



## THE DIVERSITY OF EPIPHYTIC ORCHID AND ITS HOST TREE ALONG CEMORO SEWU HIKING PATHWAY, LAWU MOUNTAIN, DISTRICT OF MAGETAN, EAST JAVA, INDONESIA

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**Abstract** - Cemoro Sewu hiking pathway is one of the tourist attractions in Mount Lawu, District of Magetan. Along this pathway, there were various epiphytic orchid species attached on several host trees. This study analyzed the diversity of epiphytic orchid and its host trees in a type of potentially disturbed landscape in a protected area of Mount Lawu. Line transect sampling with 100 m in length was used, and by dividing the line into ten plots (as replicates) with 10 x 10 m in size. At each plot, the following data were gathered: species name and number of individual of epiphytic orchids, and species name and number of individual of host trees. Results showed that 8 epiphytic orchid species and 5 host trees species recorded. *Pholidota globosa* (Relative Abundance of Orchid/%Fo = 58,54) was the most abundant orchid at the site, followed by *Coelogyne miniata* (%Fo = 15,73). In addition, *Lithocarpus sunndaicus* is host tree with the highest number of individual epiphytic orchid attached on it Average number of individual of epiphytic orchid on a species of host tree / Ji/ Jt= 662,41.

*Keywords:* epiphytic orchids, host trees, Cemoro Sewu hiking pathway, potentially disturbed landscape.

### INTRODUCTION

Mount Lawu is a mountainous area located on the border of two provinces, East Java and Central Java. It has the highest peak at 3.265 m above sea level (asl) and covers 5.719, 4 ha area which is divided into two zones, i.e.

production forest zone and buffer zone (Perhutani, 2010). In Java Island, which is the most populated and crowded island in Indonesia, the biodiversity is now mostly preserved in mountainous area including Mount Lawu. Despite the biological richness, there is also

various natural attractiveness, spiritual and archaeological sites in Mount Lawu that can potentially be developed as ecotourism sites, side by side with other purposes such as education, research and community empowerment (Setyawan, 2000). Fortunately, the level of forest degradation due to human activities in this area can be categorized as low because of the high level community awareness. Setyawan (2001) stated that forest vegetation in Mount Lawu can be classified as stable since there have been no volcanic activity for a long period including other types of disturbance caused by humans and forest fires.

Mount Lawu can be divided into several areas including Jabolarangan forest, Mojosemi, Cemoro Kandang, Cemoro Sewu hiking pathway

and the highest peak Argo Dumilah. Cemoro Sewu is one of hiking pathways toward the highest peak of Mount Lawu. This hiking strip is a natural ecosystem located in Ngancar, Sub-district of Plaosan, District of Magetan and is the natural habitat of Cemara Gunung (*Casuarina junghuhniana*) and Lawu Starling (Anonim, 2000).

One unique phenomenon along this pathway is the occurrence of various epiphytic orchid species attached on several host trees (Setyawan, 2000). Epiphytic plant is a less known component on forest vegetation that still need further research. This type of plant needs other plants, either tree (Dressler, 1990; Hietz 1998) or herb (Dressler, 1990), as its place to grow. The diversity of epiphytic plant on an area is influenced by the microclimate condition and the host tree characteristics such as canopy type, stem height and biochemistry processes (Setyawan, 2000). Despite the rare information on this topic, Annaselvam and Parthasarathy (2001) found that the composition of epiphytic plants recorded in a tropical evergreen forest in Varagalair is dominated by Orchidaceae (54%), followed by Piperaceae and Araceae (8%). Kindlmann and Vergara (2009) emphasized that research on orchid can be focused on the topics of species diversity, such as species-area and species-abundance relationships. This study aimed to record and analyse the diversity of

epiphytic orchid species and its host trees along Ceworo Sewu hiking pathway in Mount Lawu. Results of this study can be used as a benchmark on the epiphytic orchid conservation in a type of potentially disturbed landscape in a protected area in the future.

**METHODOLOGY**

**Study sites**

This study was carried out at Cemoro Sewu hiking pathway (2041 m asl) which is located on natural forest in Mount Lawu, Sub-district of Plaosan, District of Magetan (S 07°39'28.7" - 07°39'42.1" and E 111° 11'39.6"- 111° 13'02.5"). The site is reserve forests managed by Bagian Kesatuan Pemangkuan Hutan (Sub-forest District) Lawu Selatan under Perum Perhutani (State Owned Forest Company). The climate at these sites is relatively cool and dry with temperature of 19° to 26°C and humidity of 70 to 80%. Vegetation types at the study areas are natural sub-montane forest dominated by *Lithocarpus sundaicus* (pasang), *Acer laurinum* and *Macropanax* sp.

**Data collection and analysis**

Purposive sampling which utilized line transect were used at Cemoro Sewu hiking pathway with 100 m in length. The line was then divided into ten plots (treated as replicates) measuring 10 x 10 m (Annaselvam and Parthasarathy 2001; Focho et al. 2010). At each plot, the following data were recorded: species name and number of individual epiphytic orchids, and species name and number of individual host trees. Orchids were identified to species level if possible, and the genus level otherwise, using the books by Comber (1990, 2001) as references.

All data were recorded in a spreadsheet. The following parameters were calculated: Nt is the number of trees in the plot hosting a particular orchid species; No is the number of individuals of a particular orchid species within the plot. Based on these two parameters, Relative Frequency of host tree (%Ft) and Relative Abundance of orchid (%Fo) were calculated as below:

$$\%Ft = \frac{Nt}{Total\ number\ of\ all\ host\ trees} \times 100$$

$$\%Fo = \frac{No}{Total\ number\ of\ all\ orchids} \times 100$$

The individual number of each host tree species (Jt), number of species of orchid (Js) and number of individual of orchid (Ji) were counted in order to calculate the average number of species of epiphytic orchid on a species of host tree (Js/Jt) and the average number of individual of epiphytic orchid on a species of host tree (Ji/Jt). Species-area curve was also analysed in order to examine the relationship between the addition of sampling area and the addition of epiphytic orchid species.

**RESULTS AND DISCUSSION**

**Epiphytic orchid**

Table 1 showed that eight epiphytic orchid species from four genera were recorded at the study site. Three most abundant orchid were *Pholidota globosa* (Relative Abundance of Orchid/%Fo = 58,54), *Coelogyne miniata* (%Fo= 15,73) dan *Bulbophyllum* sp. (%Fo= 15,70).

Table 1. The epiphytic orchid species at the study site and the value of parameters.

No	Orchid species	Nt	No	(%) Ft
1	<i>Bulbophyllum flavidiflorum</i> Carr.	2	202	3.13
2	<i>Bulbophyllum ovalifolium</i> (Blume) Lindl.	1	50	1.56
3	<i>Bulbophyllum</i> sp.	10	2007	15.63
4	<i>Coelogyne miniata</i> Lindl.	16	2011	25.00
5	<i>Coelogyne</i> sp.	1	10	1.56
6	<i>Eria multiflora</i> (Blume) Lindl.	9	814	14.06
7	<i>Eria</i> sp.	3	205	4.69
8	<i>Pholidota globosa</i> (Blume) Lindl.	22	7482	34.38
Total		64	12781	100.00

(Nt is the number of trees in the plot hosting a particular orchid species; No is the number of individuals of a particular orchid species within the plot; %Ft is Relative Frequency of host tree; %Fo is Relative Abundance of orchid)

**The diversity of epiphytic orchid and its host tree along Cemoro Sewu hiking pathway, Lawu mountain, district of Magetan, East Java**

The diversity of epiphytic orchid at Cemoro Sewu hiking pathway can be categorized as low. This is probably caused by the elevation (2041 m asl) that do not support some orchid to grow. Steenis (1972) stated that the variation of orchid diversity was at the highest on elevation between 500 and 1500 m asl and tend to be low on elevation more than 2000 m asl. Jacquemyn et al. (2005) also stated that elevation has negative relationship with species evenness, meaning that species evenness will decrease along with increasing altitude.

Java. This orchid grows on the areas with altitude from 1000 to 2400 m dpl and will be abundant and largely clumped on suitable habitat. (Mahyar and Sadili, 2003; Puspitaningtyas et al, 2003). *Pholidota globosa* and *Coelogyne miniata* are characterized by having long flowering periods, having good vegetative structures and easy for vegetative propagation (Comber 2001; Destri and Jodi 2006). Therefore, these two orchids are dominant among other at the study site.



Figure 1 *Pholidota globosa* flower (left) and *Coelogyne miniata* grows clumped on a host tree.

Previous studies in Mount Lawu reported that 11 epiphytic orchid were found at Jabolarang forest with altitude ranging from 1600 – 2298 m asl (Sutarno et al 2001), while Setyawan (2001) recorded there were two orchid species, i.e. *Liparis pallida* and *Pholidota articulata* attached on *Schima wallichii* (puspa), at Cemoro Sewu and Cemoro Kandang hiking pathway at the altitude 2000 – 2200 m asl.

All epiphytic orchid species recorded at the study site are orchid species that inhabit ecosystem type of sub-montane and montane with the altitude ranging from 700 to 2500 m asl (Mahyar and Sadili, 2003; Puspitaningtyas et al, 2003). *Pholidota globosa* (Figure 1), the most abundant orchid at the study site, was geographically distributed from Sumatera, to Malaya Peninsula and mostly found in forest areas in Java with elevation of 700 to 2500 m asl (Mahyar and Sadili, 2003). *Coelogyne miniata* can only be found in East Java and Central Java and therefore classified as endemic

#### Host tree

Results showed there were five species of host tree at Cemoro Sewu hiking pathway (Table 2). *Lithocarpus sundaicus* (Jt = 17, Ji/Jt = 662,41) was the most abundant host tree at the study site followed by *Macropanax sp.* (Jt = 6, Ji/Jt = 151,00).

Similar to orchid, the diversity of host tree species at the study site can be categorized as low. All five trees were species that commonly found in sub-montane and montane ecosystem type. A host tree for epiphytic orchid was usually characterized by particular traits such as thick, humid and rough ripped bark that are easily peeled off. These characters ease the orchid to get water and nutrients (Tirta, 2000). Ecologically, each epiphytic orchid prefers particular habitat and host tree (Wisnugroho, 1998). The five host trees at the study site have rough barks that made them ideal for an orchid to attach its root. This result is in accordance with the study of Flores-Palacios and Ortiz-Pulido (2005) that epiphytic orchids prefer rough barked trees

Table 2. The host tree species at the study site and the values of parameters measured.

No.	Species of host tree	Jt	Js	Ji	Js/Jt
1	<i>Lithocarpus sundaicus</i>	17	7	11261	0.41
2	Theaceaceae	2	1	45	0.50
3	<i>Macrophanax sp.</i>	6	5	906	0.83
4	<i>Acer laurinum</i>	1	2	19	2.00
5	<i>Tree stump</i>	1	3	550	3.00
Total		27		12781	

(Jt is the individual number of each host tree species, Js is the number of species of orchid and Ji is the number of individual of orchid. Js/Jt is the average number of species of epiphytic orchid on a species of host tree and Ji/Jt is the average number of individual of epiphytic orchid on a species of host tree.)

rather than the smooth ones as their hosts. Aside from trapping more water and nutrients, the thick, humid and deep ripped bark is the best place for orchid seeds because of the available substrate necessary for initial growth than the smooth bark. However, Bergstrom and Carter (2008) suggest that physical characteristic of a bark is not a single important factor to the occurrence of epiphytic orchid. Their finding revealed that there are some particular orchid species that prefer host tree with smooth and relatively thin bark. In addition, light intensity due to canopy structure of the host trees also influences the epiphytic orchid preference for growth. Many epiphytic orchids in Indonesia are found on trees with spaced canopy since sunlight is allowed to go through it (Seitske et al., 2001).

**Species-area relationship of epiphytic orchid and host tree**

The sampling area of this study was 1000 m<sup>2</sup> which was divided into ten plots of 100 m<sup>2</sup> each with total 6 species of epiphytic orchid recorded at the site. The species-area relationship showed that there was no orchid species added after 300 m<sup>2</sup> sampling area and no host tree species added after 600 m<sup>2</sup> sampling area (Figure 2). This result means that the variation of micro habitat at the study site is very low.

In general, Cemoro Sewu hiking pathway had a large number of individual of epiphytic orchid but had low diversity in terms of epiphytic orchid species, orchid host tree and orchid micro habitat. At this site, the level of disturbance either by humans or nature was relatively low. Nevertheless, the

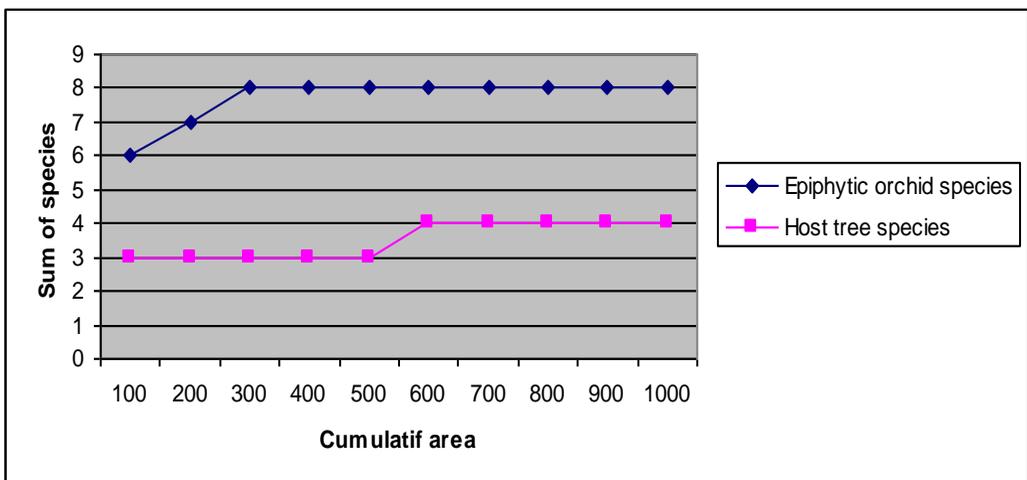


Figure 2. Species-area curve of epiphytic orchid and host tree.

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ecotourism activities along the pathway will threaten the species richness and abundance of epiphytic orchid. Habitat loss and degradation such as forest fragmentation and isolation will negatively impact population structure and distribution of epiphytic plants such as orchids. Therefore, it is recommended that evaluation of the orchid diversity at Cemoro Sewu hiking pathway should be conducted in the future, in order to analyse the dynamics of disturbance of the area.

### CONCLUSION

It can be concluded that there were eight epiphytic orchid species and five host trees species recorded in the study site. *Pholidota globosa* (Relative Abundance of Orchid/%Fo = 58,54) was the most abundant orchid at the site, followed by *Coelogyne miniata* (%Fo = 15,73). In addition, *Lithocarpus sundaicus* was the host tree with the highest number of individual epiphytic orchid attached on it. The average number of individual of epiphytic orchid on a species of host tree / Ji/ Jt= 662,41.

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