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Research Paper

The Inventory of Mistletoe and Host Trees at the Farmer's Cultivated Area in Wan Abdul Rachman Grand Forest Park

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ABSTRACT: *It is hoped that the Wan Abdul Rachman Grand Forest Park can function to preserve biodiversity, including mistletoe. Therefore, the research aims to determine the presence of mistletoe and analyze the level of association between species of mistletoe and the species of host trees at the cultivated area of farmers belonging to the Wana Karya G Forest Farmers Group in Wan Abdul Rachman Grand Forest Park. The research was carried out by surveying vegetation using a rectangular plot method which was arranged systematically. The sampling intensity was 10%, the number of plots was 27, each plot measuring 20 m x 20 m. The results of the research showed that there were 13 individual mistletoes consisting of 3 species. The three species of mistletoes are Dedrophthoe pentandra, Dedrophthoe falcata, and Scurrula parasitica. The number of Dedrophthoe pentandra was 8 individuals, Dedrophthoe falcata was 1 individual, and Scurrula parasitica was 4 individuals. There are only 2 species of trees that host mistletoe (14.3%) of the 14 species of trees and shrubs that make up forest garden stands. Associations between mistletoe and host trees have varying strengths. The Dendrophthoe pentandra with stink bean tree formed a strong association with an Ochiai Index (OI) value of 0.57 which was declared significant. The Dendrophthoe falcata with stink bean tree formed a weak association with an OI value of 0.29 which was declared not significant. Likewise, the Scurrula parasitica with cocoa tree formed a weak association with an OI value of 0.41 which was declared not significant.*

KEYWORDS: *Association, Host tree, Mistletoe*

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I. INTRODUCTION

Mistletoe as a Parasitic Plant

Mistletoe is a group of parasitic plants that host on woody plants in various species of ecosystems (Hutabarat et al., 2020). Based on the size of the plant body, mistletoe is classified as a macroparasitic plant as well as a nuisance plant (aerial weeds) that lives in the canopy of its host plant (Muttaqin et al., 2016). Most of these species of parasites are plants belonging to the Loranthaceae family (Solikin, 2021) which live on the branches and twigs of the canopy of the host plant (Tjitrosoepomo, 1989). Several species of parasites are also members of the Viscaceae/Santalaceae family (Haryanta & Susilo, 2018; Hasanbahri et al., 2014), and members of the Balanophoraceae family (Tjitrosoepomo, 1989). These plants are mostly distributed throughout tropical areas.

According to Tjitrosoepomo (1989), mistletoe (pasilan) members of the Loranthaceae family have the largest number of species, namely approximately 1,300 species belonging to 40 genera, and have a hemiparasitic habit. Meanwhile, parasites are members of the Viscaceae (Santalaceae) family, which is estimated to number 400 species belonging to 7 genera, and has a hemiparasitic habit (Hasanbahri et al., 2014). It is estimated that there are 100 species of parasites belonging to the Balanophoraceae family, belonging to 17 genera, and having the habit of holoparasites or true parasites (Tjitrosoepomo, 1989). The number of species of mistletoe throughout the world is very large, namely around 1,600 species (Solikin, 2021), and could even be more. According to Hasanbahri et al. (2014), the total number of parasitic plants is estimated to be 4,500 species belonging to 280 genera.

Mistletoe is classified into two groups based on how it obtains the necessities of life and its growth, namely holoparasitic mistletoe and hemiparasitic mistletoe (Waston, 2009). Holoparasitic mistletoe is a parasite

whose survival needs and growth depend entirely on the host plant (Waston, 2009) because this parasite does not have leaves and chlorophyll, so it cannot carry out photosynthesis (Hutabarat et al., 2020). Hemiparasitic parasites are parasites that live and whose growth does not completely depend on the host plant (Waston, 2009). Hemiparasitic mistletoe, apart from utilizing organic material from the host plant, can also photosynthesize because it has leaves and chlorophyll (Hutabarat et al., 2020).

Hutabarat et al. (2020) stated that the absorption of organic matter and water by holoparasitic mistletoes as well as the absorption of nutrients and water by hemiparasitic mistletoes from host plants is carried out through the haustorium. Haustorium is a structure formed from mistletoe roots attached to its host (Irving & Cameron, 2009). A haustorium or haustoria is an organ in the form of a fibrous root that penetrates the skin tissue to the vascular tissue of the host plant (Indriyanto, 2017; Mudgal et al., 2022). Indriyanto (2017) stated that the fibrous roots of mistletoe emerge from mistletoe seeds which germinate on the surface of the skin of the branches and branches of the host plant, then the roots penetrate until they reach the vascular tissue. Haustorium mistletoe not only functions to absorb nutrients and water from its host plant, but also absorbs photosynthate in the body of its host plant (Solikin, 2021). Thus, mistletoe can disrupt the physiological processes of its host plant if it is present in large numbers (Haryanta & Susilo, 2018), and can even kill its host plant (Hasanbahri et al., 2014; Mudgal et al., 2022).

Mistletoe hosts generally consist of plants that have a habit of trees and shrubs (Sunaryo & Uji, 2010), both wild and cultivated trees or shrubs (Uji & Sunaryo, 2008). The relationship between mistletoe and its host plant is an interaction in the form of parasitism which can cause disturbance/loss to the host plant, as well as benefiting the mistletoe (Indriyanto, 2024).

Ecological Function of **Mistletoe**

Mistletoe has an important function in the ecosystem. Mistletoe is part of what determines the size of biodiversity in an ecosystem (Irving & Cameron, 2009) and is a component in the food web (Indriyanto, 2024). Mistletoe fruit is a source of food for various species of birds, for example various species of chili birds or scarlet-headed flowerpeckers (*Dicaeum spp.),* members of the Dicaeidae family (Hasanbahri et al., 2014). Various species of birds that eat mistletoe fruit include: javanese chili or scarlet-headed flowerpecker (*Dicaeum trochileum*), plain flowerpecker (*Dicaeum concolor*), mountain chili or blood-breasted flowerpecker (*Dicaeum sanguinolentum*), finches or sooty-headed bulbul (*Pycnonotus aurigaster*), sriganti sunbird or olive-backed sunbird (*Cinnyris jugularis*), javanese sunbird or javan sunbird (*Aethopyga mystacalis*), banana cinenen bird or common tailorbird (*Orthotomus sutorius*), and various other species of fruit-eating birds (Muttaqin et al., 2016), for example yellow-vented bulbul (*Pycnonotus goiavier*) (Solikin, 2021).

Muttaqin et al. (2016) stated that birds also function as intermediaries in the process of spreading mistletoe, because the seeds of mistletoe fruit are not digested in the bird's digestive system. Mistletoe seeds will be spread to various places along with bird droppings and stick to tree branches (Mudgal et al., 2022; Solikin, 2021). Mistletoe seeds that come out with bird droppings and stick to branches germinate easily (Muttaqin et al., 2016). Several species of birds (approximately 8 bird species) were observed eating mistletoe fruit and spreading the seeds an average of 50 m from the parent plant (Godschalk, 2015).

Economic Functions of Mistletoe

Diba et al. (2021) stated that mistletoe can be used as an ingredient for traditional medicines, as well as an alternative source of raw materials for anti-microbial substances, as an anti-cancer medicine, and as a medicine for tonsillitis (Palupi & Nugraha 2014). Sembiring et al. (2016) stated that the Dendropthoe pentandra mistletoe has potential as an antioxidant, in fact various types of mistletoe have long been used by people as traditional ingredients for cough medicine, anti-inflammatory, anti-bacterial, diuretic and wound medicine. Sunaryo & Uji (2010) also stated that Dendropthoe pentandra leaf pulp can be used to treat wounds and skin infections, all plant organs are boiled to treat hypertension and coughs.

For a long time, mistletoe has been used by the community for traditional treatment of various diseases such as medicine for inflammation, heat, and medicine for pain or inflammatory symptoms (Neman et al., 2022). According to Neman et al. (2022) mistletoe leaves contain secondary metabolite compounds such as alkaloids, steroids, triterpenoids, tannins, and glycosides which have anti-inflammatory potential. Likewise, the mistletoe *Scurula parasitica* can be used as an ingredient in traditional medicine to treat hypertension, increase bone strength, treat back, and knee pain (Sunaryo & Uji, 2010).

Wan Abdul Rachman Grand Forest Park

A grand forest park (Tahura in Indonesian) is a natural conservation area for the purpose of collecting natural or artificial plants and/or animals, native and/or non-native species which are used for research, science, education, cultivation support, and utilization of environmental conditions (Pemerintah Republik Indonesia, 2024). The main function of nature conservation areas is to protect life support systems, preserve the diversity of

plant and animal species, and sustainably utilize biological natural resources and their ecosystems (Pemerintah Republik Indonesia, 1999).

Wan Abdul Rachman Grand Forest Park is one of the grand forest parks in Indonesia. Wan Abdul Rachman Grand Forest Park is located in Lampung Province, Indonesia with an area of 22,245.50 ha. The grand forest park area was designated by the Indonesian Government through Decree of the Minister of Forestry and Plantation Number 679/Kpts-II/1999 dated 1 September 1999 (UPTD Taman Hutan Raya Wan Abdul Rachman, 2017). Within the grand forest park area there are 6 management blocks, namely protection blocks, utilization blocks, plant and/or animal collection blocks, rehabilitation blocks, special blocks, and traditional blocks with the aim that area management can run effectively and forest functions can be realized.

Tahura is a type of conservation forest, so that biodiversity in the entire area, including in traditional blocks, must be well maintained (Indriyanto, 2022). In terms of parasitic interactions in large numbers, mistletoe can be detrimental to its host plant (Chamidah, 2017), but from other aspects it has a positive role as a component of biodiversity (Irving & Cameron, 2009) and as a component of the food web in the ecosystem (Indriyanto, 2024), and has economic benefits for humans (Diba et al., 2021). Therefore, an inventory of mistletoe (parasitic plants) in traditional blocks which are places of traditional use by forest farmers needs to be carried out with the aim of finding out the existence of mistletoe species and their association with trees that form forest garden stands.

II. METHODS

Research Location

The research was conducted from May to July 2024. The research location at the Wana Karya G Forest Farmer Group's cultivation area in the Traditional Block of the Gedong Tataan Region, part of the Wan Abdul Rachman Grand Forest Park (Tahura in Indonesian), Lampung Province, Indonesia. Location of the research can be seen in Figure 1.

The area cultivated by the Wana Karya G forest farmer group are 10.82 ha. In all of the cultivation areas managed by these farmers, forest stands have been established, consisting of various tree and shrub species under the MPTS program. The forest garden stand consists of 14 species of trees and shrubs, namely avocado (*Persea americana*), cocoa (*Theobroma cacao*), durian (*Durio zibethinus*), stink beans (*Parkia speciosa*), sugar palm (*Arenga pinnata*), coconut (*Cocos nucifera*), jointfir (*Gnetum gnemon*), rosewood (*Dalbergia latifolia*), kapok (*Ceiba pentandra*), cinnamon (*Cinnamomum zeylanicum*), rubber (*Hevea brasiliensis*), cloves (*Eugenia aromatica*), nutmeg (*Myristica fragrans*), and coffee (*Coffea arabica*).

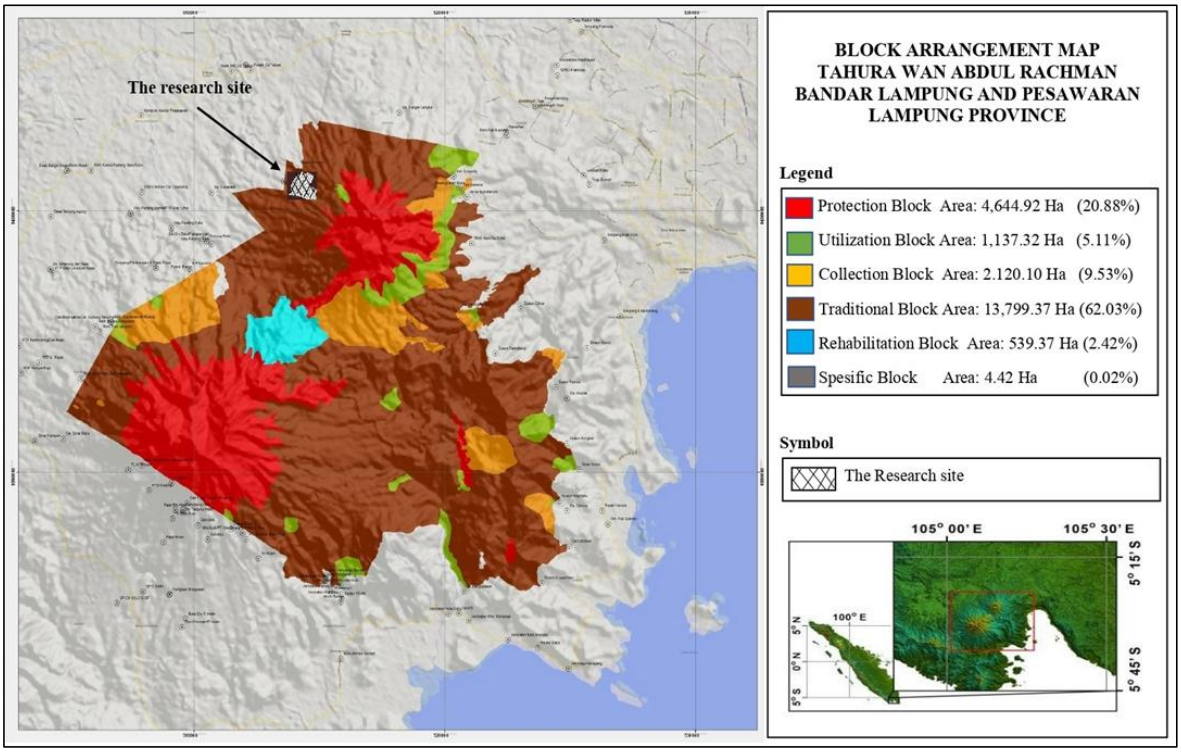

Figure 1. Map of the research site at the farmers' cultivated area of Wana Karya G Forest Farmer Group in Wan Abdul Rachman Grand Forest Park, Lampung Province, Indonesia (adapted from UPTD Taman Hutan Raya Wan Abdul Rachman, 2017).

Equipment

The equipment used for this research consists of GPS (*global positioning system*) binoculars, roll meter, measuring tapes, digital camera, altimeter, a writing board, ballpoint pens, and tally sheets.

Data Acquisition

The collection of research data was carried out by surveying forest vegetation to observe composition of tree species that make up forest garden stand, spicies of mistletoe, and mistletoe host plant. Data were collected on sample plots with a sampling intensity of 10% from an area of 10.82 ha. The number of sample plots were 27 plots. Each sample plot measures 20 m x 20 m and all sample plots were arranged systematically with a distance between plots of 60 m. The detailed of sample plots layout is shown in Figure 2.

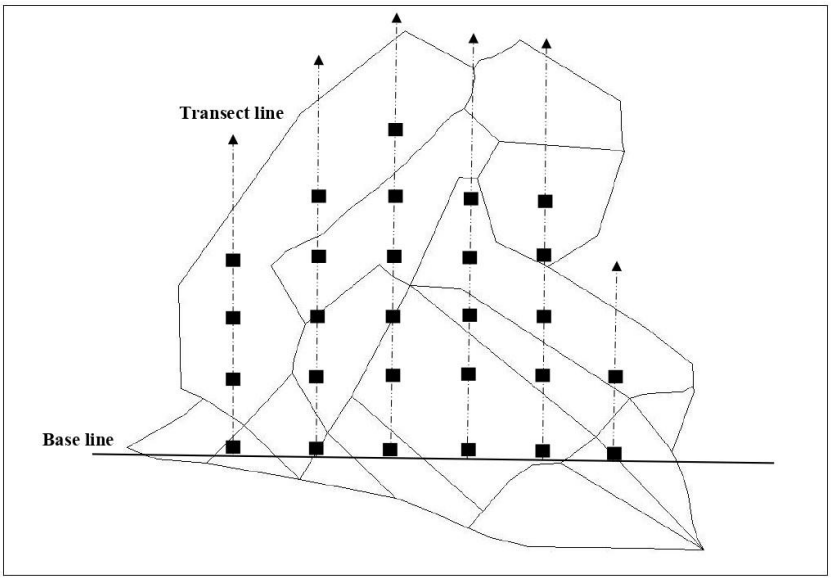

Figure 2. The layout of research sample plots at the farmers' cultivated area of Wana Karya G Forest Farmer Group in Wan Abdul Rachman Grand Forest Park, Lampung Province, Indonesia.
Remark: ■: sample plots

The types of data collected include: names of tree species that make up forest garden stands, names of mistletoe species, number of individual mistletoe, and host plant species.

Data Processing

1. Composition of Forest Garden Stands

The species of trees that make up forest garden stands were presented in tabular form which containing local names, scientific names (botanical names), density, frequency, and dominance of each tree population. Frequency and dominance levels were determined by making frequency and dominance class intervals using the formula according to Indriyanto (2021).

2. Species of Mistletoe and Their Hosts

The species of mistletoes that have been found and the species of host plants were presented in tabular form containing local name of the mistletoe, scientific name of the mistletoe, number of mistletoe, the name of the host plant, and the number of individual host plants that were attacked.

3. The Level of Association of Mistletoe with the Host Tree

The level of association of each mistletoe species with its host plant was analyzed using the Ochiai Index formula according to Ludwig & Reynolds (1988).

III. RESULT AND DISCUSSION

Composition of Forest Garden Stands

The species of woody plants that make up the forest garden stands in the areas cultivated by farmers belonging to the Wana Karya G Forest Farmer Group consist of 13 species of trees and 1 species of shrub. The

population conditions of each species of tree and shrub that make up the forest garden stand are presented in Table 1.

Table 1. Density, frequency, and the level of dominance of tree species that make up forest garden stands at the farmers' cultivated area, members of Wana Karya G Forest Farmer Group in Wan Abdul Rachman Grand Forest Park, Lampung Province, Indonesia

Number	Local name in Indonesia	Botanical name	Density (individual/ha)	Frequency	IVI (%)
1.	Alpokat	*Persea americana*	16	0.22 l	13.17 ld
2.	Aren	*Arenga pinnata*	16	0.11 l	15.72 ld
3.	Cengkeh	*Eugenia aromatica*	48	0,26 l	19.18 ld
4.	Durian	*Durio zibethinus*	31	0.19 l	26.62 ld
5.	Kakao	*Theobroma cacao*	45	0.44 m	20.96 ld
6.	Karet	*Hevea brasiliensis*	99	0.52 m	84.40 hd
7.	Kayu manis	*Cinnamomum zeylanicum*	4	0.11 l	5.55 ld
8.	Kelapa	*Cocos nucifera*	14	0.15 l	9.53 ld
9.	Kopi *)	*Coffea arabica*	96	0.22 l	32.45 md
10.	Pala	*Myristica fragrans*	51	0.22 l	20.17 ld
11.	Petai	*Parkia speciosa*	16	0.44 m	17.94 ld
12.	Randu	*Ceiba pentandra*	4	0.11 l	6.38 ld
13.	Sonokeling	*Dalbergia latifolia*	12	0.15 l	21.67 ld
14.	Tangkail	*Gnetum gnemon*	8	0.19 l	6.27 ld
Total			460	4.66	300.00

Remark: Calculated based on the formula for determining the level of dominance (Indriyanto, 2021)
Dominant (high dominance), that is IVI> 58,12
Moderate dominance, that is IVI 31,83—58,12
Not dominant (low dominance), that is IVI< 31,83
High frequency (h), that is F> 0,67
Moderate frequency (m), that is F 0,33—0,67
Low frequency (l), that is F< 0,33
*)= shrub species

Based on Table 1, the dominant tree species in forest garden stands is rubber (*Hevea brasiliensis*). Rubber trees are the only dominant tree species with an IVI value of 84.40%. Rubber trees are dominant in forest garden stands because their density and frequency are the highest compared to other tree species with a density of 99 individuals/ha and a frequency of 0.52. The density of the 14 species of woody plants varies from 4 individuals/ha to 99 individuals/ha. Meanwhile, the frequency of 14 species of woody plants varied from 0.11 to 0.52.

The dominant tree species in forest garden stands at forest farmer cultivation areas indicate that these tree species are most preferred by forest farmers compared to other tree species (Indriyanto, 2022), in general many farmers plant them, so the density and frequency values are large. Rubber trees are favored by forest farmers because the non-wood commodities produced are latex which has high economic value (Rokhmah & Sobari, 2017).

The species of plant that has moderate dominance in forest garden stands is the coffee plant (*Coffea arabica*). The level of coffee plant dominance is in the medium category with an IVI of 32.45%, a density of 96 individuals/ha and a frequency of 0.22. The density of coffee plants is second only to rubber (Table 1) because the commodity produced in the form of seed has long-term economic prospects for improving the economy of forest farmers (Supriadi & Pranowo, 2015). The frequency of coffee plants is in the low category, this indicates that the existence or distribution of coffee plants is limited to the areas cultivated by certain farmers. Indriyanto (2024) stated that the frequency value of an organism species is the intensity of finding a species of organism in the habitat or study area. This also indicates the width or narrowness of the distribution area of a species of organism.

There are 11 tree species with frequency values in the low category (F<0.33), namely *Persea americana, Arenga pinnata, Eugenia aromatica, Durio zibetinus, Cinnamomum zeylanicum, Cocos nucifera, Coffea arabica, Myristica fragrans, Ceiba pentandra,* and *Gnetum gnemon*. Meanwhile, 3 species of trees have frequency values in the moderate frequency category (F: 0.33–0.67), namely *Theobroma cacao, Hevea brasiliensis,* and *Parkia speciosa*.

Species of Mistletoe and Their Hosts

In the cultivation area of the Wana Karya G Forest Farmer Group were found 3 species of mistletoes that attached to 2 species of trees. The three species of mistletoes that found are belong to the hemiparasitic mistletoes consisting *Dendrophthoe pentandra, Dendrophthoe falcata,* and *Scurrula parasitica*. The names of mistletoe species and their host trees are presented in Table 2.

Table 2. Species of mistletoes found in forest garden stands at farmers'cultivated area of Wana Karya G Forest Farmer Group in Wan Abdul Rachman Grand Forest Park, Lampung Province, Indonesia

Number	Local name in Indonesia	Botanical name	Life form	Host plant
1.	Benalu cengkeh	*Dendrophthoe pentandra* (L.) Miq.	Hemiparasite	*Parkia speciosa*
2.	Benalu petai	*Dendrophthoe falcata* (L.f.) Ettingsh)	Hemiparasite	*Parkia speciosa*
3.	Benalu kakao	*Scurrula parasitica* L.	Hemiparasite	*Theobroma cacao*

Based on the data in Table 2, there are only two species of trees that host mistletoes, namely stink bean (*Parkia speciosa*) and cocoa (*Theobroma cacao*). The number of tree species that host mistletoes is in the very small category, namely 14.3% of the number of trees species that make up forest garden stands in farmers' cultivated areas. This means that the presence of mistletoe in forest garden stands has not become a parasite that is harmful to forest health. On the contrary, the presence of mistletoe enriches plant biodiversity (Indriyanto, 2024; Irving & Cameron, 2009) and becomes a food source for birds in forest ecosystems (Muttaqin *et al.*, 2016; Solikin, 2021). The individual number of mistletoes and the number of host trees attacked by mistletoe can be seen in Table 3.

Table 3. The individual number of mistletoes per species that found in forest garden stands at farmers' cultivated area of Wana Karya G Forest Farmer Group in Wan Abdul Rachman Grand Forest Park, Lampung Province, Indonesia

Number	Species of mistletoe	Number of host plant was attacked (individuals)	Number of mistletoes per host plant (individuals)	Total number of mistletoes (individuals)
1.	*Dendrophthoe pentandra* (L.) Miq.	4	2	8
2.	*Dendrophthoe falcata* (L.f.) Ettingsh)	1	1	1
3.	*Scurrula parasitica* L.	2	2	4
Total number of mistletoes (individuals)				13

Dendrophthoe pentandra is a species of mistletoes that has the largest number of individuals, namely 8 individuals or 61.5% of the total number of mistletoe individuals found at the research location. The number of host trees attacked by *Dendrophthoe pentandra* was also the highest, namely 4 individual host trees compared to 1 individual for *Dedrophthoe falcata* and 2 individual host trees for *Scurrula parasitica*. This indicates that the *Dendrophthoe pentandra* mistletoe has a greater attack area compared to other species of mistletoes. The number of mistletoe individuals attached to each host tree varies from 1 individual to 2 individuals. Based on the number of mistletoe individuals, it appears that the host tree does not experience physiological disorders, so the presence of mistletoe can still be tolerated, and does not require control measures. Thus, paying attention to the population density of mistletoe on each host tree makes it possible to allow the existence of mistletoe as a rich source of biodiversity in the forest ecosystem.

Based on the research results of Putri et al. (2021) at the collection block of the Wan Abdul Rachman Grand Forest Park, that *Dendrophthoe pentandra* is the mistletoe with the largest number of individuals out of the four species of mistletoes found. Likewise, in the research results of Hutabarat et al. (2020) that *Dendrophthoe pentandra* is the species of mistletoe with the largest number of individuals of the four species of mistletoes found in Ecopark, Cibinong Science Center-Botanic Gardens.

The Level of Association of Mistletoe with the Host Tree

The association between mistletoe and host trees is a form of ecological interaction between the two groups of plants in a habitat or living place (Indriyanto, 2021; Indriyanto, 2024). Furthermore, Indriyanto (2024) stated that the ecological interaction between mistletoe and the host tree is a type of parasitism interaction.

The strength of the association between mistletoe and the host plant reflects the suitability of the mistletoe to its host. The strength of association between organisms and other organisms in a habitat or living place can be measured using the Ochiai Index formula according to (Ludwig & Reynolds (1988).

The Ochiai index for the association of two species of organisms is declared strong if the Ochiai Index is > 3.84. The greater the Ochiai index than 3.84, the stronger the association between the two species of organisms. On the other hand, the smaller the Ochiai Index (much smaller than 3.84), the weaker the association between the two species of organisms or it is considered that there is no association.

The results of the association analysis between mistletoe and host trees can be seen in Table 4.

Table 4. The results of the association analysis between mistletoe and host trees that found in forest garden stands at farmers'cultivated area of Wana Karya G Forest Farmer Group in Wan Abdul Rachman Grand Forest Park, Lampung Province, Indonesia

Number	Species of mistletoe	Host plant	Ochiai Index	$X^2_{corrected}$	$X^2_{(1;0,05)}$	Level of association
1.	*Dendrophthoe pentandra* (L.) Miq.	*Parkia speciosa*	0.57	5.69	3.84	Significant
2.	*Dendrophthoe falcata* (L.f.) Ettingsh)	*Parkia speciosa*	0.29	0.024	3.84	Not significant
3.	*Scurrula parasitica* L.	*Theobroma cacao*	0.41	0.81	3.84	Not significant

Associations between mistletoe and host trees have varying strengths. The *Dendrophthoe pentandra* with stink bean tree formed a strong association with an Ochiai Index (OI) value of 0.57 which was declared significant. The *Dendrophthoe falcata* with stink bean tree formed a weak association with an OI value of 0.29 which was declared not significant. Likewise, the *Scurrula parasitica* with cocoa tree formed a weak association with an OI value of 0.41 which was declared not significant.

The association between mistletoe and the host tree depends on internal and external factors. The internal factors referred to are factors in the mistletoe itself, for example fruit production and viability or the ability of mistletoe seeds to germinate on the surface of the bark of tree branches (Muttaqin et al., 2016). Meanwhile, external factors are environmental factors in the life of mistletoe, for example the presence of various types of birds that eat mistletoe fruit as intermediaries for the distribution of mistletoe seeds (Hasanbahri et al., 2014), as well as the nature of the branch skin of the host tree species which is compatible with mistletoe seeds that stick to the surface of the skin (Mudgal et al., 2022). If these two factors (internal and external factors) are adequate, they will have a positive effect on the mistletoe population.

Based on the data in Table 3 and Table 4, it can be seen that the greater the number of mistletoe individuals, the higher the OI value. On the other hand, it appears that the smaller the number of mistletoe individuals, the smaller the OI value. This indicates that there are one and/or many factors that do not support the existence of mistletoe. Then, it can be suspected that the lack of bird population could be an agent for the spread of mistletoe fruit. Mistletoe seeds cannot possibly stick to the surface of tree branches if there is no agent for spreading the fruit.

IV. CONCLUDING REMARK

Conclusion

Forest garden stands can be a natural habitat for conserving mistletoe species. Three species of mistletoe have been found that live in forest garden stands, namely *Dedrophthoe pentandra*, *Dedrophthoe falcata*, and *Scurrula parasitica*.

The number of mistletoe individuals attached to each host tree varies from 1 individual to 2 individuals. Based on the number of mistletoe individuals, it appears that the host tree does not experience physiological disorders, so the presence of mistletoe can still be tolerated, and does not require control measures. Thus, paying attention to the population density of mistletoe on each host tree makes it possible to allow the existence of mistletoe as a rich source of biodiversity in the forest ecosystem.

Recommendation

Further research is needed over the next few months to determine the development of mistletoe population density from the three species of mistletoe that currently exist. As well as to determine the possibility of increasing species of mistletoe and increasing species of trees attacked by mistletoe. Forest farmers are expected not to eradicate mistletoe when the number of mistletoe individuals does not cause significant damage to the host tree.

Research on the presence of mistletoe fruit-eating birds is also very necessary as information on the presence of mistletoe spreading agents in forest garden stands.

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REFERENCE

[1]. Chamidah, D. (2017). "Jenis-jenis benalu dengan tanaman inang pada ruang terbuka hijau Kota Surabaya." *Ibiez: Jurnal Kependidikan Dasar Islam Berbasis Sains* 2(2):83–92. https://ibriez.iainponorogo.ac.id/index.php/ibriez/article/view/38/30

[2]. Diba, M. F., Laeto, A. B., Purnamasari, S., & Inggarsih, R. (2021). "Uji aktivitas antibakteri fraksi aktif daun benalu jeruk nipis (*Dendrophtoe petandra* (L.)Miq.) terhadap bakteri *Staphylococcus aureus* dan Escherichia coli." *Jurnal Kedokteran Dan Kesehatan* 8(2):146–52. DOI: https://10.32539/JKK.V8I2.13128

[3]. Godschalk, S. K. B. (2015). "Feeding behaviour of avian dispersers of mistletoe frut in the Loskop Dam Nature Reserve, South Africa." *South African Journal of Zoology* 20(3):136–46. https://doi.org/10.1080/02541858.1985.11447926

[4]. Hasanbahri, S., Marsono, D., Hardiwinoto, S., & Sadono, R. (2014). "Serangan benalu pada beberapa kelas umur tanaman jati di wilayah hutan BKPH Begal, KPH Ngawi, Jawa Timur." *Jurnal Manusia dan Lingkungan* 21(2):195–201. DOI: https://10.22146/jml.18544

[5]. Haryanta, D. & Susilo, A. (2018). "Pola distribusi dan identifikasi jenis benalu pada tumbuhan ruang terbuka hijau Kota Surabaya." *Journal of Research and Technology* 4(2):86–93. DOI**:** https://doi.org/10.55732/jrt.v4i2

[6]. Hasanbahri, S., Marsono, D., Hardiwinoto, S., & Sadono, R. (2014). "Serangan benalu pada beberapa kelas umur tanaman jati di wilayah hutan BKPH Begal, KPH Ngawi, Jawa Timur." *Jurnal Manusia Dan Lingkungan* 21(2):195–201. DOI: https://10.22146/jml.18544

[7]. Hutabarat, P. W. K., Zulkarnaen, R. N., & Mulyani, M. (2020). "Keanekaragaman benalu di Ecopark, Cibinong Science Center-Botanic Gardens." *AL-KAUNIYAH: Jurnal Biologi* 13(2):263–77. DOI: http://dx.doi.org/10.15408/kauniyah.v13i2.15112

[8]. Indriyanto. (2017). *Jenis-jenis Ekosistem Hutan*. 1st ed. Yogyakarta: Plantaxia. 209 p.

[9]. Indriyanto. (2021). *Metode Analisis Vegetasi dan Komunitas Hewan* . 2nd ed. Yogyakarta: Graha Ilmu. 253 p.

[10]. Indriyanto. (2022). "Composition, domination, and similarity level of stand among farmers' cultivated blocks at Wan Abdul Rachman Grand Forest Park." *Jurnal Penelitian Kehutanan Wallacea* 11(2):139–51. https://journal.unhas.ac.id/index.php/wallacea/article/view/26308

[11]. Indriyanto. (2024). *Ekologi Hutan*. 8th ed. Jakarta: PT Bumi Aksara. 210 p.

[12]. Irving, L. J. & Cameron, D. D. (2009). "You are what you eat: interactions between root parasitic plants and their hosts." *Advances in Botanical Research* 50:87–138. https://doi.org/10.1016/S0065-2296(08)00803-3

[13]. Ludwig, J. A. & Reynolds, J. F. (1988). *Statistical Ecology: a Primer on Methods and Computing*. John Wiley and Sons. Inc. Canada. 337 p.

[14]. Mudgal, G., Kaur, J., Chand, K., Parashar, M., Dhar, S. K., Singh, G. B., & Gururani, M. A. (2022). "Mitigating the mistletoe menace: biotechnological and smart management approaches." *Biology* 11(1645):1–35. https:// doi.org/10.3390/biology11111645

[15]. Muttaqin, Z., Budi, R. S. W., Wasis, B., Siregar, I. Z., &. Corryanti. (2016). "Karakter biologi benalu pada jati di Kebun Benih Klonal (Kbk) Padangan, Perum Perhutani." *Scientific Repository, IPB University. Bogor, Indonesia*. http://repository.ipb.ac.id/handle/123456789/82402

[16]. Neman, A. I., Maarisit, W., & Karauwan, F. (2022). "Uji ekstrak etanol daun benalu kersen (*Dendropthoe pentandra* L.) terhadap tikus putih (*Ratus norvegicus*) sebagai anti inflamasi." *Biofarmasetikal Tropis: The Tropical Journal of Biopharmaceutical* 5(1):55–59. https://journal.fmipaukit.ac.id/index.php/jbt/article/view/369/209

[17]. Palupi, N. W. & Nugraha, A. S. (2014). "Pemanfaatan benalu kapas sebagai salah satu sumber bahan antimikroba alami: kajian aktivitas antimikroba." *Jurnal Ilmiah INOVASI* 14(1):75–81. https://publikasi.polije.ac.id/jii/article/view/88/90

[18]. Pemerintah Republik Indonesia. (1999). Undang-undang Nomor 41 Tahun 1999 Tentang Kehutanan. Jakarta: Sekretariat Kabinet Republik Indonesia.

[19]. Pemerintah Republik Indonesia. (2024). Undang-undang Nomor 32 Tahun 2024 Tentang Perubahan Atas Undang-undang Nomor 5 Tahun 1990 Tentang Konservasi Sumber Daya Alam Hayati dan Ekosistemnya. Jakarta: Kementerian Sekretariat Negara Republik Indonesia.

[20]. Putri, D. P., Indriyanto, & Riniarti, M. (2021). "Tingkat asosiasi jenis-jenis benalu dengan pohon inangnya di blok koleksi Taman Hutan Raya Wan Abdul Rachman." *Jurnal Hutan Tropis* 9(2):445–53. https://ppjp.ulm.ac.id/journal/index.php/jht/article/view/11296/7269

[21]. Rokhmah, D. N. & Sobari, I. (2017). "Agroforestri karet di Indonesia." *JURNAL SIRINOV* 5(1):35–44. https://repository.pertanian.go.id/server/api/core/bitstreams/4db846af-3f44-4de0-8686-a9d228441ce1/content

[22]. Sembiring, H.B., Lenny, S., & Marpaung, L. (2016). "Aktivitas antioksidan senyawa flavonoida dari daun benalu kakao (*Dendrophthoe pentandra* (L.) Miq.)." *Chimica et Natura Acta* 4(3):117–22. https://jurnal.unpad.ac.id › article › download

[23]. Solikin. (2021). "Population dynamics of mistletoes species on *Cassia fistula* in Purwodadi Botanic Garden, Indonesia." *B IOD I V E R S I T A S* 22(4):1612–20. https://smujo.id/biodiv/article/view/7234/4696

[24]. Sunaryo & Uji, T. (2010). "Keanekaragaman jenis benalu pemarasit pada tanaman di Kebun Raya Batu Raden Dan Sekitarnya." *Jurnal Teknik Lingkungan* 11(2):205–12. https://media.neliti.com/media/publications/158322-ID-keanekaragaman-jenis-benalu-pemarasit-pa.pdf

[25]. Supriadi, H. & Pranowo, D. (2015). "Prospek pengembangan agroforestri berbasis kopi di Indonesia." *Jurnal Perspektif* 14(2):135–50. https://media.neliti.com/media/publications/158506-ID-prospek-pengembangan-agroforestri-berbas.pdf

[26]. Tjitrosoepomo, G. (1989). Taksonomi Tumbuhan Spermatophyta. 2nd ed. Yogyakarta: Gadjah Mada University Press. 474 p.

[27]. Uji, T. &. Sunaryo. (2008). "Keragaman dan penyebaran benalu pada tanaman koleksi di Kebun Raya Cibodas, Jawa Barat." *Biota: Jurnal Ilmiah Ilmu-Ilmu Hayati* 13(3):132–40. **DOI:** https://doi.org/10.24002/biota.v13i3.2566

[28]. UPTD Taman Hutan Raya Wan Abdul Rachman. (2017). Blok Pengelolaan Taman Hutan Raya Wan Abdul Rachman Provinsi Lampung. Bandar Lampung: Dinas Kehutanan Provinsi Lampung. 49 p.

[29]. Waston, D. M. (2009). "Parasitic plants as facilitators: more dryad than dracula?" *Journal of Ecology* 97:1151–1159. DOI: 10.1111/j.1365-2745.2009.01576.x