

The orchids found in this study were located in an Arabica coffee agroforestry area. where some of the original conditions of the forest area are still maintained, accompanied by planting Arabica coffee under the tree canopy. The current condition and also based on observations, the most threatened orchid population is the wild orchid type epiphyte, there is tree logging activity, where the tree is a place for epiphytic orchids to grow, some species lose their habitat and their populations decline, especially *T.hasseltii* which are often found growing on pine tree trunks. Tree logging occurs for several reasons, such as clearing land for planting agricultural crops, reducing trees for light reception for coffee, wood needs, and clearing fallen tree trunks due to wind exposure. The loss of the orchid's natural habitat has a negative impact on the orchid population and diversity. Parties interested in the use of forest land should also pay attention to the preservation of the native flora in the forest.



Fig. 5. Wild orchid habitat conditions in agroforestry area: A. coffee agroforestry with few trees and B. several trees were cut down

Changes and loss of orchid habitat conditions require special attention, there are many ways that can be used to reduce habitat loss and the decline in orchid populations, such as maintaining native flora and trees, reducing tree logging, multiplying species ex situ and returning them to nature in greater numbers, adapting coffee planting patterns to the growth patterns of native forest trees, and other conservative efforts. The diversity of germplasm, including orchids, is evidence of Indonesia's natural wealth. preserving biodiversity is the same as efforts to maintain environmental sustainability for the long term[30], because all native flora have an important role in the ecosystem and environment.

4. Conclusion

The exploration of wild orchids in arabica coffee agroforestry areas on Mount Sindoro successfully documented ten orchid species with considerable morphological diversity. The wide similarity index range and clear phenetic grouping indicate substantial genetic resource potential within this habitat. Morphological characterization proved effective in revealing phenetic relationships and identifying closely related species that may serve as promising parental material for orchid breeding programs. The study also demonstrates that coffee based agroforestry systems can function as important refuges for wild orchids, supporting biodiversity conservation while maintaining agricultural productivity. However, habitat disturbances, particularly tree removal, pose significant threats to epiphytic orchid populations. Therefore, integrated conservation efforts that combine habitat protection, sustainable agroforestry management, and further ex situ and molecular studies are strongly recommended to ensure the long term preservation and utilization of wild orchid genetic resources.

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Data and Software Availability Statements

The data in this exploratory research were obtained from direct observation and characterization in the field. The data obtained were then analyzed and processed using the NTSYS (Numerical Taxonomy and Multivariate Analysis System) series 2.02i. Citation and bibliography were written using the Zotero application. The primary data for this research can be requested by the reader with the author's permission.

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