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Research Paper

Species, Dominance, and Distribution Patterns of Invasive Undergrowth at the Lauraceae Collection Block of the Bogor Botanical Gardens, Indonesia

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ABSTRACT
Invasive plants are plants that can originate from outside the native area and can threaten ecosystem stability and cause disturbances that damage the structure, composition, and growth of native vegetation in an ecosystem. Likewise, the existence of invasive plants can have a negative impact to other plants that collected in the Bogor Botanical Gardens, affecting habitat conditions and the growth of other vegetation. Therefore, the objectives of this research were to know the pecies of invasive undergrowth, analyze the level of dominance and distribution patterns of each species of plant. The data was collected using the double plot method with a sampling intensity of 2%, each plot measuring 2 m x 2 m, then the data was analyzed for density, frequency, Important Value Index, and Morisita Index. The data was collected using the double plot method with a sampling intensity of 2% that each plot measuring 2 m x 2 m, covering individual number of undergrowth, organ morphus of each species of undergrowth and then identification was carried out, then analyzed for density, frequency, Importance Value Index, and Morisita Index. The results of this research found 10 species of invasive undergrowth, namely Ageratum conyzoides, Asystasia intrusa, Cyanthillium cinereum, Dioscorea bulbifera, Elephantopus scaber, Epipremnum pinnatum, Mikania micrantha, Spermacoce alata, Synedrella nodiflora, and Syngonium podophyllum. There are 2 species of invasive undergrowth that are the most dominant, namely Dioscorea bulbifera and Elephantopus scaber with the highest Important Value Index and have a clustered distribution pattern which indicates strong competition between plants, but have good competitive ability, adaptation, and tolerance to environmental conditions.
Keywords: *Undergrowth, Invasive, Dominance, Distribution pattern*

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I. INTRODUCTION

Indonesia is a country with a tropical climate that is located on the equator, so Indonesia has quite a high diversity of flora and fauna (Nabila et al., 2021). These species of flora and fauna are very abundant and can be found on land and sea. One of the places where a diversity of flora and fauna can be found is botanical gardens. A botanical garden is defined as an ex situ plant conservation area that can function for scientific, conservation, nature tourism, education, environmental services, and research purposes (Peraturan Presiden Republik Indonesia Nomor 93/2011). Botanical gardens were established to maintain, preserve, and conduct research on various species of plants, as well as providing recreational facilities and environmental education for the general public (Irawanto, 2023). A botanical garden is a place that is used for collection, research, and ex-situ conservation or conservation outside its natural habitat (Purnomo et al., 2015).

One of the botanical gardens in Indonesia is the Bogor Botanical Gardens. The plant collections in the Bogor Botanical Gardens are plants originating from various regions in Indonesia as well as the result of exchange of species from abroad, thus creating the Bogor Botanical Gardens as an ex situ conservation area that is rich in plant species diversity (Widayanti, 2017). The Bogor Botanical Gardens are one of the last bastions in saving endangered flora because their populations are very small in nature (Hariri et al., 2021). The plant collection at the Bogor Botanical Gardens includes various species of plants in the form of trees, shrubs, lianas, and herbs. The total collection of plants are 13,684 individual plants consisting of 3,423 species from 222 families (Santosa et al., 2014). According to (Rachmadiyanto et al., 2021), a collection of 1,496 trees that are more than 60 years old are found in the Bogor Botanical Gardens.

As a place to conserve plant species diversity, the Bogor Botanical Gardens are very vulnerable to disturbances and threats originating from within and outside the area itself. Disturbances and threats can directly or indirectly affect biodiversity and other potential. According to Sunaryo et al. (2012) the existence of invasive plant species from outside the region can threaten ecosystem stability, damaging the structure, composition, and growth of native vegetation in the ecosystem. The existence of invasive plant species has been known to have a very large negative impact on an ecosystem (Abywijaya et al., 2014). Invasive plants directly threaten the existence of other plant species collected in the Bogor Botanical Gardens and can affect habitat conditions, reduce water availability, inhibit seed germination and growth (Yuliana, 2018).

Invasive is the expansion of the area where plants live, both local plants and foreign plants, in areas that are not supposed to be occupied by these plants (Diana et al., 2021). According to (Widiyawati et al., 2022) the existence of invasive undergrowth, for example *Ageratum conyzoides*, *Eupatorium inulifolium*, *Imperata cylindrica*, and *Scleria triglomerata* in the Tanjung Puri Botanical Garden area has influenced the composition of the vegetation in the botanical garden. Sunaryo et al. (2012) stated that in Mount Halimun-Salak National Park (TNGH-S), 4 species of 17 invasive plants species were found which had potential threats to the ecosystem and native plants in TNGH-S, namely *Austroeupatorium inulaefolium*, *Calliandra calothyrsus*, *Clidemia hirta*, and *Piper aduncum*.

Plants at the Bogor Botanical Gardens are planted in collection blocks which grouped based on families or certain themes (Hariri et al., 2021). One of the collection blocks in the Bogor Botanical Gardens is the Lauraceae Collection Block. In the Lauraceae Collection Block, there are 149 trees that have been collected which includes 81 species and consisting of 103 trees in healthy condition, 34 trees in damaged condition, and 12 trees that were dead (Zulkarnaen et al., 2021), thus creating an open area. This open area allows undergrowth to grow because more solar radiation reaches the ground surface. The intensity of solar radiation reaching the ground surface will affect the diversity of undergrowth plants (Indriyanto & Indriyanto, 2023[a]). According to Sayfulloh et al. (2020) open areas can be a good growing place for invasive plants because of the abundant intensity of solar radiatiom. The intensity of solar radiation affects growth because plants need it for the photosynthesis process. The higher the intensity of solar radiation causes the higher the rate of photosynthesis. Through the process of photosynthesis, plants can produce food for their growth and development (Pusfa, 2016).

Trees belonging to the Lauraceae family also have an important role as habitat and food sources for animals, for example birds and other animals that live in trees. However, fruit/seed-eating bird species can also have a negative impact in the form of spreading seeds of invasive undergrowth from one place and then releasing/dropping the seeds in the Lauraceae Collection Block. The spread of seeds or plant organs other than fruit/seeds also often occurs by wind (Mulia et al., 2017). So, sooner or later invasive undergrowth can grow in the collection block area and can disrupt the balance of the ecosystem and biodiversity in the Lauraceae Collection Block (Sitepu, 2020). Therefore, inventory and identification of undergrowth in areas invaded by invasive undergrowth are very necessary for early detection of the existence and condition of their populations.
The objectives of this research were to know the pecies of invasive undergrowth, analyze the level of dominance and distribution patterns of each species of plant.

II. METHODS

Time and Location of Research

The research was conducted from October to November 2023, located in the Lauraceae Collection Block, Bogor Botanical Gardens. The Bogor Botanical Gardens are located in the center of Bogor City and are located at Jl. Ir. H. Juanda No.13, Bogor City, West Java which is geographically located between 106° 47' 40”—106° 48' 10” East Longitude and 6° 25' 40”—6° 36' 20” South Latitude with the altitude is 235—265 m above sea level (Handoyo & Dewi, 2011). The location of the research location is presented in Figure 1.

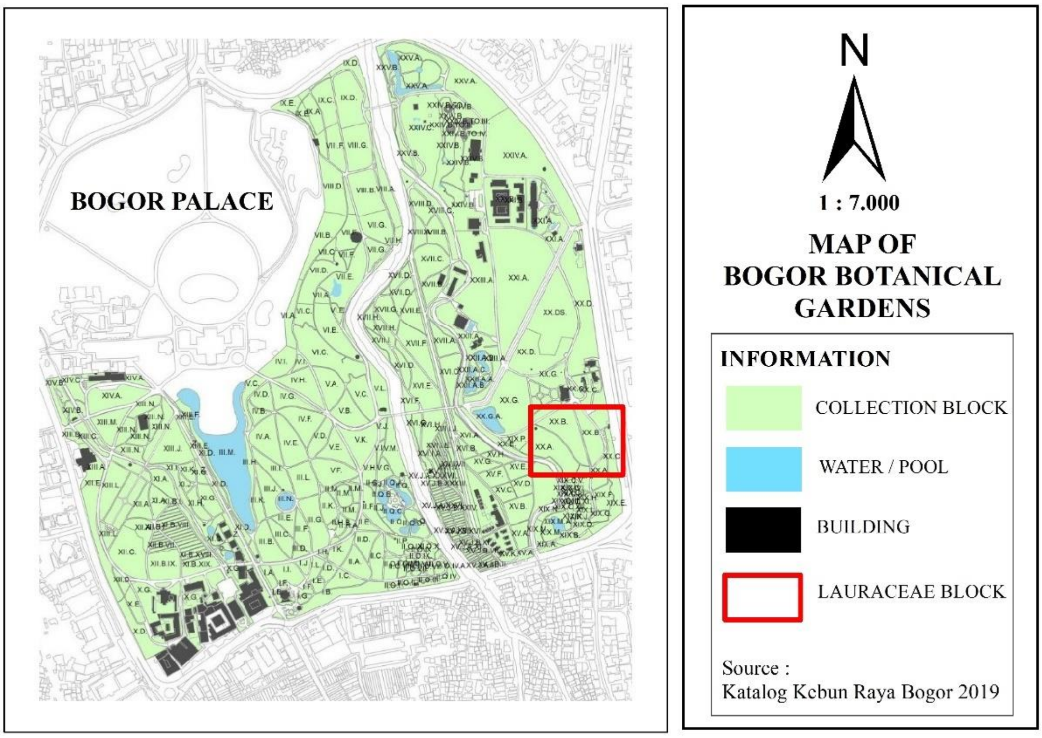

Figure 1. Map of the research locations at the Lauraceae Collection Block, Bogor Botanical Gardens (Ariati et al., 2019)

Equipment

The equipment used for this research consists of measuring tapes, a clinometer, a handheld GPS, measuring string, stakes, an abney level, a thermohygrometer, a lux meter, a measuring glass, a writing board, ballpoint pens, and tally sheets.

Data Collection Techniques

Data collection was carried out through vegetation surveys using multiple plots with a sampling intensity of 2%. The number of sample plots were 85 with the size of each sample plot being 2 m x 2 m. Sample plots were placed systematically with a distance of 10 m between sample plots. The plot method is a method used to take samples of various species of plants and animals that live in a place or habitat (Indriyanto, 2021). The undergrowth contained in the sample plots were observed for their organ morphus including body shape, leaves, flowers, fruit, seeds, etc. (Efendi et al., 2019). Determination of invasive undergrowth species was carried out based on the book "Invasive Alien Plants Species in Indonesia" written by (Setyawati et al., 2015) and other literature.

Data Processing

Undergrowth that has been identified, then grouped into invasive and non-invasive undergrowth, and then tabulated. Invasive undergrowth were described based on the morphus of some of its body organs. After that, density (D), frequency (F), and Important Value Index (IVI) and Morisita Index analyzes were carried out using the following formulas (Indriyanto, 2021).

$$\text{Density (D)} = \frac{\text{number of individuals}}{\text{total sample plots area}} \qquad (1)$$

$$\text{Relative density (RD)} = \frac{\text{kerapatan suatu jenis}}{\text{kerapatan sluruh jenis}} \text{ x } 100\% \qquad (2)$$

$$\text{Frequency (F)} = \frac{\text{number of sample plots found for a species}}{\text{total of sample plots}} \qquad (3)$$

$$\text{Relative Frequency (RF)} = \frac{\text{frequency of a species}}{\text{frequency of all species}} \text{ x } 100\% \qquad (4)$$

Important Value Index (IVI)= RD + RF (5)

The dominance level is determined by making dominance class intervals using the following formula (Indriyanto, 2021).

$$\text{Dominance class interval (I)} = \frac{\text{IVI}_{\text{highest}} - \text{IVI}_{\text{lowest}}}{3} \qquad (6)$$

a. Dominant (high dominance) if IVI> (IVI_{lowest} + 2I)
b. Moderate dominance if (IVI_{lowest} + I)—(IVI_{lowest} + 2I)
c. Not dominant (low dominance) if IVI< (IVI_{lowest} + I)

The internal distribution pattern of sugar palm tree was analyzed using Morisita Index following the equation of Ludwig & Reynolds (1988).

$$\text{Id} = (\text{n}) \frac{\sum_{i=1}^{n} X_i^{\,2} - N}{N(N-1)} \qquad (7)$$

where
Id= Morisita Index
n= total number of all sample plots
N= individual totals within all sample plots
Xi= individual totals within i-sample plot

The internal distribution patterns based on Morisita Index can be further classified as follow (Ludwig & Reynolds, 1988).
a. Id= 1: the internal distribution of plant occurs randomly.
b. 1< Id ≤n: the internal distribution of plant occurs as a clamped.
c. Id=0: the internal distribution of plant occurs uniformly.

III. RESULT AND DISCUSSION

Species of Invasive Undergrowth

There were 18 species of undergrowth that were found at the research location, including 10 species of invasive undergrowth and 8 species of non-invasive undergrowth (Table 1).

Table 1. Species of undergrowth found in the Lauraceae Collection Block

Family	Species of undergrowth		Plant group
	Botanical name	Local name in Indonesia	
Acanthaceae	*Asystasia intrusa* L.	Rumput israel	Invasive
	Hemigraphis reptans G.Forst.	Keji beling	Non-invasive
	Pseuderanthemum variabile (R. Br.) Radlk.	Bunga cinta	Non-invasive
Araceae	*Epipremnum pinnatum* (L.) Engl.	Ekor naga	Invasive
	Syngonium podophyllum Schott.	Mata panah	Invasive
	Typhonium roxburghii Schott.	Keladi tikus	Non-invasive
Asteraceae	*Ageratum conyzoides* L.	Babadotan	Invasive
	Cyanthillium cinereum (L.) H.Rob.	Sawi langit	Invasive
	Elephantopus scaber L.	Tapak liman	Invasive
	Mikania micrantha Kunth.	Sembung rambat	Invasive
	Synedrella nodiflora (L.) Gaertn.	Jotang kuda	Invasive
Convolvulaceae	*Merremia emarginata* Burm.f.	Pegagan utan	Non-invasive
Costaceae	*Costus afer* Ker Gawl.	Pacing	Non-invasive
Cucurbitaceae	*Melothria pendula* L.	Mentimun merambat	Non-invasive
Dioscoreaceae	*Dioscorea bulbifera* L.	Gembolo	Invasive
Rubiaceae	*Exallage auricularia* L.	Akar kemenyan	Non-invasive

	Spermacoce alata Aubl.	Rumput setawar	Invasive
Scrophulariaceae	*Lindernia viscosa* (Hornem.) Bodlingh	Brobos	Non-invasive

The invasive undergrowth found at the research location belongs to 5 families. The largest number of species are members of the Asteraceae family, namely 5 species. The existence of invasive undergrowth species belonging to the Asteraceae family in the Lauraceae Collection Block is due to the easy dispersal of their seeds through the wind, besides that the seeds are easy to survive and grow in various environmental conditions (Azzaroiha et al., 2022). There are species of invasive undergrowth from the Asteraceae family that has a high IVI, namely *Elephantopus scaber*, so its existence is significant in the Lauraceae Collection Block area. This species of invasive undergrowth, a member of the Asteraceae family, was found in the Protected Forest of Sorong City, West Papua (Yuliana & Lekito, 2018), in fact members of the Asteraceae family were found to be the most numerous of the 25 invasive undergrowth families in Meru Betiri National Park (Susilo, 2018).

Invasive undergrowth is a plant that is introduced either intentionally or unintentionally from outside its habitat and can become invasive in the new habitat (Nursanti dan Adriadi, 2018). (Susanti et al., 2013) stated that in the Kenali Forest Park area of Jambi City, 6 species of invasive undergrowth were found, namely Clidemia hirta, Melastoma malabathri Cum, Ageratum conyzoides, Mikania micrantha, Lantana camara, and Passiflora foetida. Sitepu (2020) stated that in KHDTK Samboja, East Kalimantan, 52 species of invasive plants from 29 families were found, dominated by *Asystasia gangetica*, *Pluchea indica*, *Mikania scandens*, *Imperata cylindrica*, *Spermacoce alata*, and *Syngonium podophyllum*. The results of research in the Lauraceae Collection Block, Bogor Botanical Gardens show that the number of invasive undergrowth plant species is less than in KHDTK Samboja, East Kalimantan. Two species of invasive undergrowth found in the Lauracea Collection Block are also found in the Kenali Forest Park area of Jambi City, namely *Ageratum conyzoides* and *Mikania micrantha*.

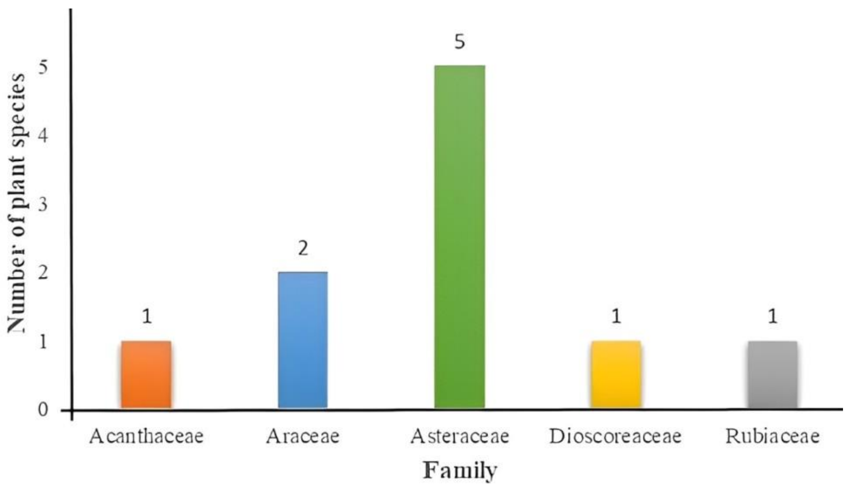

Figure 2. Invasive undergrowth families that found at the Lauraceae Collection Block, Bogor Botanical Gardens

The reason why many species of invasive undergrowth belonging to the Asteraceae family are found including because the Asteraceae family has quite a lot of members (1,911 genera or 32,205 species) (Pertiwi et al., 2015), both in the habit of shrubs, lianas, and trees (Utami et al., 2020). The Asteraceae family also has seeds that can spread widely and can grow well in tropical areas where the intensity of solar radiation is high. In addition, pollen can spread to distant places via wind (Tampubolon et al., 2019). According to (Sahira, 2016), the Asteraceae family is a family that easily adapts to new environments and lives easily in areas that have high light intensity and are not shaded. (Sahira, 2016) further stated that plants in the Asteraceae family generally have small, dry fruit which when ripe are easily blown away by the wind. The Asteraceae family is found in abundance at the Lauraceae Collection Block in open areas and there are not too many trees shading the area so that the intensity of solar radiation is available quite a lot. Not many invasive undergrowth are found in areas that are heavily shaded by tree canopies, resulting in limited energy requirements for the photosynthesis process (Zannah et al., 2023).

Description of Invasive Undergrowth Species

The species of invasive undergrowth that found in the Lauraceae Collection Block, Bogor Botanical Gardens were described one by one as follows.

Ageratum conyzoides (Figure 3) is an upright annual herbaceous plant, can reach 30 cm in height with stems covered with hair and has a single leaf with a alternate leaf arrangement, the leaf blade is oval, oblong or elongated, the leaf blade is 2 – 8 cm long and 1.5 – 6 cm wide, with serrated leaf edges, and has white flowers.

Figure 3. *Ageratum conyzoides*, (a.) plant habitus, (b.) flower morphus, (c) leaf morphus.

Asystasia intrusa (Figure 4) is a herbaceous plant that can climb, its stem is rectangular in shape and covered with hair, it has single leaf with opposite leaf arrangement, the leaf blade is oval to oblong, the leaf length is 3 – 12 cm and the wide is 1 – 5 cm. The base of the leaf is rounded, the edges of the leaf is flat and the tips is tapered, the spines of the leaf is pinnate, and have white flowers.

Figure 4. *Asystasia intrusa*, (a.) plant habitus, (b.) flower morphus, (c) leaf morphus.

Cyanthillium cinereum (Figure 5) is an erect annual upright herbaceous plant that can reach a height of 50 cm. Single-leaf plants whose the shape varies from ovate, rhombic, elongated to oval. The edge of the leaf is slightly wavy and serrated. The type of homogamous inflorescence is a single tube with a number of flowers between 20 – 25, violet, pink, and sometimes white.

Figure 5. *Cyanthillium cinereum*, (a.) plant habitus, (b.) flower morphus, (c) leaf morphus.

Dioscorea bulbifera (Figure 6) is a climbing liana with round and green stems that grow in twists. The leaf is single, wide, oval, acuminate at the tip, and entire at the leaf edge. The flowers are compound type with a corolla is yellow. This plant has aerial bulbs at each node of its stem.

Figure 6. *Dioscorea bulbifera*, (a.) plant habitus, (b.) aerial bulbs, (c) leaf morphus.

Elephantopus scaber (Figure 7) is a perennial upright herbaceous plant, reaching a height of 20-60 cm. A single-leaf plant, dark green in color, the leaf blades are inverted oval-shaped, the leaf edges are wavy or serrated, and are arranged in a rosette. The stems are stiff, the flowers are located at the end of the stem, are small and yellow.

Figure 7. *Elephantopus scaber*, (a.) plant habitus, (b.) flower morphus, (c) leaf morphus

Epipremnum pinnatum (Figure 8) is a climber or liana. The stem can produce cylindrical adventitious roots and can reach a length of up to 15 meters or more. The leaves are single leaf type, the leaf blade is ovate shaped. The edges of young leaves are flat (entire), 5-15 cm long and 3-7 cm wide. The edges of the old leaves are shared (partitus), 20–30 cm long and 10–15 cm wide.

Figure 8. *Epipremnum pinnatum*, (a.) young leaf morphus, (b.) old leaf morphus

Mikania micrantha (Figure 9) is a perennial herbaceous plant. The plant has single leaves, shaped like a heart, arranged oppositely, the length of the blade is 4–12 cm and the width is 2–8 cm, the tip of the leaf is tapered, and the edge of the leaf is wavy. The stems spread or creep, are light green, branched, and have fine hair. Stem length reaches 3–6 m. The leaf surface is slightly concave like a bowl. The flowers are white, small, grow in the axils of the leaves and at the ends of the branches.

Figure 9. *Mikania micrantha*, (a.) plant habitus, (b.) young leaf morphus, (c) old leaf morphus

Spermacoce alata (Figure 10) is an upright herbaceous plant. Plant height can reach 5–7.5 cm. The stem is woody and rectangular in shape. The leaves are single leaf type, elliptical to ovate shaped, light green to dark green, and arranged oppositeky. The upper surface of the leaves is hairy, while the lower surface of the leaves is glabrous. The flowers are the perfect flower type, small, white, and located in the leaf axils.

Figure 10. *Spermacoce alata*, (a.) plant habitus, (b.) leaf morphus

Synedrella nodiflora (Figure 11) is a herbaceous plant. Short sized plants with a height of around 20 – 65 cm. The leaves are single leaf type, the leaf blade is elliptical, has 3 leaf veins arranged parallel. Short leaf stalks, leaf layout opposite and crossed. Yellow flowers, located in the leaf axils and at the nodes of the stem, have seeds for reproduction.

Figure 11. *Synedrella nodiflora*, (a.) plant habitus, (b.) flower morphus, (c) leaf morphus

Syngonium podophyllum (Figure 12) is a vine that can produce adventitious roots with stems up to 10 m long. Leaves are of the complete type with increase in size towards the centre, with shaped ovate. Flowers are unisexual with inflorescence stalks up to 9 cm long and can extend up to 14 cm along with the growth process.

Figure 12. *Syngonium podophyllum*, (a.) plant habitus, (b.) leaf morphus

Dominance and Distribution Patterns of Invasive Undergrowth

The dominance of invasive undergrowth was divided into 3 levels, namely dominant (high dominance) with an IVI value of >40.83%, medium dominance with an IVI value of 22.60%–40.83%, and not dominant (low dominance) with an IVI value of <22.60%. The dominant invasive undergrowth are *Dioscorea bulbifera* and *Elephantopus scaber* , the moderate dominance is *Spermacoce alata*, while the not dominant are *Epipremnum pinnatum*, *Syngonium podophyllum*, *Mikania micrantha*, *Synedrella nodiflora*, *Ageratum conyzoides*, *Cyanthillium cinereum*, and *Asystasia intrusa*.

Based on the Morisita Index analysis, there are two distribution patterns of members of the invasive understory plant population, namely a clustered distribution pattern of 6 plant species and a uniform distribution pattern of 4 plant species (Table 2).

Table 2. Level of dominance and distribution pattern of each species of invasive undergrowth

Species of invasive undergrowth	IVI (%)	Dominance level	Indeks Morisita	Distribution pattern
Ageratum conyzoides L.	7.81	Low dominance	0,98	Uniform
Asystasia intrusa L.	4.37	Low dominance	0,97	Uniform
Cyanthillium cinereum (L.) H.Rob.	5.09	Low dominance	1,05	Clumped
Dioscorea bulbifera L.	59.07	High dominance	1,47	Clumped
Elephantopus scaber L.	52.98	High dominance	1,66	Clumped
Epipremnum pinnatum (L.) Engl.	12.65	Low dominance	1,27	Clumped
Mikania micrantha Kunth.	9.94	Low dominance	1,07	Clumped
Spermacoce alata Aubl.	27.89	Medium dominance	0,94	Uniform
Synedrella nodiflora (L.) Gaertn.	9.94	Low dominance	1,03	Clumped
Syngonium podophyllum Schott	10.27	Low dominance	0,92	Uniform

The Important Value Index (IVI) of plant species in a community is one of the parameters that indicates the level of dominance of invasive undergrowth species in an area. The existence of a plant species in an area shows its ability to adapt to its habitat and tolerance to environmental conditions. The greater the IVI value of a plant species, the greater the level of control over the plant community (Soerianegara & Indrawan, 2005). *Dioscorea bulbifera* and *Elephantopus scaber* have the highest IVI values, indicating that these plants are the most dominant in the Lauraceae Collection Block. These two species of plants were found quite a lot in several sample plots where conditions were not heavily shaded by tree canopies.

Dioscorea bulbifera is a member of the Dioscoreaceae family with a high level of dominance and included in one species of invasive plant that can cause environmental problems in various regions (Oksari *et al.*, 2021). According to (Santosa *et al.*, 2014), *Dioscorea bulbifera* has spread from several areas of the Bogor Botanical Gardens and associated with rapidly climbing host trees, covering tree branches and twigs, and reducing the photosynthetic activity of host trees. *Dioscorea bulbifera* grows rapidly in the Bogor Botanical Gardens, including at the Lauraceae Collection Block, and detrimental to the trees this species grows on. *Dioscorea bulbifera* is a creeping plant and has 2 types of tubers, namely aerial tubers and ground tubers. These air bulbs, when they fall to the ground, will grow and become new individuals.

Elephantopus scaber is a member of the Asteraceae family with a high level of dominance and classified as an invasive plant that can grow in various types of soil, including disturbed soil, and is resistant to drought conditions (Solikin, 2012). *Elephantopus scaber* can invade grasslands, roadsides, rice field embankments, forest boundaries, fallow land, and can grow in soil with acidic pH (Iqbar et al., 2017). This plant is known as a weed that causes problems in agricultural areas because it can compete with cultivated plants for nutrients and water (Rizal et al., 2022).

Invasive undergrowth that has a clustered distribution pattern is *Epipremnum pinnatum*, *Cyanthillium cinereum*, *Elephantopus scaber*, *Mikania micrantha*, *Synedrella nodiflora*, and *Dioscorea bulbifera* with a Morisita Index of 1.03–1.66 (Table 2). The clustered distribution pattern is a distribution pattern that commonly occurs in nature because environmental conditions in nature are generally not uniform (Indriyanto, 2019). This clustered distribution pattern occurs when plants live and grow by utilizing the same natural resources (Abywijaya et al., 2014), occurs because of the natural way of regeneration which tends to be clustered (Indriyanto, 2019), and because the seeds are spread along with the feces of animals animal that eat the fruit or seeds (Indriyanto & Indriyanto, 2023[b]). Plants whose seeds fall near their parents tend to live in groups and depend on each other, resulting in a clustered distribution pattern (Wahidah et al., 2015). Besides that, climate and nutritional conditions are environmental factors that also play a role in shaping plant distribution patterns in nature (Nopiyanti dan Riastuti, 2019). The availability of sufficient nutrients around the parent plant influences seed production and tends to form a clustered distribution pattern (Wahidah et al., 2015).

Invasive undergrowth that has a uniform distribution pattern is *Asystasia intrusa*, *Syngonium podophyllum*, *Ageratum conyzoides*, and *Spermacoce alata* with a Moricita Index of 0.92–0.98. A uniform distribution pattern occurs when environmental conditions are fairly uniform throughout the area and there is strong competition between individual members of the plant population. Strong competition will encourage the division of space between individuals, thus forming a uniform distribution pattern (Indriyanto, 2019).

Invasive undergrowth that has a uniform distribution pattern is *Asystasia intrusa*, *Syngonium podophyllum*, *Ageratum conyzoides*, and *Spermacoce alata* with a Moricita Index of 0.92–0.98. A uniform distribution pattern occurs when environmental conditions are fairly uniform throughout the area and there is strong competition between individual members of the plant population. Strong competition will encourage the division of space between individuals, thus forming a uniform distribution pattern (Indriyanto, 2019; Sulistiyowati et al., 2021). Haruna et al., (2022) also stated that uniform distribution patterns can occur due to competition between interacting individuals, such as competition for the same nutrients or space, thus uniform distribution occurs because there are important limiting factors and influence each other.

Environmental conditions at the Lauraceae Collection Block area where invasive undergrowth is found with a uniform distribution pattern, namely in a relatively uniform environment such as soil pH that is slightly acidic to neutral with a value of 5.6–7.0, soil moisture from medium to high with a value of 60%–90%, intensity of solar radiation from medium to high with a value of 6,910 lux–19,330 lux, indicating that these plants prefer to grow in places with sufficient solar radiation and uniform shade, amounting to 54%–81%. Uniformity in environmental factors creates environmental conditions that support to plant growth and uniform distribution (Wahyuni et al., 2017). The interaction of environmental factors and plants used simultaneously can create suitable conditions for these plants to grow and be distributed uniformly (Syahrial et al., 2020).

IV. CONCLUDING REMARK

Conclusion

At the Lauraceae Collection Block of the Bogor Botanical Gardens, 10 species of invasive undergrowth were found belonging to 5 families. The most dominant invasive undergrowth is *Dioscorea bulbifera* and *Elephantopus scaber*. The distribution pattern of invasive undergrowth consists of clumped distribution pattern of 6 species of plants and uniform distribution pattern of 4 species of plants.

Recommendation

Further research is needed regarding the analysis of the negative impacts of the existence of invasive undergrowth at the Bogor Botanical Gardens. In addition, it is necessary to carry out regular monitoring of the most dominant invasive undergrowth, so that population control can be carried out effectively.

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