



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

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【 Summary 】

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 $0.5 > 0$.

Key words: 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 dan Chalermglin, 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 Salleh dan Latiff, 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.

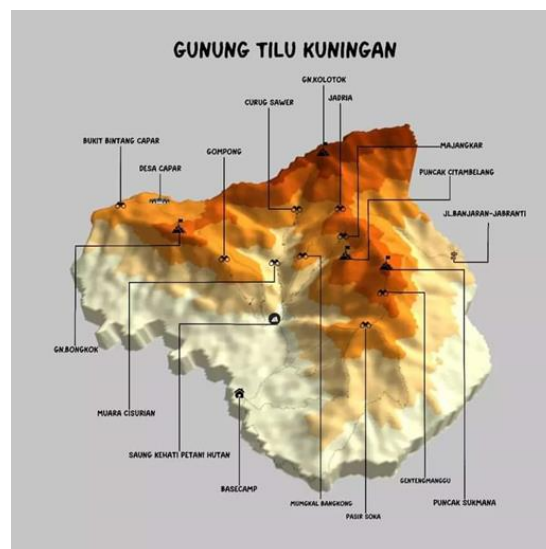
Until now, research has been conducted on distribution *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson it's still not uncommon. The aim of this research is to determine distribution patterns and population structure *Goniothalamusmacrophyllus*

(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.

MATERIALS AND METHODS

The research was carried out in the GunungTilu area in Kuningan Regency. This area is included in the administrative area of Cimara Village, Cibereum District, Kuningan Regency and is managed by PerumPerhutani KPH Kuningan, West Java Banten Regional Division (Fig. 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.

Fig 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 ($I\delta$) calculated using the Brower and Zar (1977) formula to observe plant distribution patterns *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson with the condition If $I\delta = 1$, distribution patterns are random, even or uniform, and clustered (aggregate, contagious, and clumped). The formula for the

Morisita Spread Index is as follows.

1

$$I\delta = \frac{n\sum x^2 - \sum x^2}{\sum x^2 - \sum x}$$

- 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

Based on the results of research conducted in the field with encounters with plants *Goniothalamus macrophyllus* (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 GentengManggu route with 128 individuals, followed by the Citabelang 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 *Goniothalamus macrophyllus* (Blume) Hook.f. & Thomson

| Kode | Route | Coordinate | | Altit ude (masl) | ∑I ndividu |
|-------|---------------|--------------|------------|---------------------|---------------|
| | | 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 |

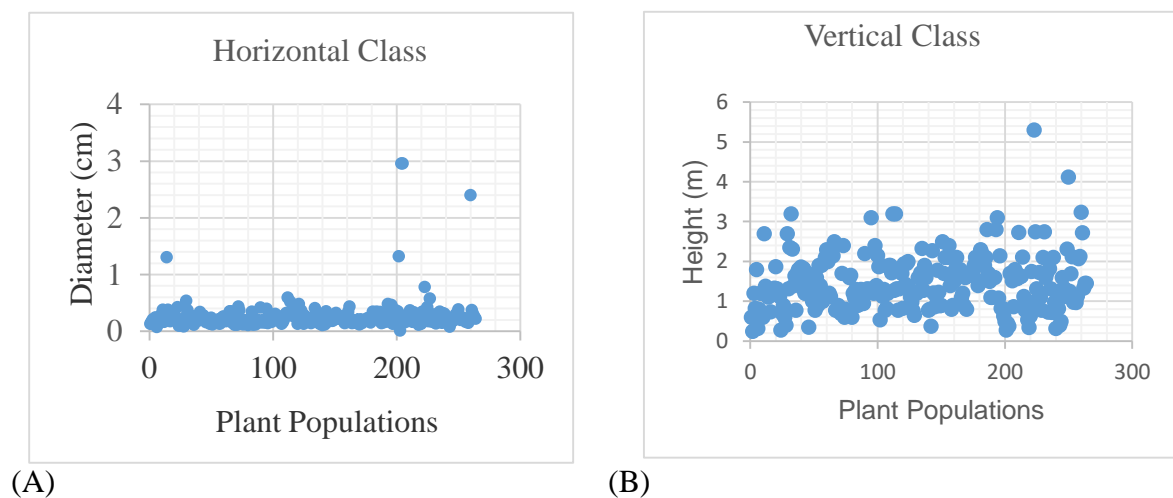
| | | | | | |
|-------|---------------|------------------|------------|------|----|
| GT012 | GentengManggu | - 7,110624025 | 108,693622 | 905 | 4 |
| GT013 | GentengManggu | -7,11074003 | 108,693457 | 905 | 7 |
| GT014 | GentengManggu | - 7,110877996 | 108,693161 | 902 | 7 |
| GT015 | GentengManggu | - 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 | Citabelang | - 7,122456003 | 108,697805 | 1060 | 2 |
| GT032 | Citabelang | - 7,120169001 | 108,698673 | 1071 | 2 |
| GT033 | Citabelang | - 7,119892985 | 108,698715 | 1065 | 3 |
| GT034 | Citabelang | - 7,119861972 | 108,699033 | 1056 | 2 |
| GT035 | Citabelang | - | 108,699889 | 1034 | 6 |

| | | | | | |
|-------|------------|------------------|-------------|------|----|
| | | 7,119846968 | | | |
| GT036 | Citabelang | - 7,119734986 | 108,700157 | 1028 | 2 |
| GT037 | Citabelang | - 7,119615041 | 108,700373 | 1027 | 4 |
| GT038 | Citabelang | - 7,119142804 | 108,7007327 | 989 | 2 |
| GT039 | Citabelang | - 7,118909871 | 108,7007329 | 989 | 3 |
| GT040 | Citabelang | - 7,118176874 | 108,7014183 | 989 | 5 |
| GT041 | Citabelang | - 7,117954418 | 108,7016759 | 989 | 1 |
| GT042 | Citabelang | -7,11780983 | 108,7018057 | 989 | 1 |
| GT043 | Citabelang | - 7,117472794 | 108,7019096 | 989 | 1 |
| GT044 | Citabelang | - 7,116865357 | 108,7022939 | 989 | 1 |
| GT045 | Citabelang | - 7,116677184 | 108,7023691 | 989 | 1 |
| GT046 | Citabelang | - 7,116488758 | 108,7024301 | 989 | 1 |
| GT047 | Citabelang | -7,11624803 | 108,7026208 | 989 | 1 |
| GT048 | Citabelang | -7,11592583 | 108,7028076 | 989 | 1 |
| GT049 | Citabelang | - 7,115424508 | 108,7029243 | 989 | 1 |
| GT050 | Citabelang | - 7,115179757 | 108,7029068 | 989 | 12 |
| GT051 | Citabelang | - 7,114693774 | 108,7027444 | 989 | 6 |
| GT052 | Citabelang | - 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 |

Horizontal and vertical population structure of the plant *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson are measured based on diameter (cm) and height (m). according to Kusmana&Istomo, 1995, *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson included in the sapling growth stage with a diameter of <10 cm and a height of \leq 1.5 m. as seen in figure 2 below, shows that the distribution of *Goniothalamusmacrophyllus* (Blume) plant saplings is quite abundant.

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



In Indonesia existence *Goniothalamusmacrophyllus* (Blume) Hook.f. & Thomson

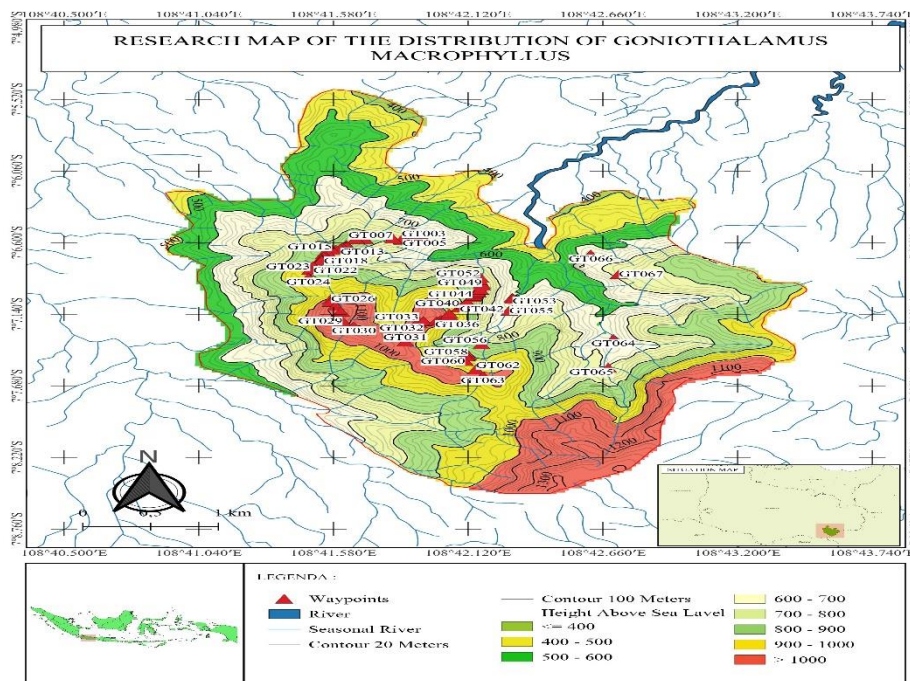
available in several locations. Several studies found this type of plant at the growth level of seedlings, saplings and poles in the natural forest of Mount KareumbiMasigit, Sumedang Regency, West Java. (Suwandhi, 2009).

Fig 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, Citabelang, 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). Distribution map *Goniothalamusmacrophyllus* can be seen in Fig. 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.

DISCUSSION

The abundance of plant seedlings *Goniothalamus macrophyllus* is a benchmark for viewing plant growth patterns. 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.

Yusuf (2005) find type *Goniothalamus macrophyllus* 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 *Goniothalamus macrophyllus* in the Gunung Lumut Protected Forest, East Kalimantan. Adhya et al., (2020) declare existence *Goniothalamus macrophyllus* in the lowland forests of Kuningan Regency, it is dominated by the seedling stage.

Goniothalamus macrophyllus (Blume) Hook.f. & Thomson can grow at temperatures of 19–25 °C with relative humidity of 80–90%, and sandy loam soil texture with relatively acidic soil properties in line with research Hung dan Potokin (2019) that *Goniothalamus vietnamensis* Ban. and *Goniothalamus dongnaiensis* Fin. & Gagn. found to grow at an average temperature of 26.4°C with a relative humidity of 80-95%. Other research finds that *Goniothalamus macrocalyx* Ban found in the average annual temperature 23°C with humidity 86% (Pham et al, 2020).

Uniform distribution patterns are the result of negative interactions between individuals, such as competition for food or space (Ludwig dan Reynold 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

CONCLUSIONS

Goniothalamus macrophyllus (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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