

Flora of Seed Plants in Jinyin Lake National Wetland Park

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Abstract. Using line method and typical sample method, the plant resources of the Jinyin Lake National Wetland Park were investigated in detail. There were 62 families, 113 genera and 135 species of seed plants. 4 families and more families were the dominant families of seed plants in this area. 1 genera were the main reasons for the diversity of seed plants in this area. The 62 families can be divided into 9 areal types and 5 forms, of which tropical families accounted for 61.36% of the total number of non-cosmopolitan families. The 113 genera can be divided into 13 distribution types and 2 variants, of which the temperate distribution is 61.39% of the non-cosmopolitan genus. The 135 species can be divided into 7 distribution types, mainly in the subtropical monsoon climate area, accounting for 45.19% of the total species. The research results provide basic information and scientific basis for the protection and management of plant diversity resources in the Jinyin Lake National Wetland Park.

1 Preface

Wetland is the most important ecosystem on earth. The primary task of wetland biodiversity is plant diversity. Flora is the result of the development and evolution of plants under certain geographical and historical conditions. It is of great significance for regional plant composition and plant species diversity. Jinyin Lake National Wetland Park is the largest urban wetland park in Wuhan. It provides a variety of habitats for plants, animals and microorganisms in the park. It plays an important role in biodiversity protection, regional environment regulation and urban ecology improvement [1].

In recent years, there were few studies on Jinyin Lake National Wetland Park, and there was a lack of research on the flora diversity. The research team conducted a detailed investigation and floristic diversity research on the plant resources, aiming to provide basic information and scientific basis for the protection and management of plant diversity resources in Jinyin Lake National Wetland Park.

2 Research area and methods

2.1 Overview of research area

Jinyin Lake National Wetland Park built in 2001 year. It is the first national urban wetland park in Hubei Province. It is located in Jinshan Avenue, Dongxihu District, Wuhan City, Hubei Province. It covers an area of 77 hectare, including 17 hectare of peninsula land and 60 hectare of lake. The wetland area accounts for 91% of the wetland park. This is a natural ecological country wetland park

dominated by aquatic plants. It is also the experimental base for the introduction and planting of aquatic plants in Wuhan Garden Research Institute.

At present, there were 135 species of plants in the park. The wetland park has a subtropical monsoon (humid) climate with an annual average temperature of 17.6°C, annual precipitation of 1300 mm. The annual frost free period is 240 days and the total sunshine hours is 2000 hours. The soil can be divided into 8 soil types, 17 subclasses, 56 soil genera and 303 soil species, of which paddy soil accounts for 45.23%, yellow brown soil 24.77%, fluvo aquic soil 16.97%, red soil 11.22%, etc [2-3].

2.2 Survey methods

The plant resources of Jinyin Lake National Wetland Park were investigated in detail by using route method and typical sample method. Multiple investigation lines cover the whole park, recording all plant species on the line, and selecting the sections with rich vegetation to conduct detailed investigation with typical sample method [4-6].

In the process of investigation, specimens of uncertain and important plants were collected, morphological and habitat characteristics were recorded, and photos were taken for later identification. Through the investigation data processing and specimen identification. Based on the related research data of Jinyin Lake National Wetland Park, the final plant list was determined and the floristic diversity of seed plants were analyzed [7-9].

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3 Research results and analysis

3.1 Basic composition of flora

There were 135 species of seed plants in Jinyin Lake National Wetland Park, belonging to 62 families and 113 genera. The seed plants in this area accounted for 31% of the total families, 8.34% of the total genera and 2.38% of the total species. It accounted for 17.37% of the total families, 3.51% of the total genera and 0.47% of the total species of seed plants in China. As the terrestrial area of the reserve is only 17 hectare, the plant species were relatively rich.

3.2 Composition of floristic families

There were 62 families of seed plants in Jinyin Lake National Wetland Park. Among them, only 1 family contained more than 10 species, including 14 genera and 18 species, accounting for 13.33% of the total families. There were 5 families with 4-9 species, accounting for 7.94% of the total families, including 26 genera and 33 species. There were 22 families with 2-3 species, accounting for 34.92% of the total families, including 50 species of 39 genera. There were 34 families with only one species, accounting for 55.56% of the total families, including 34 genera and 34 species.

It can be seen that although there were only 6 families with 4 or more species, accounting for 9.52% of the total number of families, the number of species accounts for 37.78% of the total number of species, more than one third of the total number of species, which were the dominant families in the flora. They were Rosaceae, Gramineae, Leguminosae, Oleaceae, Magnoliaceae and Liliaceae.

3.3 Composition of floristic genera

There were 113 genera of seed plants in Jinyin Lake National Wetland Park. They were *Magnolia*, *Acer* and *Ligustrum*, accounting for 2.52% of the total genera. They contained 9 species, accounting for 6.67% of the total. There were 106 genera with only one species, accounting for 89.08% of the total genera and 78.52% of the total species. Such as *Elaeocarpus*, *Liriodendron*, *Phyllostachys*, *Cynodon*, *Broussonetia*, *Pittosporum*, *Saxifraga*, *Zanthoxylum*.

3.4 Distribution types of floristic families

The 62 families of seed plants in Jinyin Lake National Wetland Park can be divided into 9 areal types and 5 varieties (Table1). There were 18 cosmopolitan families, accounting for 29.03% of the total families. The families with more species were Rosaceae, Oleaceae, Gramineae, Leguminosae, Rubiaceae, Saxifragaceae, Lythraceae, etc. Some families are mainly temperate or most of them are distributed in temperate zone, and have some temperate component properties.

There were 27 families in tropical distribution (type 2-7, Table2), accounting for 43.55% of the total families and 61.36% of non world distribution families. Among them,

20 families (74.07%) were dominant, such as Euphorbiaceae, Apocynaceae, Anacardiaceae, Guttiferaceae and Malvaceae.

There were 15 families in temperate distribution (8-14 types), accounting for 24.19% of the total families and 34.09% of the non world distribution families. Among them, 13 families (86.67%) were dominant, such as Caprifoliaceae, Pinaceae, Liliaceae, Fagaceae, Aceraceae and Salicaceae.

One family was endemic to China, accounting for 1.61% of the total families, and 2.27% of the non world families. It is Ginkgoaceae.

In addition, there was one family (16 types) which is not distributed in China. *Araucaria cunninghamii*, an exotic species, was widely used in some parks in Wuhan.

Table1. Distribution types of seed plants families in Jinyin Lake National Wetland Park

| Code | Distribution types | Number of families | Percentage (%) |
|-------|---|--------------------|----------------|
| 1 | Cosmopolitan | 18 | 29.03 |
| 2 | Pantropic | 17 | 27.2 |
| 2-2 | Tropical Asia, Africa & South America disjuncted | 1 | 1.61 |
| 2S | Tropical Asia, Africa & South America disjuncted | 2 | 3.23 |
| 3 | Tropical Asia & Tropical America disjuncted | 3 | 4.84 |
| 4 | Old World Tropics | 2 | 3.23 |
| 5 | Tropical Asia to Tropical Australia | 1 | 1.61 |
| 6d | South Africa (mainly the Cape of Good Hope) disjuncted | 1 | 1.61 |
| 8 | North Temperate | 4 | 6.45 |
| 8-4 | North Temperate & South Temperate disjuncted | 8 | 12.9 |
| 8-5 | Eurasia & Temperate South America disjuncted | 1 | 1.61 |
| 9 | East Asia & North America disjuncted | 2 | 3.23 |
| 15 | Endemic to China | 1 | 1.61 |
| 16 | Australia, New Zealand, New Caledonia, North Kodak New Guinea to the Philippines and Temperate South America disjuncted | 1 | 1.61 |
| Total | | 62 | 100 |

Table2. Tropical distribution of seed plants families in Jinyin Lake National Wetland Park

| Family | Distribution types code | Number of genera | Number of species |
|----------------|-------------------------|------------------|-------------------|
| Cannaceae | 2 | 1 | 1 |
| Flacourtiaceae | 2 | 1 | 1 |
| Euphorbiaceae | 2 | 2 | 2 |
| Apocynaceae | 2 | 2 | 2 |
| Anacardiaceae | 2 | 2 | 2 |
| Theaceae | 2 | 1 | 1 |
| Guttiferaceae | 2 | 1 | 2 |
| Celastraceae | 2 | 1 | 1 |

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|----------------|-----|---|---|
| Sapindaceae | 2 | 1 | 1 |
| Pontederiaceae | 2 | 1 | 1 |
| Meliaceae | 2 | 1 | 1 |
| Rutaceae | 2 | 1 | 1 |
| Lauraceae | 2 | 1 | 1 |
| Marantaceae | 2 | 1 | 1 |
| Bignoniaceae | 2 | 1 | 1 |
| Palmae | 2 | 1 | 1 |
| Malvaceae | 2 | 1 | 2 |
| Iridaceae | 2-2 | 1 | 2 |
| Podocarpaceae | 2s | 1 | 1 |
| Amoryllidaceae | 2s | 2 | 2 |
| Elaeocarpaceae | 3 | 1 | 1 |
| Araliaceae | 3 | 1 | 1 |
| Aquifoliaceae | 3 | 1 | 3 |
| Pittosporaceae | 4 | 1 | 1 |
| Musaceae | 4 | 1 | 1 |
| Cycadaceae | 5 | 1 | 2 |
| Ericaceae | 6d | 1 | 2 |

Table3. Temperate distribution of seed plants families in Jinyin Lake National Wetland Park

| Family | Distribution types code | Number of genera | Number of species |
|----------------|-------------------------|------------------|-------------------|
| Caprifoliaceae | 8 | 1 | 1 |
| Pinaceae | 8 | 1 | 1 |
| Liliaceae | 8 | 4 | 4 |
| Platanaceae | 8 | 1 | 1 |
| Cupressaceae | 8-4 | 2 | 2 |
| Buxaceae | 8-4 | 2 | 2 |
| Hamamelidaceae | 8-4 | 3 | 3 |
| Fagaceae | 8-4 | 1 | 1 |
| Geraniaceae | 8-4 | 1 | 1 |
| Aceraceae | 8-4 | 1 | 3 |
| Cornaceae | 8-4 | 1 | 1 |
| Salicaceae | 8-4 | 1 | 2 |
| Berberidaceae | 8-5 | 3 | 3 |
| Taxodiaceae | 9 | 2 | 2 |
| Magnoliaceae | 9 | 2 | 5 |

3.5 Distribution types of floristic genera

The 113 genera of seed plants in Jinyin Lake National Wetland Park can be divided into 13 areal types and 2 varieties (Table 4). There were 12 cosmopolitan genera, accounting for 10.62% of the total genera, such as *Oxalis*, *Lythrum*, *Pycnostachys*, *Euonymus*, *Geranium*, *Sabina*.

There were 33 genera in tropical distribution (type 2-7), accounting for 29.20% of the total genera and 32.67% of non world distribution genera. The dominant genera were pantropic, accounting for 33.33% of the total

number of tropical genera, such as *Sapium*, *Hibiscus*, *Phragmites*, *Zanthoxylum*, *Xylosm*, *Albizia*, *Taxodium*.

There were 62 genera in temperate distribution (8-14 types), accounting for 54.87% of the total genera and 61.39% of non world distribution genera. The dominant genera were wide distribution and varieties in the north temperate zone, included 20 genera, accounting for 32.26% of the temperate genera, such as *Cedrus*, *Platanus*, *Salix*, *Acer*, *Prunus*, *Rhododendron*, *Iris*.

Three genera were endemic to China, accounting for 2.65% of the total genera, and 2.97% of the non world genera. They were *Koelreuteria*, *Metasequoia* and *Ginkgo*. *Ginkgo biloba* and *Metasequoia glyptostroboides* are known as living fossils. Among them, *Metasequoia glyptostroboides* was selected as city tree by Wuhan City, while *Ginkgo biloba* was selected as city tree by Chengdu City. They have an important position in this area.

Table4. Distribution types of seed plants genera in Jinyin Lake National Wetland Park

| Code | Distribution types | Number of families | Percent age (%) |
|-------|--|--------------------|-----------------|
| 1 | Cosmopolitan | 12 | 10.62 |
| 2 | Pantropic | 11 | 9.73 |
| 3 | Tropical Asia & Tropical America disjuncted | 4 | 3.54 |
| 4 | Old World Tropics | 7 | 6.19 |
| 5 | Tropical Asia to Tropical Australia | 5 | 4.42 |
| 7 | Tropical Asia(Indo-Malesia) | 6 | 5.31 |
| 8 | North Temperate | 19 | 16.81 |
| 8-4 | North Temperate & South Temperate disjuncted | 1 | 0.88 |
| 9 | East Asia & North America disjuncted | 14 | 12.39 |
| 10 | Old World Temperate | 14 | 12.39 |
| 11 | Temperate Asia | 1 | 0.88 |
| 12 | Mediterranea, West Asia to Central Asia | 2 | 1.77 |
| 14 | East Asia | 10 | 8.85 |
| 14SJ | Sino-Japan | 4 | 3.54 |
| 15 | Endemic to China | 3 | 2.65 |
| Total | | 113 | 100 |

3.6 Distribution types of floristic species

There were 135 species of seed plants in Jinyin Lake National Wetland Park, which can be divided into 7 distribution types. The subtropical monsoon climate species accounted for 45.19% of the total species. In addition, due to the introduction of plants in the park, there were 3 species of coniferous forest in frigid zone and 1 species of plateau mountain. Although they do not belong to the origin of central China, they had been fully adapted to the local climate due to long-term cultivation and geographical evolution.

There were 27 national distribution species, accounting for 20%, such as *Koelreuteria paniculata*, *Prunus blireana*, *Amygdalus persica* var. *Persica*, *Melia azedarach*, *Photinia serrulata*, *Sabina chinensis*, *Buxus sinica*, *Nerium indicum*, *Punica granatum*. There were 19

tropical monsoon climate species, accounting for 14.07%, such as *Trachycarpus fortunei*, *Liquidambar formosana*, *Sophora japonica*, *Albizia julibrissin*, *Cycas revoluta*, *Jasminum mesnyi*. There were 61 subtropical monsoon climate species, accounting for 45.19%, such as *Cinnamomum camphora*, *Chaenomeles sinensis*, *Pyrus calleryana*, *Malus halliana*, *Platanus acerifolia*, *Salix babylonica*. There were 3 temperate monsoon climate species, accounting for 2.22%. They were *Amygdalus persica*, *Prunus cerasifera* and *Cerasus serrulata*. There were 21 temperate continental climate species, accounting for 15.56%, such as *Sophora japonica*, *Ligustrum lucidum*, *Ilex cornuta*, *Acer palmatum* var. *Palmatum*, *Ligustrum japonicum*, *Acer palmatum*. *Cedrus deodara*, *Araucaria cunninghamii* and *Podocarpus macrophyllus* were coniferous forest in frigid zone species, accounting for 2.22%. *Populus euphratica* was plateau mountain species, accounting for 0.74%.

4 Conclusion and discussion

There were 135 species of seed plants belonging to 113 genera and 62 families in Jinyin Lake National Wetland Park. Herbaceous plants and arbors accounted for a large proportion, and shrub species were relatively scarce. Families with four or more species were the dominant families in the flora, and genera with one species were the main reasons for the genus diversity of seed plants.

The 62 families of seed plants can be divided into 9 areal types and 5 varieties. The tropical families accounted for 61.36% of the non world families, and were dominant in the flora, with the pantropic distribution and its forms being the main ones. Temperate families accounted for 34.09% of the total number of non world families, and were mainly distributed in the north temperate zone. It was indicated that the floristic family was mainly composed of tropical elements and part of temperate elements.

The 113 genera of seed plants can be divided into 13 areal types and 2 varieties. The tropical genera accounted for 32.67% of the non world genera, and the pantropic type was the main one. The temperate genera accounted for 61.39% of the non world genera, and the north temperate genera were widely distributed and their forms were dominant. It showed that the flora was mainly temperate.

In general, the floristic composition of Jinyin Lake National Wetland Park was diverse, with obvious differentiation of families and genera. The Floristic and geographical characteristics of seed plants families were consistent with the local subtropical monsoon (humid) climate. The floristic characteristics of the genus were quite different from the local climate. This was due to the fact that most of the plant species in the park were artificially introduced and cultivated, resulting in the flora geographical type of the genus contrary to the local climate. It was suggested that native plants should be the main plant species in the future. Do not introduce a large number of alien species, as well as species that do not conform to the local climate characteristics and floristic geographical characteristics. To protect the original plant

germplasm resources and realize the plant species diversity and ecosystem stability.

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