



Inventory of Weeds in Mexican Park, Bogor Botanical Garden

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ABSTRACT

The Bogor Botanical Gardens' Mexican Park presents various dry-climate plants useful for recreation and learning. The presence of weeds in the collection site would have a negative impact because they can inhibit the growth of the collection plants. This study examined the diversity of weeds in the Mexican Park, Bogor Botanical Gardens. This descriptive study took place in the Bogor Botanical Gardens, specifically in the Mexican Park, and weed identification was carried out at the National Research and Innovation Agency. The weed data obtained was then analyzed descriptively through a literature study. The results showed that there were 52 weed species from 28 families. Most species came from the *Asteraceae* and *Araceae* families. The block that had the most weeds was Block II.O.IV, with a total of 15 weed species. The species that were often found in each area of the Mexican Garden Collection include *Euphorbia graminea* Jacq., *Euphorbia heterophylla* L., *Calliandra calothyrsus* Meisn, *Coleus monostachyus* (P. Beauv.) AJ Paton, *Cecropia peltata* L., and *Cissus verticillata* subsp. *verticillata*.

Keywords: Inventory, Weeds, Mexican Park, Bogor Botanical Garden

INTRODUCTION

The Bogor Botanical Garden is a plant conservation area with various collections to preserve plants, research facilities, education, tourism, and environmental service providers. The Garden, which serves as a conservation area, has a variety of plant species with 13,912 specimens from 213 families and 1,248 genera and holds a complete collection of plants (Nabila *et al.* 2021). One of the parks in the Garden is the Mexican Park, which provides a variety of dry-climate plant species that are made to resemble their natural habitat with arid conditions. The arid-climate plants that grow in Mexican Park are influenced by abiotic factors and are known to have a soil pH of 6.5–7, an air temperature of 34–37°C, an air humidity of 46.5–52.3%RH, and an adequate light intensity of about 266.9–1545.6 rcol (Salamah *et al.* 2023).

Weeds are often called nuisance plants and can grow in the wrong or unwanted places (out of place) (Hardjosuwarno 2008). Weed inventory can help understand an area's species composition, distribution,

and ecology (Widyatmoko 2019). This is important because, apart from being a nuisance plant, some weeds have economic value, such as potential as food, animal feed, or traditional medicine (Yuliana & Ami 2020). In addition, weeds can also improve the soil's physical and chemical properties, increase land productivity, and function as biofilters or pest-trap plants (Simatupang *et al.* 2015). Thus, weed inventory helps in agroecosystem management and conservation strategies, especially in countries with high biodiversity, such as Indonesia (Widyatmoko 2019).

Weed can cause biodiversity shrinkage because they can displace native plant species and disrupt the balance of ecosystems (Candraningtyas *et al.* 2023). Generally, weeds will grow competitively and aggressively in abundance, damaging and inhibiting surrounding plants (Mokoginta *et al.* 2021). The open conditions of the Mexican Park can allow weed species to grow quickly. Weeds can take the same food source as the surrounding plants, affecting the development and growth of dry-climate plant collections in the Park. Therefore, this study aimed to inventory weeds growing in the Mexican Park of the Bogor Botanical Garden.

METHODS

Research Location

The study was carried out in the Mexican Park of the Bogor Botanical Garden (Figure 1). The plants were

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identified at the National Research and Innovation Agency on Jl. Otto Iskandardinata, Paedang, Central Bogor District, Bogor City, West Java. The exact location of the research was at the coordinates LS 6°36'07.6"S, E 106°48'01.4". The observation was carried out throughout July 2023.

Data Collecting

This study was performed using cruise methods, such as walking through each plot of block (Vak) collection in the Park, which were 10 blocks, starting from Block II.O.I to II.O.X. Weeds found in each block collection were documented using cameras and recorded. In this area, weeds refer to all plants that grow in the Mexican park except for the dry-climate plants that occupy the garden.

Plant Identification

The weeds were identified by analyzing morphological characteristics starting from roots, stems,

leaves, and flowers. Identification was done using *the Plants of the World Online* (<https://powo.science.kew.org/>), *Flora of Java (Spermatophytes only)*, and *atlas of 220 Weeds of Sugarcane Fields in Java Guidelines*. The weed data was then processed, grouped, and presented in tables and figures. In addition to making direct observations, secondary information in this study was obtained through literature studies relevant to the research's focus. The data was then analyzed using a descriptive analysis method.

RESULTS AND DISCUSSION

The Bogor Botanical Garden's Mexican Park has 10 blocks of various collections of dry-climate plants overgrown with weeds (Figure 2). The collection block consists of Block II.O.1, II.O.II, II.O.III, II.O.IV, II.O.V,

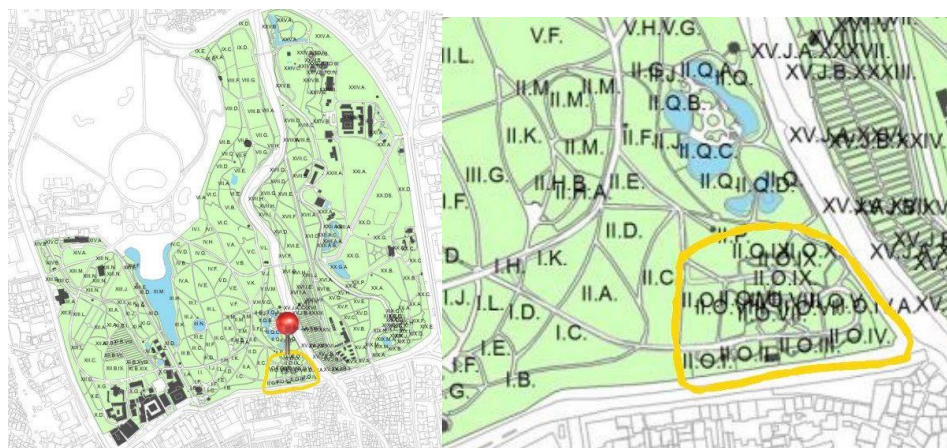


Figure 1 Observed locations of Block II.O.I–II.O.X in the Mexican Park, Bogor Botanical Garden (Ariati *et al.* 2019).

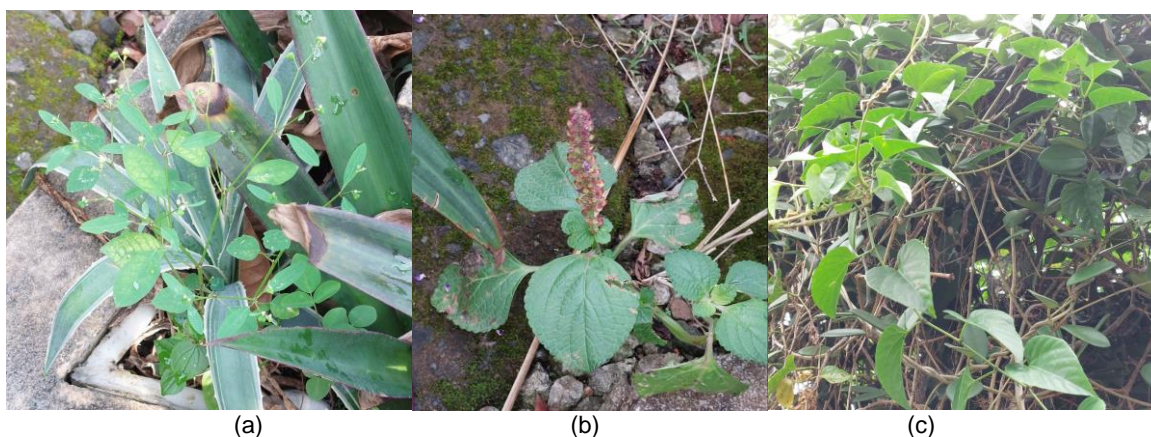


Figure 2 Some weeds in the Mexican Park, (a) *Euphorbia graminea* Jacq, (b) *Coleus monostachyus* (P. Beauv.) AJ Paton, and (c) *Cissus verticillata* subsp. *Verticillata*.

II.O.VI, II.O.VII, II.O.VIII, II.O.IX, and II.O.X. The results of the inventory showed that there were 52 species of weeds consisting of 28 families. The most common weed

species found in Mexican Park were species from the Asteraceae (6 species) and Araceae (5 species) (Table 1).

Table 1 Weeds in the Mexican Park of the Bogor Botanical Garden

Family	Species
Araceae	<i>Syngonium podophyllum</i> Schott* <i>Epipremnum pinnatum</i> (L.) Engl.* <i>Xanthosoma sagittifolium</i> (L.) Schott* <i>Caladium bicolor</i> (Aiton) Vent. <i>Leucocasia gigantea</i> (Blume) Schott
Moraceae	<i>Ficus septica</i> Hook. ex Miq <i>Ficus fistulosa</i> f. <i>benguetensis</i> (Merr.) TS Liu & JCLiao <i>Ficus hispida</i> var. <i>hispida</i> L.f <i>Ficus fulva</i> Elmer
Euphorbiaceae	<i>Acalypha siamensis</i> Oliv. ex Gage* <i>Euphorbia hirta</i> L. <i>Euphorbia graminea</i> Jacq. <i>Euphorbia heterophylla</i> L.
Oxalidaceae	<i>Oxalis barrelieri</i> L. <i>Biotyphum reinwardtii</i> <i>Oxalis corniculata</i> L.
Acanthaceae	<i>Ruellia tuberosa</i> L. <i>Asystasia gangetica</i> (L.) subsp. <i>micrantha</i> (Nees) <i>Fittonia albivenis</i> (Lindl. ex Veitch) Brummitt <i>Pseuderanthemum variabile</i> (R. Br.) Radlk. <i>Calliandra calothyrsus</i> Meisn.*
Fabaceae	<i>Crassocephalum crepidioides</i> (Benth.) S Moore
Asteraceae	<i>Praxelis clematidea</i> (Hieron. ex Kuntze) RM King & H Rob <i>Synedrella nodiflora</i> (L.) Gaertn <i>Sonchus arvensis</i> L. <i>Ageratum conyzoides</i> L.* <i>Conyza sumatrensis</i> <i>Cleome ruidosperma</i> DC. <i>Coleus monostachyus</i> (P. Beauv.) AJ Paton
Cleomaceae	<i>Cecropia peltata</i> L.
Lamiaceae	<i>Cecropia polystachya</i> Trecul*
Urticaceae	<i>Boehmeria cylindrica</i> (L.) Sw. <i>Bridelia tomentosa</i> Blume* <i>Phyllanthus reticulatus</i> Poir* <i>Spermocoe alata</i> Aubl. <i>Amaranthus spinosus</i> L. <i>Passiflora suberosa</i> L.* <i>Cissus verticillata</i> subsp. <i>verticillata</i> <i>Spigelia anthelmia</i> L. <i>Melothria pendula</i> L. <i>Impatiens walleriana</i> Hook f. <i>Solanum diphyllum</i> L. <i>Peperomia pellucida</i> (L.) Kunth* <i>Hydrocotyle sibthorpioides</i> Lam <i>Psidium guajava</i> L.* <i>Caesalpinia pulcherima</i> (L.) Sw.* <i>Ipomea obscura</i> (L.) Ker Gawl. <i>Ipomoea quamoclit</i> L. <i>Centrosema pubescens</i> Benth. <i>Ceiba pentandra</i> (L.) Gaertn* <i>Mimusops elengi</i> L. <i>Commelina benghalensis</i> L.

Remarks: * species which is also a part of the KRB collection.

Based on Nur & Chairul (2023) study, most of the *Asteraceae* family are weeds with invasive properties that can dominate a region. The *Asteraceae* adapts well in its environment and reproduces through its seeds. Meanwhile, plants of the *Araceae* family are often known for their abundant diversity and can grow quickly in various soil types (Hartanti *et al.* 2020).

Some species that grew include plants that were also a collection in the Bogor Botanical Garden but are categorized as weeds in the Mexican Park because they grow outside their habitat and their existence interferes with the main trees. These weeds are feared to dominate the existing area due to their invasive nature (Firmansyah *et al.* 2020). Weeds are present in unwanted places and impact the production of other plants. According to Harahap *et al.* (2021), weeds can absorb nitrogen and phosphorus even up to twice the absorption capacity of plants.

In this study, the block of the Mexican Park was overgrown with the most weeds, namely Block II.O.IV with a total of 15 weeds, Block II.O.II which was overgrown with 13 weed species, and Block II.O.I had a

total of 11 weed species (Table 2). Looking at the location, Block II.O.IV was more overgrown with weeds because of the favorable light conditions, and in the block, there was more space for the growth of various species of weeds. The process of spreading weeds does not co-occur. In its development, weeds will carry out processes such as introduction, colonization, and dominance (Firmansyah *et al.* 2019).

In this Mexican Park, the most common weed species were found and were found in almost every plot of the block, namely *Euphorbia graminea* Jacq., *Euphorbia heterophylla* L., *Calliandra calothyrsus* Meisn, *Coleus monostachyus* (P. Beauv.) AJ Paton, *Cecropia peltata* L., and *Cissus verticillata* subsp. *verticillata* (Table 3). These weeds had dispersal of seeds that are easy to move because they were carried away by the wind, as well as the reproduction of many seeds so that it can quickly dominate the territory. The ability of these weeds to grow and develop in a variety of environmental conditions can also increase their potential to colonize new areas (Uwalaka 2023).

Table 2 Weeds based on a block in the Mexican Park

Block	Family	Species	
II.O.I	<i>Araceae</i>	<i>Syngonium podophyllum</i> Schott	
	<i>Moraceae</i>	<i>Ficus septica</i> Hook. ex Miq	
	<i>Euphorbiaceae</i>	<i>Acalypha siamensis</i> Oliv. ex Gage	
	<i>Euphorbiaceae</i>	<i>Euphorbia hirta</i> L.	
	<i>Fabaceae</i>	<i>Calliandra calothyrsus</i> Meisn.	
	<i>Asteraceae</i>	<i>Crassocephalum crepidioides</i> (Benth.) S Moore	
	<i>Asteraceae</i>	<i>Praxelis clematidea</i> (Hieron. ex Kuntze) RM King & H Rob	
	<i>Cleomaceae</i>	<i>Cleome rutidosperma</i> DC.	
	<i>Lamiaceae</i>	<i>Coleus monostachyus</i> (P. Beauv.) AJ Paton	
	<i>Urticaceae</i>	<i>Cecropia peltata</i> L.	
	<i>Papilionaceae</i>	<i>Centrosema pubescens</i> Benth.	
	II.O.II	<i>Araceae</i>	<i>Epipremnum pinnatum</i> (L.) Engl.
		<i>Araceae</i>	<i>Leucocasia gigantea</i> (Blume) Schott
		<i>Moraceae</i>	<i>Ficus fistulosa</i> f. <i>benguensis</i> (Merr.) TS Liu & JC Liao
		<i>Euphorbiaceae</i>	<i>Euphorbia graminea</i> Jacq.
<i>Acanthaceae</i>		<i>Fittonia albivenis</i> (Lindl. ex Veitch) Brummitt	
<i>Fabaceae</i>		<i>Calliandra calothyrsus</i> Meisn.	
<i>Lamiaceae</i>		<i>Coleus monostachyus</i> (P. Beauv.) AJ Paton	
<i>Urticaceae</i>		<i>Cecropia polystachya</i> Trecul	
<i>Urticaceae</i>		<i>Cecropia peltata</i> L.	
<i>Phyllanthaceae</i>		<i>Bridelia tomentosa</i> Blume	
<i>Vitaceae</i>		<i>Cissus verticillata</i> subsp. <i>verticillata</i>	
<i>Malvaceae</i>		<i>Ceiba pentandra</i> (L.) Gaertn	
<i>Sapotaceae</i>		<i>Mimusops elengi</i> L.	
II.O.III	<i>Euphorbiaceae</i>	<i>Euphorbia graminea</i> Jacq.	
	<i>Oxalidaceae</i>	<i>Oxalis barrelieri</i> L.	
	<i>Acanthaceae</i>	<i>Pseuderanthemum variabile</i> (R. Br.) Radlk.	
	<i>Acanthaceae</i>	<i>Asystasia gangetica</i> (L.) subsp. <i>micrantha</i> (Nees)	
	<i>Rubiaceae</i>	<i>Spermacoce alata</i> Aubl.	
	<i>Amaranthaceae</i>	<i>Amaranthus spinosus</i> L.	
	<i>Passifloraceae</i>	<i>Passiflora suberosa</i> L.	
	<i>Vitaceae</i>	<i>Cissus verticillata</i> subsp. <i>verticillata</i>	
	<i>Malvaceae</i>	<i>Ceiba pentandra</i> (L.) Gaertn	

Table 2 Weeds based on a block in the Mexican Park (Advanced)

Block	Family	Species
II.O.IV	Araceae	<i>Syngonium podophyllum</i> Schott
	Araceae	<i>Xanthosoma sagittifolium</i> (L.) Schott
	Oxalidaceae	<i>Oxalis barrelieri</i> L.
	Acanthaceae	<i>Asystasia gangetica</i> (L.) subsp. <i>micrantha</i> (Nees)
	Acanthaceae	<i>Pseuderanthemum variabile</i> (R. Br.) Radlk
	Fabaceae	<i>Calliandra calothyrsus</i> Meisn.
	Laminaceae	<i>Coleus monostachyus</i> (P. Beauv.) AJ Paton
	Urticaceae	<i>Cecropia peltata</i> L.
	Urticaceae	<i>Boehmeria cylindrica</i> (L.) Sw.
	Rubiaceae	<i>Cecropia polystachya</i> Trecul
	Commelinaceae	<i>Spermacoe alata</i> Aubl.
	Loganiaceae	<i>Commelina benghalensis</i> L.
	Cucurbitaceae	<i>Spigelia anthelmia</i> L.
	Balsaminaceae	<i>Melothria pendula</i> L.
	Balsaminaceae	<i>Impatiens walleriana</i> Hook f.
	II.O.V	Moraceae
Oxalidaceae		<i>Oxalis corniculata</i> L.
Fabaceae		<i>Calliandra calothyrsus</i> Meisn.
Asteraceae		<i>Sonchus arvensis</i> L.
Asteraceae		<i>Ageratum conyzoides</i> L.
Cleomaceae		<i>Cleome rutidosperma</i> DC.
Lamiaceae		<i>Coleus monostachyus</i> (P. Beauv.) AJ Paton
Solanaceae		<i>Solanum diphyllum</i> L.
Piperaceae		<i>Peperomia pellucida</i> L.
II.O.VI		Moraceae
	Moraceae	<i>Ficus fistulosa</i> f. <i>benguetensis</i> (Merr.) TS Liu & JC Liao
	Euphorbiaceae	<i>Euphorbia graminea</i> Jacq.
	Asteraceae	<i>Praxelis clematidea</i> (Hieron. ex Kuntze) RM King & H Rob
	Asteraceae	<i>Cissus verticillata</i> subsp. <i>verticillata</i>
II.O.VII	Moraceae	<i>Ficus hispida</i> var. <i>hispida</i> L.f
	Euphorbiaceae	<i>Euphorbia heterophylla</i> L., Sp. Pl.
	Euphorbiaceae	<i>Euphorbia graminea</i> Jacq.
	Passifloraceae	<i>Passiflora suberosa</i> L.
	Vitaceae	<i>Cissus verticillata</i> subsp. <i>verticillata</i>
II.O.VIII	Oxalidaceae	<i>Hydrocotyle sibthorpioides</i> Lam
	Araceae	<i>Leucocasia gigantea</i> (Blume) Schott
	Moraceae	<i>Ficus fulva</i> Elmer
	Euphorbiaceae	<i>Euphorbia heterophylla</i> L.
	Myrtaceae	<i>Psidium guajava</i> L.
II.O.IX	Convolvulaceae	<i>Ipomoea quamoclit</i> L
	Euphorbiaceae	<i>Euphorbia heterophylla</i> L., Sp. Pl.
	Acanthaceae	<i>Ruellia tuberosa humilis</i> M.Gómez
	Cleomaceae	<i>Cleome rutidosperma</i> DC.
	Urticaceae	<i>Cecropia peltata</i> L.
II.O.X	Vitaceae	<i>Cissus verticillata</i> subsp. <i>verticillata</i>
	Cucurbitaceae	<i>Melothria pendula</i> L.
	Araceae	<i>Xanthosoma sagittifolium</i> (L.) Schott
	Araceae	<i>Caladium bicolor</i> (Aiton) Vent.
	Euphorbiaceae	<i>Euphorbia heterophylla</i> L.
	Acanthaceae	<i>Praxelis clematidea</i> (Hieron. ex Kuntze) RM King & H Rob
	Acanthaceae	<i>Conyza sumantresis</i>
	Vitaceae	<i>Cissus verticillata</i> subsp. <i>verticillata</i>
	Caesalpinaceae	<i>Caesalpinia pulcherima</i> (L.) Sw.
	Loganiaceae	<i>Spigelia anthelmia</i> L.
Convolvulaceae	<i>Ipomea obscura</i> (L.) Ker Gawl.	

Euphorbiaceae is one of the most prominent plant families, consisting of 300 genera and more than 7500 species (Elshamy *et al.* 2019). *Euphorbia graminea* Jacq. and *E. heterophylla* L. were widely found in almost every

block of the Mexican Park Collection. *E. graminea* Jacq. is native to Southern Mexico and has been naturalized outside its distribution area and has been recorded as a new record of Euphorbiaceae plants on the island of Java

Table 3 The most abundant weed species found in each block in the Mexican Park

Species	Vak II.O...
<i>Euphorbia graminea</i> Jacq.	I, II, III, VI, VII, IX
<i>Euphorbia heterophylla</i> L	VII, VIII, IX, X
<i>Calliandra calothyrsus</i> Meisn	I, II, IV, V
<i>Coleus monostachyus</i> (P. Beauv.) AJ Paton	I, II, IV, V
<i>Cecropia peltata</i> L.	I, II, IV, IX
<i>Cissus verticillata</i> subsp. <i>verticillata</i>	II, III, VI, VII, IX, X

Note: Vak II.O...= refers to the block collection (Vak) in the Mexican Garden consisting of 10 vak, starting from II.O.I to II.O.X. Writing 'Vak II.O....' with the dots refers to sections I to X. For example, Vak II.O.I, II.O.II, II.O.III, and so on.

(Irsyam *et al.* 2019). *E. graminea* Jacq. has the potential to multiply and spread rapidly so that it can be a threat to the main plants (Aigbokhan & Ekutu 2012).

E. graminea Jacq. is a shrub with a height of about 15–30 cm or even higher, branching from the base, and the dichotomy is distal branching (Bolaji *et al.* 2019). The leaves are alternate, i.e., the leaves that go to the base of the plant are oval or oval with some distance, while the leaves towards the shoots of the plant are elliptical to linear (Olopete & Ugboogu 2019). On the other hand, *E. graminea* Jacq. can be used to treat skin infections, ulcers, cancers, tumors, and warts (Bolaji *et al.* 2019).

E. heterophylla L. is a shrub with a height of 0.5–1 m. The leaves are oval with pointed tips, curved bases, and flat leaf edges. *E. heterophylla* L. is commonly used to treat constipation, bronchitis, and asthma. The metabolite content of this weed also has antimicrobial activity that functions for wound healing (Jafri 2019). Kone *et al.* (2020) revealed that this species can be used to treat infectious diseases of *Pseudomonas aeruginosa* and *Candida albicans*.

Calliandra calothyrsus Meisn is a plant that originated in Mexico and Central America, then entered Indonesia and spread throughout the country, starting from Java Island (Danu *et al.* 2020). *C. calothyrsus* Meisn is known to excrete allelopathy based on Kaboneka *et al.* (2020) research, which tested the allelopathic compound *C. calothyrsus* Meisn against the growth of *Phaseolus vulgaris* L. and *Zea mays* L. Mustabi & Prahesti (2019) reported that *C. calothyrsus* Meisn can be an alternative treatment for worms.

Coleus monostachyus (P. Beauv.) AJ Paton is a plant from the *Lamiaceae* family that is native to tropical Africa (Mustaqim *et al.* 2022). Its existence has been naturalized and reported from Java by Irsyam & Mountara (2018). *C. monostachyus* (P. Beauv.) AJ Paton has an elliptical leaf shape with acuminate leaf apex, opposite leaves, zigomorf flower shapes, terminal inflorescences, and erect plants with succulent stems. In tropical Africa, *C. monostachyus* (P. Beauv.) AJ Paton is commonly used as a vegetable and is recommended as a remedy for fever, cough, pain, headache, and seizures (Prasad *et al.* 2022).

Cecropia peltata L. is a plant native to Southern Mexico. In Indonesia, this plant was first introduced in the Bogor Botanical Garden. Now *C. peltata* L. is reported to have been widely naturalized on the island of Java. It is an invasive weed, as it can quickly invade an area by producing many seeds of about 2725 seeds (Putri *et al.* 2021). The invasion that is often carried out by *C. peltata* L. is to replace the main plant species and reduce the richness of certain species in the surrounding area (Yudaputra & Hutabarat 2021).

Cissus verticillata subsp. *verticillata* is reportedly originated in Mexico (Martinez *et al.* 2020). It has the shape of a shrub with fibrous roots, growing attached to the host, cylindrical stems, ovoid leaves with flat edges, leaf bases, and tapered leaf tips. *C. verticillata* subsp. *verticillata* is a weed in the Mexican Park. Since it can cover the main plant with its growth wrapped around the plant on which it rides, it can have a negative impact because it inhibits growth. *C. verticillata* subsp. *verticillata* has been studied to help reduce excessive fat accumulation in obese bodies (Kim *et al.* 2021).

The high or low level of species diversity in an area depends on the large number of individuals growing in the area and their rapid reproduction rate. Because of this, the existence of weeds in the Mexican Park is disturbing, so weeds must be controlled. This effort needs to be made so that the development and growth of the main plants of dry-Park plants that do occupy the Mexican Garden can be optimally maintained.

CONCLUSION

The weeds found in the Mexican Park of the Bogor Botanical Garden amounted to 52 species of 28 families. The most numerous weed species found in the Park come from the families *Asteraceae* (6 species) and *Araceae* (5 species). The block with the most weeds is found in Block II.O.IV with 15 weed species. Species that are often found in every block of the Mexican Garden Collection were *Euphorbia graminea* Jacq., *Euphorbia heterophylla* L., *Calliandra calothyrsus* Meisn, *Coleus monostachyus* (P. Beauv.) AJ Paton, *Cecropia peltata* L.,

and *Cissus verticillata* subsp. *verticillata*. The blocks, with much space and favorable light conditions, had a greater chance of being overgrown by weeds.

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