Investigation and Analysis of Vascular Plant Flora in Xuzhou Area

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Abstract. Xuzhou is located in the northwest of Jiangsu Province, at the junction of the four provinces of Sulu, Henan and Anhui. It belongs to a warm temperate and semi-humid climate. Based on the field investigation in Xuzhou area, a total of 1037 species, 595 genera and 144 families of vascular plants were obtained. The flora has certain importance and particularity in Jiangsu area. Based on the analysis of the species diversity of vascular plants and their floristic characteristics and geographical components, it is found that there are a lot of vascular plants in Xuzhou, most of which are distributed in the world and north temperate zone, and the tropical distribution also accounts for a certain proportion, which shows that the flora is mainly the type of transition from tropical to temperate, At the same time, its flora also has some ancient elements.

Keywords: Xuzhou Area, Vascular Flora, Floristic Characteristics

1. Introduction
Plants are an important part of a region's natural ecological environment, and play an important role in improving the human living environment and adjusting the regional ecological balance. At present, researches on plants mostly focus on plant diversity, plant landscape application, and so on, and few studies on flora characteristics.

The formation of flora is the result of long-term differentiation, reproduction, and development of germine, and is closely related to changes and changes in regional natural geographical conditions, paleogeology, and paleoclimate and other aspects [1]. The investigation and analysis of flora is to provide information and basis for the study of plant origin, vegetation evolution, and the relationship between vegetation and geographical environment. It is the basis for the rational use of vegetation resources, the comprehensive ecological benefits of vegetation, and the development of vegetation restoration. Criteria for the reasonableness of plant applications [2,3]. Investigating the composition and nature of flora in a region can understand the structural characteristics of the plant community in
the region, which is beneficial to the use of garden plants and the development and protection of forest plants.

In recent years, Xuzhou area has paid more attention to the importance of plants to the urban ecological environment, and gradually increased the use of plant species in urban greening to expand the urban greening area. This paper investigates the composition and characteristics of flora in Xuzhou area, understands the ecological characteristics and flora characteristics of plants, and provides reference for the rational use of garden plants in Xuzhou area.

Xuzhou is located in the northwest of Jiangsu Province, the southeast of North China Plain, the junction of Jiangsu, Shandong, Henan and Anhui provinces. The east longitude is about 116° 22′～118° 40′ and the north latitude is about 33° 43′～34° 58′. It covers an area of 11258 square kilometers, accounting for 11% of the total area of the province. The terrain is mainly plain, accounting for about 90% of the city's area, belonging to the Huang Huai plain, with an altitude of about 20 to 50 meters, and decreases from northwest to southeast. Hilly land accounts for about 10%. It is the South extension of the low hills in the middle and south of Shandong Province. The climate is a warm temperate semi-humid monsoon climate. The precipitation is uneven in different seasons and varies greatly in different years. The precipitation in spring and summer accounts for 75.4% of the whole year, while that in autumn and winter only accounts for 24.6%. Four distinct seasons, large temperature difference between cold and summer, sufficient light throughout the year, and the rain and heat are in the same period. The annual average temperature is about 13.2 °C～14°C, and the annual average precipitation is about 800mm～930mm. The city's soil is mainly divided into six categories: fluvo-aquic soil, brown soil, paddy soil, brown soil, shajiang black soil, and purple soil. In this area, the impact plain soil is mainly tidal soil, and the zonal soil is brown soil and Cinnamon.

According to the "Flora of Jiangsu Province", Xuzhou is located in the hilly area of the Xuhuai Plain. The zonal forest vegetation is deciduous broad-leaved forest. Due to the flooding of the Yellow River and war, the native forest vegetation has been severely damaged. In addition to a small area of secondary deciduous broad-leaved miscellaneous forest in some areas, most of the vegetation in this area is the side Berlin planted in the original afforestation movement, and a few areas have mixed coniferous and broad-leaved forest. According to the classification standard of vegetation classification system in China vegetation [4], the vegetation types in Xuzhou area can be divided into deciduous broad-leaved forest, coniferous and coniferous and broad-leaved mixed forest.

2. Materials and Methods
Using plant specimen data collected in multiple regions of Xuzhou during 2015-2019, combined with relevant literature data ("Landscape Dendrology "[5], "Garden Flowers"[6] and "Flora of China ", Xuzhou vascular plants were identified, and the number of Xuzhou vascular plant families, genera, and species was determined statistically; Refer to Wu Zhengyi's "distribution type system of world seed plant family"[7],"Chinese Flora and Vegetation Geography" edited by Chen Lingzhi and others[8], and other data, the flora is divided, and the flora of Xuzhou area is divided according to the type of distribution area.

3. Result

3.1 Species Composition of Vascular Plants in Xuzhou
Flora refers to the sum of all plants in a certain area or unit. It is the result of the comprehensive action, development, and evolution of plants under certain natural conditions, especially under the comprehensive conditions of natural history. According to the data collected by the author's investigation (Table 1, Table 2), there are 144 families, 595 genera, and 1037 species of vascular plants in Xuzhou, of which 14 families, 14 genera, and 15 species of ferns, and 130 families of seed plants, 581 genera, 1022 species, gymnosperms 6 families, 19 genera, 34 species, angiosperms 124 families, 562 genera, 988 species. There are 109 families, 325 genera and 565 species of garden plants, and 118 families, 432 genera and 678 species of forest wild plants.
Table 1. Statistics of vascular plants in Xuzhou

| Plant category | Classification level | Family number | Genus number | Species number |
|----------------|----------------------|---------------|--------------|---------------|
| Ferns          |                      | 14            | 14           | 15            |
| Gymnosperms    |                      | 6             | 19           | 34            |
| Angiosperms    |                      | 124           | 562          | 988           |
| **Total**      |                      | 144           | 595          | 1037          |

Among them, there are 4 kinds of big families with more than 50 kinds, which are Gramineae (110 species), Asteraceae (100 species), Rosaceae (74 species), and Legume (63 species). There are 18 (290 species) of 10 to 30 species of middle families. There are 78 families (354 species) of 2 to 10 species, and 44 families (44 species) of single genera. It can be seen that the flora of Xuzhou is the most dominant in Gramineae and Compositeae, followed by Rosaceae, Leguminosae, Liliaceae, Euphorbiaceae, etc.

Table 2. Size order of Xuzhou plant family

| Family name     | Species | account for total number of Xuzhou species /% |
|-----------------|---------|----------------------------------------------|
| ≥50 species (347 species in 4 families) |         |                                               |
| Gramineae       | 110     | 10.61                                        |
| Compositae      | 100     | 9.64                                         |
| Rosaceae        | 74      | 7.14                                         |
| Leguminosae     | 63      | 6.08                                         |
| 11-30 species (290 species in 18 families) |         |                                               |
| Liliaceae       | 27      | 2.60                                         |
| Euphorbiaceae   | 24      | 2.31                                         |
| Labiatae        | 23      | 2.22                                         |
| Oleaceae        | 23      | 2.22                                         |
| Cruciferae      | 18      | 1.74                                         |
| Salicaceae      | 17      | 1.64                                         |
| Caprifoliaceae  | 16      | 1.54                                         |
| Apiaceae        | 15      | 1.45                                         |
| Polygonaceae    | 15      | 1.45                                         |
| Ranunculaceae   | 14      | 1.35                                         |
| Cupressaceae    | 13      | 1.25                                         |
| cucurbitaceae   | 13      | 1.25                                         |
| Caryophyllaceae | 13      | 1.25                                         |
| Scrophulariaceae| 13      | 1.25                                         |
| cyperaceae      | 12      | 1.16                                         |
| Ulmaceae        | 12      | 1.16                                         |
| moraceae        | 11      | 1.06                                         |
| pinaceae        | 11      | 1.06                                         |
| 2-10 species (354 species in 78 families) |         |                                               |
| 1 species (44 species in 44 families) |         |                                               |

3.2 Analysis of Floristic Geographical Components of Flora in Xuzhou
In plant taxonomy, the family of plants is the largest practical natural taxonomic unit and plays an important role in flora research [9]. In order to understand the species and floristic characteristics of all plants in Xuzhou area in detail, please refer to "Landscape Dendrology ", "Garden and Flora", "Chinese Flora" to classify the vascular plants in Xuzhou, and to describe the flora Perform analysis and research separately. Based on the plant survey statistics in Xuzhou, the flora composition of the plant family was analyzed. The number and proportion of plant families included in each flora are shown in Table 3.

Table 3. Distribution types of vascular plants in Xuzhou

| Distribution type                                      | Branch number | Percentage of total branch number (%) |
|--------------------------------------------------------|---------------|--------------------------------------|
| Wide spread worldwide (1)                              | 51            | 35.42%                               |
| Pan-tropical distribution (2)                          | 48            | 33.33%                               |
| Discontinuous distribution in tropical Asia and tropical America (3) | 9             | 6.25%                                |
| Old World Tropical Distribution (4)                    | 4             | 2.78%                                |
| North temperate zone distribution (8)                  | 24            | 16.67%                               |
| Discontinuous distribution in East Asia and North America (9) | 4             | 2.78%                                |
| Temperate distribution in the old world (10)           | 1             | 0.69%                                |
| Mediterranean, Western and Central Asia (12)           | 1             | 0.69%                                |
| Endemic to China (15)                                  | 2             | 1.39%                                |
| Subtotal                                               | 144           | 100.00%                              |

Among the plants in Xuzhou area, the world's most widely used types of plants are the most widely used, with a total of 51 families, accounting for 35.42% of the total, the largest proportion;

There are 61 families of tropical types, accounting for 42.36% of the total. Among them, there are 48 families of pan-tropical distribution types , accounting for 33.33% of the total. Most of these families are distributed in the tropical lands in the east and west hemispheres, and many are introduced and domesticated to the local plantation in southern China; There are 9 families of intermittently distributed plants in tropical Asia and tropical America, accounting for 6.25% of the total. There are 4 families of tropical-type plants in the Old World, accounting for 2.78% of the total; Plants of tropical Asia to tropical Africa distribution types and tropical Asia to tropical Oceania distribution types and tropical Asia distribution types (India, Malaysia) have not been found.

There are 30 families in temperate distribution types, accounting for 20.83% of the total. Among them, there are 24 families of plants in the northern temperate zone, accounting for 16.67% of the total; East Asian and North American intermittently distributed plants of 4 families, accounting for 2.78% of the total; plants in the old world temperate zone only include 1 family of Tamaricaceae Plants; plants of the Mediterranean, West Asia, and Central Asia distribution types include Punicaceae 1 family of plants; However, no plants have been found in temperate Asia, Central Asia and East Asia.

There are 2 types of plants endemic to China, accounting for 1.39% of the total, including ginkgoaceae, Eucommiaceae.

3.3 Analysis of Geographical Components of Flora in Xuzhou
The analysis and research of the plant family can reflect the generality and general composition of the flora, but the origin and distribution area of the plant genera are different. As a true natural taxa, the
The genus is composed of various plant species and has relatively stable classification characteristics [10]. The genera of plants can more accurately reflect the geographical environment differences of various regions, and can better reflect the adaptability of plants to different site environments.

According to the survey, there are 595 genera of vascular plants in Xuzhou. According to the distribution type of Chinese seed plants by Professor Zhengyi Wu, "Chinese Flora", "Chinese Flora and Vegetation Geography", it can be divided into 15 distribution types. The genus included in each distribution type is shown in Table 4.

In Xuzhou area, there are 72 genera of the world's widely distributed plants, accounting for 12.10% of all plant genera. Plants in this distribution area mainly include *Artemisia, Euphorbia, Viola, Phleum*, etc, and they are rich in plant species.

There are 196 genera in tropical distribution, accounting for 32.95% of the total. Among them, there are 101 genera of pan-tropical types, accounting for 16.98% of the total. The main plants include *Euonymus, Celtis, Ilex, Hibiscus*, etc. There are 26 different genera in tropical Asia and tropical America, accounting for 4.37% of the total. The main plants are *Agave, Desmodium, Canna*, etc. There are 27 genera of tropical distribution in the Old World, accounting for 4.54% of the total. The latter are mainly *Cynanchum, Nanandina, and Bambusa*. There are 15 genera in tropical Oceania, accounting for 2.52% of the total, mainly including *Ligustrum, Lagerstroemia, Zoysia* and other species. The distribution types of tropical Asia to tropical Africa are 9 genera, accounting for 1.51% of the total. The main types are *Broussonetia, Miscanthus*, and *Excoecaria*. The distribution types of tropical Asia (India, Malaysia) include Genus, accounting for 3.03% of the total, mainly including *Eriobotrya, Duchesnea, Rhapis*, etc;

There are 306 genera of temperate plants, accounting for 51.43% of the total. Among them, there are 120 genera in the northern temperate zone, accounting for 20.17% of the total. The number of genera of this distribution type is relatively large in each type. Because the geographic and natural environment of the geographic area it covers is similar to that of Xuzhou, the plant types are richer. This distribution type mainly includes *Pinus, Populus, Quercus, Spiraea, Mume*, etc; there are 44 genus discontinuous distribution types in East Asia and North America, accounting for 7.39% of total. *Lespedeza, Mahonia, Magnolia*, etc; 55 types of temperate distribution in the Old World, accounting for 9.24% of the total, mainly include *Pyracantha, Medicago, Roegneria*, etc; temperate Asian distribution types There are 11 genera, accounting for 1.85%. They mainly include *Salix, Gueldenstaedtia, Kalimeris and Eccoilopus*. There are 19 genera in the Mediterranean, West Asia, and Central Asia, accounting for 3.19% of the total. The main types are *Hedera, Punica, Trapal*, and *Rosmarinus*. There are 1 genus of plants distributed in Central Asia, including only *Incarvillea*; 56 types of plants in East Asia, accounting for 9.41% of the total, mainly *Phyllostachys, Liriope, Weigela* and *hosta*.

The geographical characteristics of the endemic distribution types in China are similar to those in the temperate zone. There are 21 genera in this distribution type, accounting for 3.53% of the total, mainly including *Ginkgo, Chaenomeles, Thyrocarpus, Koranreuteria, Pseudolarix*, etc.

Table 4. The proportion of plants belonging to different species

| Distribution type                                      | Number of genera | Percent of total genera (%) |
|--------------------------------------------------------|------------------|----------------------------|
| Wide spread worldwide (1)                              | 72               | 12.10%                     |
| Pan-tropical distribution (2)                          | 101              | 16.98%                     |
| Intermittent distribution of tropical Asia and tropical America (3) | 26               | 4.37%                      |
| Old World Tropical Distribution (4)                   | 27               | 4.54%                      |
| Distribution from tropical Asia to tropical Oceania (5) | 15               | 2.52%                      |
| Distribution from tropical Asia to tropical Africa (6)  | 9                | 1.51%                      |
4. Conclusions
Vascular plants is rich in Xuzhou. There are currently 144 families, 595 genera and 1037 species of vascular plants in Xuzhou, of which 14 families, 14 genera, 15 species of ferns, 130 families, 581 genera, and 1022 species of seed plants, 6 families, 19 genera, and 34 species of gymnosperms, 124 families, 562 genera and 988 species of angiosperms. There are 109 families, 325 genera and 565 species of garden plants in total, and 118 families, 432 genera and 678 species of forest wild plants in total. Vascular plants are rich in species, and their flora is of certain importance and particularity in the Jiangsu region.

Xuzhou flora is mainly a tropical to temperate transition type. In terms of the type of distribution area and the composition of geographical components, the flora of Xuzhou is dominant in temperate distribution. There are 306 genera in this zone, accounting for 51.43% of the total, of which the northern temperate zone (120 genera) and East Asia (56 genera), Old World temperate zone (55 genera), East Asian and North American discontinuous distribution (44 genera), 4 species are dominant. It can be seen that the vascular flora of Xuzhou should be a temperate plant region in nature. However, there are also 196 genera of tropically distributed plants, accounting for 32.94% of the total, accounting for a certain proportion. This also reflects the transitional characteristics of the vascular flora of Xuzhou, which is a tropical to temperate transition.

Xuzhou flora has a certain ancient component. From the composition of the flora of Xuzhou, it can be seen that it contains a large number of discontinuous distribution types, For example, some plant species from the family Pinaceae, Magnoliaceae, Nyssaceae, Cupressaceae, Elaeagnaceae, Juncaceae, These are some of the older groups, and to a certain extent, it shows that the flora of Xuzhou has a certain ancient component. At the same time, it also contains earlier-originated families such as Tamaricaceae, thymelaeaceae, Lythraceae, etc., which also illustrates the ancient origin of Xuzhou flora.

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