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Spatial Distribution of Medicinal Plant Types *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson in the GunungTilu Forest Area, Kuningan Regency, West Java

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Abstract

Goniothalamusmacrophyllus (Blume) Hook.f. & Thomson is one of the plants that has medicinal properties and is distributed in Indonesia on the islands of Sumatra, Java and Kalimantan. The aim of this research is to determine the distribution pattern and population structure of *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson in its natural habitat in the lowland forests of Mount Tilu, Kuningan Regency. Data collection was carried out using the census method with route transects, on each route a sample plot measuring 20 x 20 m was made for 5 observation lines based on encounters with the *Goniothalamusmacrophyllus* (Blume) Hook.f plant. & Thomson. Data were analysed using the Morisita index to determine distribution patterns. The results of the research showed that there were 264 individuals found with the overall population structure classified into sapling and seedling levels. The distribution pattern of this plant is included in the cluster distribution pattern with a Morisita Index value of 0.5 > 0.

Keywords**:** Medicinal Plant, Forest, Goniothalamusmacrophyllus, Mount Tilu, Spatial Distribution.

Introduction

Generalities *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson is a type of plant included to the Annonaceae family, the Annonaceae family is included in the angiosperm group which has quite a large diversity of species. There are 107 genus and 2,400 species which are important components of the lowland forest ecosystem (Guo et al., 2017). The genus is widely distributed in lowland and sub-montane forests in Southeast Asia, with centers of diversity in West Malesia, Sumatra and Peninsular Malaysia (Saunders, 2002; Saunders danChalermglin, 2008; Tang et al., 2013). Genus Goniothalamus is a member of the Annonaceae family which includes around 115 species of aromatic trees and shrubs, spread across Asia and Australia (Burkill, 1966). Goniothalamus has several species and some of them are distributed in Thailand, Malaysia and Kalimantan (Jantan et al., 2005). Genus Goniothalamus has 50 - 100 species found from Southeast Asia, Malaysia, to the tropical north of Australia (Saunders, 2003).

Goniothalamusmacrophyllus (Blume) Hook.f. & Thomson is a bush, shrub or small tree that can grow up to 8 meters. Local people know this type by name ‘gajahberanak’,

'penawarhitam' or 'monsoi' (Wiart, 2000). The distribution of this plant in Indonesia is spread across the islands of Java, Kalimantan and Sumatra. The population of this plant in West Java is in Kuningan Regency where it is found in the Bukit Pembarisan Forest Area (Adhya, 2020). Then it was also found on Kalimantan Island in North PenajamPaser Regency and Kutai Regency, East Kalimantan (Rahmadani, 2016; Kurniawan et al, 2023), and on the island of Sumatra it is found in Merangin Regency, Jambi Province (Hariyadi& Tamara, 2012).

Goniothalamus species contain compounds that are useful for treatment (Tantithanaporn et al., 2011; Tip-pyang et al., 2010; Tai et al., 2010). There are ten species of Goniothalamus which are known as ingredients in traditional medicine, namely *G. curtisii, G. dolichocarpus, G. fulvus, G. giganteus, G. macrophyllus, G. malayanus, G. scortechinii, G. tapis, G. terniifolius*dan *G. umbrosus* (Mat SallehdanLatiff, 2002). The use of plants as a source of medicine has become part of medical practice for human health. Tropical biodiversity, especially Indonesia, is rich in plant species that have health potential that has not yet been fully discovered. The plants of concern *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson, plant species known to have potential medicinal properties.

Considering that this species has great benefits as a medicinal plant, conservation efforts are needed to increase the population and effectiveness of use for society in general. Plant conservation requires plant distribution data in the form of spatial data. Plant distribution patterns have different characteristics, this is because plant communities are a combination of several distribution patterns of various plant species and they interact with each other (Sastroutomo 1990). This spatial distribution study will provide a significant contribution, especially in the context of biological resource conservation and the development of plant-based medicines. By combining ecological and ethnobotanical approaches, this research is expected to provide an in-depth understanding of the ecology of *Goniothalamusmacrophyllus* as well as the potential impact of human exploitation on population sustainability.

Until now, research has been conducted on distribution *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson it's still not uncommon. The aim of this research is to determine distribution patterns and population structure *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson in its natural habitat, the lowland forests of Mount Tilu, Kuningan Regency. The results of this research are expected to be one of the foundations developed in plant conservation efforts as well as the development of medicinal plants.

Methods

The research was carried out in the GunungTilu area in Kuningan Regency. This area is included in the administrative area of Cimara Village, Cibeureum District, Kuningan Regency and is managed by PerumPerhutani KPH Kuningan, West Java Banten Regional Division (Figure 1). Equipment used in this research included binoculars, measuring tape, digital camera, plastic clip, GPS, distance meter, survey paper, notebook, guide/identification book, stationery, and the ArcGis application. The subject of this research is plants *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson.

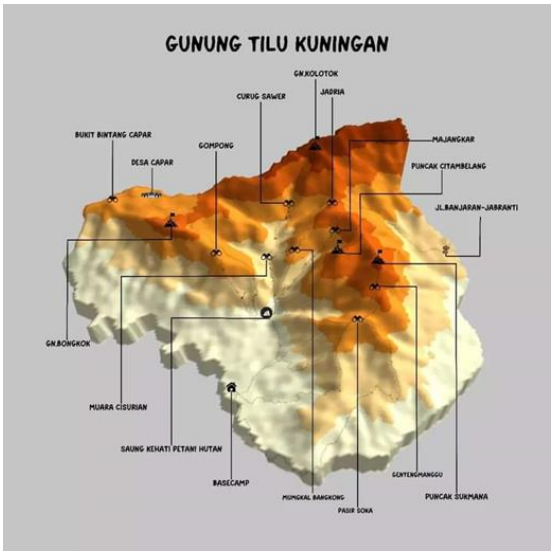


Figure 1. Map of Research Location

Data collection was carried out using the census method with route transects to collect data on the type and number of individuals based on encounters *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson. The route transect will be divided into 5 lines, each of which will have a sample plot measuring 20 m x 20 m. Next, sample data is collected to identify each plant found along the path based on vertical and horizontal classes (Ismail et al, 2019). Data collected includes sample name, distance of sample location to trail, DBH, GPS point, and height. Then, using ArcGis software, the coordinates of the plant points will be analyzed and displayed in a *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson distribution map.

The data that has been collected is then analyzed to determine the distribution pattern. Morisita Population Distribution Index (Iδ) calculated using the Brower and Zar (1977) formula to observe plant distribution patterns Goniothalamusmacrophyllus (Blume) Hook.f. & Thomson with the condition If Iδ = 1, distribution patterns are random, even or uniform, and clustered (aggregate, contagious, and clumped). The formula for the Morisita Spread Index is as follows.

$$I\delta = n\,\frac{\sum_x 2 - \sum_x}{(\sum_x)2 - \sum_x}$$

Description :
Iδ : Morisita Distribution Index
N : Number of Sample Plots
∑x : Number of Individual Species in each Sample Plot
∑x2 : Number of Squares of Individual Species in each Sample Plot

Results and Discussion

Based on the results of research conducted in the field with encounters with plants *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson, total of 264 individuals were found on the observation track (Table 2). This plant is found at an altitude ranging from 624 – 1,151 masl. The largest population compared to other routes was found on the GentengMangu route with 128 individuals, followed by the Citambelang route with 64 individu, the Gompong route with 38 individu, the Ebeg-Ebeg route with 29 individu, and the CurugSawer route with 5.

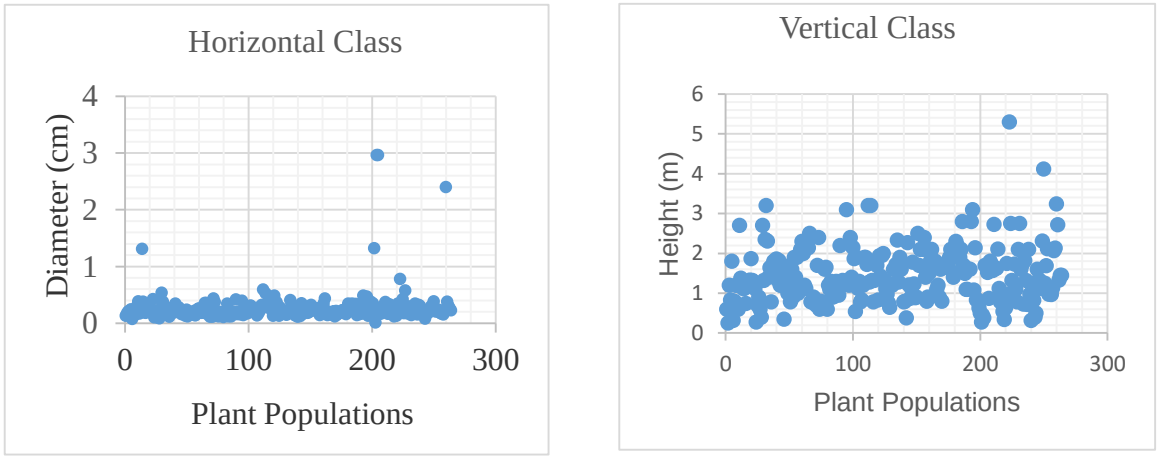
Table 1. Plant Populations *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson

Kode	Route	Coordinate		Altitude (masl)	∑Individu
		Latitude	Longitude		
GT001	GentengManggu	-7,109157024	108,698851	725	14
GT002	GentengManggu	-7,10916901	108,698338	738	2
GT003	GentengManggu	-7,109430023	108,697925	762	6
GT004	GentengManggu	-7,109563965	108,697763	772	5
GT005	GentengManggu	-7,109653987	108,697604	784	2
GT006	GentengManggu	-7,109577041	108,697577	790	5
GT007	GentengManggu	-7,109477967	108,696964	806	1
GT008	GentengManggu	-7,109599002	108,695103	874	1
GT009	GentengManggu	-7,109579975	108,694495	883	9
GT010	GentengManggu	-7,110281037	108,693869	906	1
GT011	GentengManggu	-7,110467032	108,693821	907	5
GT012	GentengManggu	-7,110624025	108,693622	905	4
GT013	GentengManggu	-7,11074003	108,693457	905	7
GT014	GentengManggu	-7,110877996	108,693161	902	7
GT015	GentengManggu	-7,110914038	108,692905	897	4
GT016	GentengManggu	-7,111255014	108,692601	887	4
GT017	GentengManggu	-7,111475961	108,692344	884	10
GT018	GentengManggu	-7,111753989	108,692352	886	7
GT019	GentengManggu	-7,111982983	108,692197	886	9
GT020	GentengManggu	-7,112154979	108,692203	883	6
GT021	GentengManggu	-7,112240978	108,692203	878	6
GT022	GentengManggu	-7,112931982	108,691652	875	1
GT023	GentengManggu	-7,113419976	108,691455	883	3
GT024	GentengManggu	-7,114411974	108,691321	912	3
GT025	GentengManggu	-7,117188983	108,692807	1020	1
GT026	GentengManggu	-7,117463993	108,692833	1054	1
GT027	GentengManggu	-7,117970008	108,693156	1111	1
GT028	GentengManggu	-7,118680039	108,693493	1151	1
GT029	GentengManggu	-7,119853003	108,693608	1145	1

GT030	GentengManggu	-7,120518023	108,694366	1115	1
GT031	Citambelang	-7,122456003	108,697805	1060	2
GT032	Citambelang	-7,120169001	108,698673	1071	2
GT033	Citambelang	-7,119892985	108,698715	1065	3
GT034	Citambelang	-7,119861972	108,699033	1056	2
GT035	Citambelang	-7,119846968	108,699889	1034	6
GT036	Citambelang	-7,119734986	108,700157	1028	2
GT037	Citambelang	-7,119615041	108,700373	1027	4
GT038	Citambelang	-7,119142804	108,7007327	989	2
GT039	Citambelang	-7,118909871	108,7007329	989	3
GT040	Citambelang	-7,118176874	108,7014183	989	5
GT041	Citambelang	-7,117954418	108,7016759	989	1
GT042	Citambelang	-7,11780983	108,7018057	989	1
GT043	Citambelang	-7,117472794	108,7019096	989	1
GT044	Citambelang	-7,116865357	108,7022939	989	1
GT045	Citambelang	-7,116677184	108,7023691	989	1
GT046	Citambelang	-7,116488758	108,7024301	989	1
GT047	Citambelang	-7,11624803	108,7026208	989	1
GT048	Citambelang	-7,11592583	108,7028076	989	1
GT049	Citambelang	-7,115424508	108,7029243	989	1
GT050	Citambelang	-7,115179757	108,7029068	989	12
GT051	Citambelang	-7,114693774	108,7027444	989	6
GT052	Citambelang	-7,114415662	108,7028147	989	6
GT053	Ebeg-Ebeg	-7,116933251	108,704959	659	2
GT054	Ebeg-Ebeg	-7,117071636	108,705025	659	1
GT055	Ebeg-Ebeg	-7,118563363	108,7047441	659	5
GT056	Ebeg-Ebeg	-7,122789184	108,7028905	659	4
GT057	Ebeg-Ebeg	-7,124048313	108,7018117	659	2
GT058	Ebeg-Ebeg	-7,124146465	108,7019915	659	3
GT059	Ebeg-Ebeg	-7,124256687	108,70189	917	2
GT060	Ebeg-Ebeg	-7,124334974	108,701795	917	7

GT061	Ebeg-Ebeg	-7,124891113	108,7017763	940	1
GT062	Ebeg-Ebeg	-7,125959974	108,7025067	940	1
GT063	Ebeg-Ebeg	-7,126770001	108,7029866	1012	1
GT064	CurugSawer	-7,122119972	108,711702	624	1
GT065	CurugSawer	-7,125729974	108,711347	640	4
GT066	Gompong	-7,111491971	108,710187	625	24
GT067	Gompong	-7,113964967	108,71207	724	14

The horizontal and vertical population structure measured based on the diameter (cm) and height (m) of the plant shows the entire plant *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson that were found included in the growth stage of saplings with a diameter of <10 cm and a height of >1.5 m and seedlings with a height of ≤ 1.5 m (Kusmana&Istomo, 1995) (Figure 2). Based on research Mekonnen et al, (2023) that the number of saplings and seedlings is greater than other growth rates or there are no other growth rates, indicating that the area is still new and has not yet reached peak growth. Previous research according to Adhya et al., (2020) shows that the population structure of this plant in the Bukit Barisan Area consists of three growth levels, namely poles, saplings, and seedlings.



(A) (B)

Figure 2. Horizontal and Vertical Structure of Plants *Goniothalamusmacrophyllus*

In Indonesia existence *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson available in several locations. Several studies found this type of plant at the growth level of seedlings, saplings and poles in the natural forest of Mount KareumbiMasigit, Sumedang Regency, West Java. (Suwandhi, 2009). Yusuf (2005) find type *Goniothalamusmacrophyllus* as a group of shrubs (small trees) growing in the secondary forest of Kuala Ran, Bulungan Regency, East Kalimantan. Slik et al., (2007) find type *Goniothalamusmacrophyllus* in the GunungLumut Protected Forest, East Kalimantan. Adhya et al., (2020) declare existence *Goniothalamusmacrophyllus* in the lowland forests of Kuningan Regency, it is dominated by the seedling stage.

Flower

Fruits

Seedlling

Figure 3. Photographic views of *Goniothalamusmacrophyllus*.

Goniothalamusmacrophyllus (Blume) Hook.f. & Thomson found in the GunungTilu area, Kuningan Regency, West Java in five observation routes, namely: GentengMangu, Citambelang, Gompong, Ebeg-Ebeg, CurugSawer. The resulting population data was then analyzed using the Morisita Index to estimate plant distribution patterns. Based on the analysis results, it shows that the Morisita Index value of 0.50 > 0 indicates that *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson has a clustered distribution pattern (Figure 3). Clustered distribution patterns occur when environmental conditions tend to be different from other areas and some plants adapt to their environment so that they grow in areas that support them (Rizkiah et al, 2021). *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson can grow at temperatures of 19–25 o C with relative humidity of 80–90%, and sandy loam soil texture with relatively acidic soil properties in line with research Hung danPotokin (2019) that *Goniothalamusvietnamensis* Ban. and*Goniothalamusdongnaiensis* Fin. &Gagn. found to grow at an average temperature of 26.4oC with a relative humidity of 80-95%. Other research finds that *Goniothalamusmacrocalyx* Ban found in the average annual temperature 23oC with humidity 86% (Pham et al, 2020). Distribution map *Goniothalamusmacrophyllus* can be seen in Figure 4.

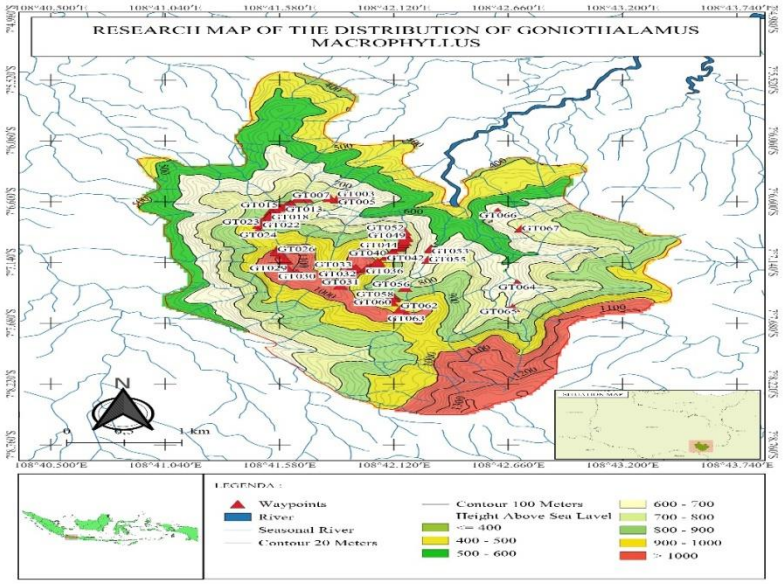


Figure 4. Spatial Distribution of *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson

The spatial distribution of a species is important for ecological knowledge (Dale, 1999; Folt and Burn, 1999). According to Odum (1996) Uniform distribution can occur where competition between individuals is very strong and positive antagonism divides the same space. Uniform distribution patterns are the result of negative interactions between individuals, such as competition for food or space (Ludwig danReynold 1988). Indonesia's tropical climate provides enormous benefits for biodiversity. Whitmore (1990) stated that the area of tropical regions is only around 7% of the earth's area, but has biodiversity reaching more than half of the world's plant species. Species diversity increases as we approach the tropics. This occurs in almost all groups of organisms (Kaufman & Cohen, 1993).

Plant distribution patterns are generally determined by complex relationships or relationships between a number of factors, including seed dispersal patterns (Bell, 2000), (the presence of small trees is influenced by spatial distribution (Vroh, &Koné, 2024) competition for pollinators (Svenning, 1999; Armbruster, 1995), recruitment and regeneration process (Harms, et al. 2000; Christie, et al. 2003) (Widyatmoko, et al. 2005), influence of population density (Webb &Peart, 2000), interference influence (Molino dan Sabatier. 2001) as well as variations in topography and groundwater availability (Campbell, 1985; Swaine, 1996; Davie &Sumardja, 1997; Clark, et al. 1998,Svenning, 2001). The environmental factors that influence the entity and existence of the various types of plants that make up mountain forests are very complex (Whitmore, 1998; Steenis, 2006). According to UNEP (2003), Mountainous tropical areas have structural and compositional characteristics that change with increasing altitude. The higher the altitude, the less conducive environmental factors are for plant and animal life, this is indicated by the decreasing number of species and their smaller size.

Conclusion

Goniothalamusmacrophyllus (Blume) Hook.f. & Thomson is a plant that is distributed in clusters in the lowland forest area of Mount Tilu in Kuningan Regency, West Java. In this area there were 264 individuals found. This plant is found at an altitude of 624 – 1,151 meters above sea level

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