

Floral Characteristics Analysis of Plants in Tianjin Lingang Urban Ecological Wetland Park

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Abstract. This study aims to identify the composition and distribution characteristics of plant flora of Urban Ecological Wetland Park in Tianjin Lingang. Results show that plant species of Wetland Park in Tianjin Lingang are relatively rich. There are 246 vascular plants from 171 genera and 73 families. 16 families, 37 genera gymnosperm species including 2 families and 5 genera *Pinopsida* and 1 families, 1 genera *Ginkgopsida*, recorded a total of 134 genera of dicotyledonous plants belonging to 57 families and 31 genera of monocotyledonous plants belonging to 13 families. The major families are *Gramineae*, *Rosaceae* and *Asteraceae* and the major genera is *Chenopodium* and *Salix*. From the point of Genera composition, small genera and monotypic genera account for higher proportion. 77 species of wild plants are mainly come from herbaceous plants, and the arbor layer is mainly composed of cultivated species. The flora of Wetland's vegetation in Lingang Ecological Wetlands Park had a wide distribution including 15 geographical components with 9 sub-types, 34.16% of the species are of the North temperate type, generally with a typical temperate floristic characteristics.

Introduction

Flora is a region (a certain period of time or a classification group) of all plants of sum owing to the comprehensive effects of the natural geographical environment, especially the natural and historical conditions, a results after evolution, a important basis of plant classification and a reaction of natural geographic environment^[1-3]. In recent years, Urban Wetland Park is a big concern, research focuses on the plant characteristics^[4-6], development status, sewage treatment technology, selection and arrangement of vegetation, but the research on the geographical areal-types of seed plants in urban wetland park is less. This study on flora analysis of plants for urban wetland park in order to provide reference advice about achieving a reasonable selection of plant species, and give the scientific community to configure and to improve the eco-system functions.

Research method

Research area

Lingang Ecological Wetland Park is an urban ecological wetland park with the advantages of water treatment and landscape effect combined, located in Tianjin Lingang industrial zone, east Bohai ten road, South to Binjiang Road, west Binhai Avenue, north up Changjiang Road, covering an area of about 63 hm². The overall shape of the park is looked like butterfly-shaped and there are three main major scenery plots including Subsurface Flow Constructed Wetlands, Adjusting Lake and Main Landscape in it. The typical park is built on the Bohai Bay muddy tidal flat, which had accumulated a considerable degree of pollution due to the long-term development of the coastal zone. Plants are sparse in the marsh along the coast which has been dehydrated and there has a big intensive distribution of *Spartina Anglica* community and halophytes. Effective collection of sewage and rainwater through the construction of artificial wetland, combined with water purification and recycling by international advanced ecological technology in wastewater treatment helped the wetland park achieve partial sewage zero emissions^[7-8].

Research method

Vegetation surveys had been carried out all around the entire Lingang Urban Ecological Wetland Park from November 2013 to November 2015 using field investigation and quadrat method. Recorded the community's species, location, data of elevation, plant arrangement, composition qualities and coverage has also been surveyed. Data analysis mainly uses the Excel form 2011 and the R 3.3.0 software.

Result and analysis

Flora composition

There are 246 vascular plants from 171 genera and 73 families. 16 families, 37 genera gymnosperm species including 2 families and 5 genera Pinopsida and 1 families, 1 genera Ginkgopsida, recorded a total of 134 genera of dicotyledonous plants belonging to 57 families and 31 genera of monocotyledonous plants belonging to 13 families. Results displayed that dicotyledonous plant occupies important position. Plant composition had a trend of centralization to some big typical world family, such as Rosaceae (28 species), Compositae (25 species), Gramineae (17 species), Leguminosae (14 species) and Oleaceae (10 species), while also has tendency of moving upwards small generas and monotypic generas, such as *Chenopodium* and *Salix*. The composition of 47 monotypic family and 137 monotypic species were fully reflected the transitional and complexity of the wetland park, these kinds of plants from monotypic family or a monotypic species of plant are often appeared as a companion plant.

Diversity analysis of plant family

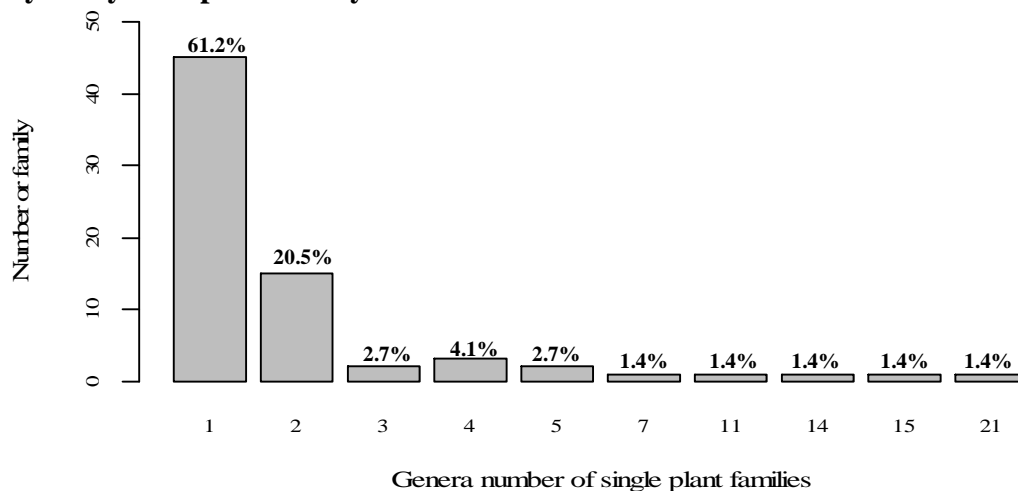


Fig 1. Wetland Park's composition of genera of plant families

There are 73 families of seed plants of Tianjin lingang Urban Ecological Wetland Park (Fig. 1), some of them are highly evolved, such as Compositae, Gramineae; some angiosperms like Saxifragaceae are in a differentiated position. The number of genera in different family has great disparity. There are 5 family contained more than 5 generas, these are Compositae (21 generas), Gramineae (15), Rosaceae (14), Leguminosae (11), Oleaceae (7), their propotion are all 1.37%; while, monotypic genera has 47 familis which account for 64.38%, and two generas have 15 families which have a share of 20.55%. These kid of family had larger proportion in the total which take the sub-domination role in plant flora.

Diversity analysis of plant genera

There are 171 generas of seed plants of Tianjin lingang Urban Ecological Wetland Park (Fig. 2), some generas are highly evolved contained many herb generas, such as Compositae, Cyperaceae, there also has lower level of evolution plants from ancient types, Compositae's *Heteropappus* is one of the few woody generas. It showed that Lingang ecological wetland species

of vegetation are abundant and weren't dominated by a single dominant specie(Fig.2).Monotypic genera had a total of 137 generas with absolute advantage, a total of 137 genus, 80.12% of the total genera number.Six genera contained more than 5 species, *Chenopodium* and *Salix* has 8 species, occupying 1.2%; *Sophora*(7 species) account for 06%;*Sabina*,*Prunus* and *Malus* are all woody plants occupying 5 species.

Chenopodium and *Artemisia* are typical wetland weed communities have a wide distribution in Tianjin, *Chenopodium* is mainly distributed on the border of wetland and land, associated with *Phragmites australis*, *Lythrum salicaria* and so on.*Artemisia* is always distributed in some arid areas around wetlands.Statistics shows that differentiation of Tianjin local genus is quite significant, medium and small genera are abundant,a few large genera are high developed mostly manual transplanting plants, the influence from artificial intervention is more obvious.

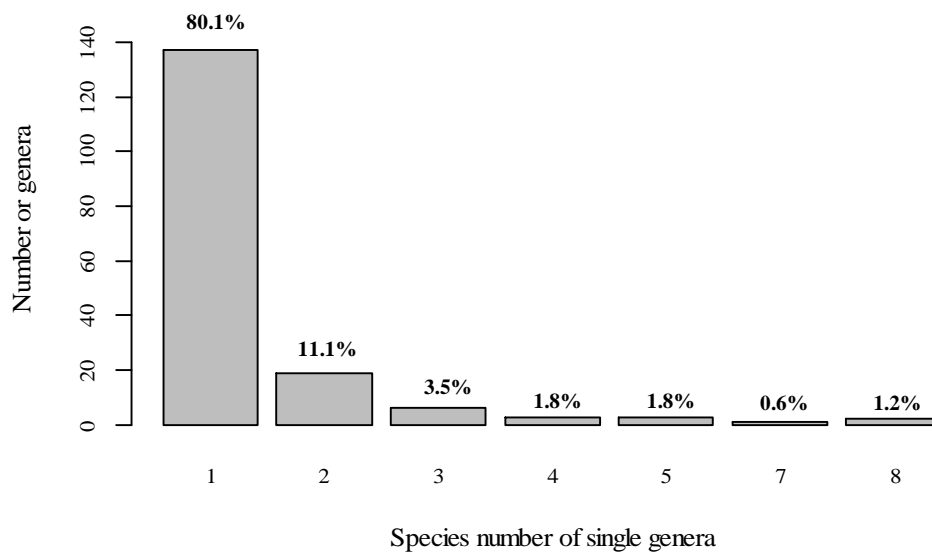


Fig 2. Wetland Park's composition of species of plant genera

Growth-forms of vegetation type

The growth-forms of vegetation type dominated by arbor, shrub, vine, perennial grasses, annuals,biennial and perennial herbs,a total of 246 species. Of which, herb with 122 species account for 49.6% of the total species at most, arbor second was 78 species and account for 31.7%, shrub owns 41 species and account for 16.7%; vine and perennial grasses at least was 4 and 1 specie respectively. A ratio of wild plant species was 31.3% with 77 species,among them, there are 71 herbs,5 shrubs and 1 vines,the only one vines is *Metaplexis japonica*;cultivated species(169) account for 68.7%.In addition, over 90% wild species were introduced in herbs, over 45% cultivated species were introduced in anbors,of them, the number of trees was at most, herbs second and shrubs at least in the life-forms of vegetation,the proportion was trees (46.8%), herbs (30.2%) and shrubs (21.3%) in order.

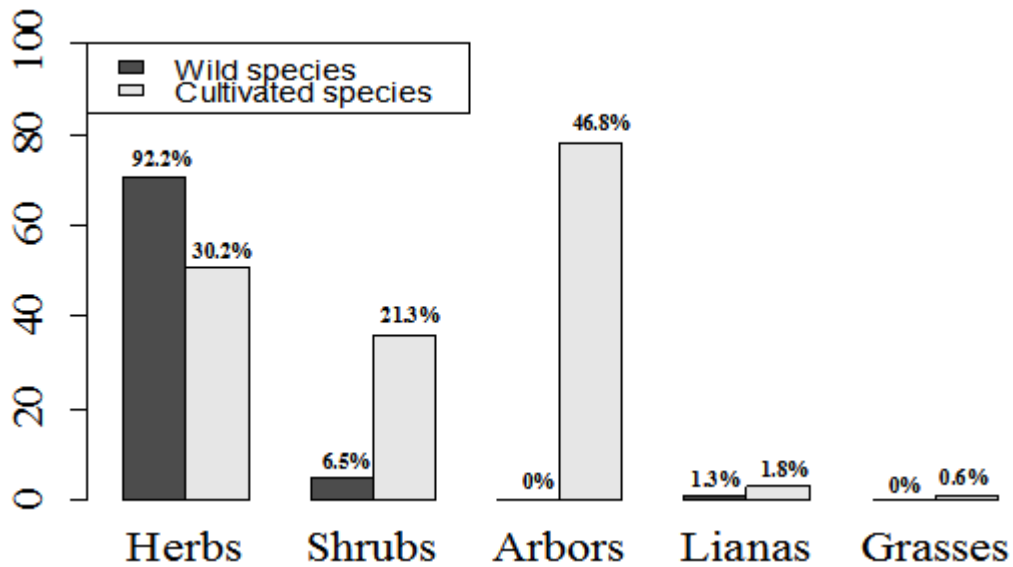


Fig 3. Patterns of plant flora of Wetland Park

Analysis of floristic geographical elements

According to Wu Zhengyi (1991)^[3] classified the areal-types of Chinese genera of seed plants, the distribution of the seed plants in the study area could be divided into 15 geographical elements types and 9 sub-type (Table 1). Floristic composition varied within the study area, which is widely distributed. North Temperate type and the Pan-tropic are the main parts of the floristic geographical elements owning larger proportion of distribution respectively account for 27.71% and 15.1% of total (Fig 4). Among them, the pan-tropical distribution is at the one

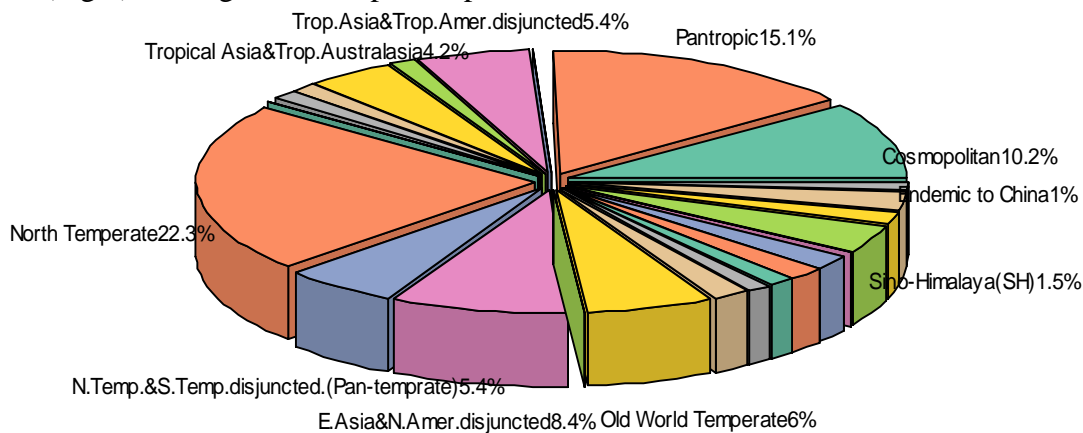


Fig 4. Genera numbers 's areal-types and variants of plants in the study area

or a plurality of distribution center widely distributed around the World tropical range, many generas are also distributed in the temperate zone, port wetland in the pan tropical plant distribution mostly belongs to the herbs and lianas, most gereras of the pan tropical were herbs and vines in Lingang ecological wetland prak, such as *Portulaca*, *Imperata*, *Setaria* and *Diospyros*, of which is relatively common in Tianjin. Addition, Chinese unique species in research district within also has distribution, for *Eucommia* and *Ginkgo* a total of 1% of the total number of genera. World distribution of herb species serve to complement it and accounted for 13.86%, which monotypic species has 11 species, by accounted for proportion for 37.93%. Most plant species within the genus *Chenopodium* contains lots of wetland herbaceous species as dominant species in the study area; duckweed genera, genus *Scirpus*, *Potamogeton*, *Atriplex*, *Suaeda* are also typical vegetation types in the region.

Table 1. Generic areal-types and variants of seed plants in the study area

Areal-type & variants	Genera	Species	Genera's proportion	Species' proportion	Areal-type & variants	Genera	Species	Genera's proportion	Species' proportion
1.Cosmopolitan	17	28	10.24%	13.86%	9.1.E.Asia and Mexico disjuncted.	1	1	0.60%	0.50%
2. Pantropic	25	31	15.06%	15.35%	10.Old World Temperate	10	13	6.02%	6.44%
2.2.Trop.Asia,Africa & C.to S.Amer.disjuncted.	1	1	0.60%	0.50%	10.1.Mediterranea.W.Asia(orC.Asia)&E.Asia disjuncted.	3	8	1.81%	3.96%
3.Trop. Asia & Trop.Amer. disjuncted	9	13	5.42%	6.44%	10.2.Mediterranea &Himalaya disjuncted.	2	3	1.20%	1.49%
4.Old World Tropics	2	2	1.20%	0.99%	10.3.Eurasia &S.Africa(Sometimes also Australasia) disjuncted.	2	2	1.20%	0.99%
5.Tropical Asia &T rop. Australasia	7	9	4.22%	4.46%	11.Temp. Asia	3	3	1.81%	1.49%
6.Trop. Asia to Trop. Africa	2	3	1.20%	1.49%	12.Mediterranea,W. Asia to c. Asia	3	3	1.81%	1.49%
7.Trop. Asia (Indo-Malesia)	2	2	1.20%	0.99%	13.C. Asia	1	1	0.60%	0.50%
7.3.Burma,Thailand to SW. China.	1	1	0.60%	0.50%	14.E. Asia	6	6	3.61%	2.97%
8.North Temperate	37	69	22.29%	34.16%	14.1Sino-Himalaya (SH)	3	3	1.81%	1.49%
8.4.N.Temp.&S.Temp.disjuncted.("9 Pan-temperate")	9	11	5.42%	5.45%	14.2.Sino-Japan (SJ)	4	9	2.41%	4.46%
9.E.Asia&N.Amer. disjuncted	14	13	8.43%	6.44%	15.Endemic to China	2	2	1.20%	0.99%

Conclusion

(1)Lingang urban ecological wetland park has a complicated geographical environment with a variety of plants.There are 246 speices and accounted for 18.1% of total number of species of vascular plants in Tianjin(1359), of which is represented by the species of Rosaceae, Compositae and Gramineae.There are other distinguishing species such as *Ash tree*,the composition of plants of Lingang wetland park is representative in the North China.

(2)Cultivated species account for a large proportion(68.7%),there are less wild species,which are mostly herbaceous plants.

(3)Diverse floristic composition distribution types covered the types of 15 geographical elements types and 9 sub-type of China.Which,Temperate ingredients were divided the for 2 geographic type components accounted for absolute advantage(27.72%), temperate sex components total 46 is, was placed under the for 2 a geographic type components, accounted for total is number of 27.72%.The more regional monotypic families and generas fully reflected the vulnerability of regional plant flora and the necessity of strengthening the wetland conservation.

(4)Endemic families and genera of seed plants are still insufficient.Only two Chinese unique generas were found in Lingang urban ecological wetland and flora's personality is not obvious.

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