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A Quantitative Analysis on *Avicennia marina* Community along Beihai Coast of Guangxi

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Abstract This paper deals with species diversity, interspecific correlation and population distribution pattern of *Avicennia marina* community along Beihai coast, Guangxi. The results are as follows:

(1) The floristic composition and structure of the community are rather simple;

(2) Compared with those of terrestrial nature communities, the degrees of interspecific correlations of the community are much low;

(3) Populations of *A. marina* and *Kandelia candel* show random distribution, while *Aegiceras corniculatum* population is an aggregated distribution.

Key words *A. marina* community, species diversity, interspecific correlation, distribution pattern

Mangroves are the special woody plant communities on tropical and subtropical sea shore. Quantitative analysis on mangrove communities will be helpful to deeping the knowledge of distribution and succession of mangrove communities. Additionally, quantatitive analysis on mangrove community is the basis of research into mangrove ecosystem. If, within an ecosystem, interspecific correlation, population quantitative dynamics and automatic regulation within a population, etc. are not sufficiently recognised, it is surely impossible to predict scientifically the development and variation of mangrove ecosystem, and to furtherly make use of, protect and exploit it. Therefore, many researches remain to be done in this field.

1 Materials and Methods

Avicennia marina community is a pioneer community occurring on seashore, the distribution of which in Beihai is more than 1.17km^2. This study, the quantitative analysis on *A. marina* community, was carried out at a sea beach in Daguansha (21°26′N, 109°14′E), Beihai, Guangxi. According to the altitude and edaphic condition of beach and growing status of the community, three zones could be recognized, that is, zone A, the zone of Mud—beach *A. marina* community; Zone B, the zone of Sandy loam—beach *A. marina* community; Zone C, the zone of Sand—beach *A. marina* community (Fig. 1). There are differences in physiognomy and floristic composition of the communities, due to the different habitat conditions in the three zones. Mud—beach *A. marina* community is composced mainly of *A. marina*, in association with *Aegiceras corniculatum* and *Kandelia candel*, and the plants grow

commonly up to 1. 90±0. 40m high. Sandy loam—beach *A. marina* community and Sand—beach *A. marina* community are composed mainly of *A. marina* , and the plants grow commonly up to 0. 86± 0. 53m high and 0. 89±0. 61m high respectively.

Three plots, Q_1, Q_2 and Q_3, were laid out in Mud—beach *A. marina* community, Sandy loam—beach *A. marina* community and Sand—beach *A. marina* community respectively. A belt transect of 192m long with 64 contiguous $3 \times 3m^2$ quadrats was pegged out at each plot. The measurements of morphologic characteristics were taken on all individuals in each quadrat.

Simpson index (D), Shannon—Wiener index (H) and Evenness (J) [1-3]were used to measure the species diversity of the community.

$$D = \sum_{i=1}^{s} n_i(n_i - 1)/N(N - 1) \tag{1}$$

$$H = 3.3219 \times [\log N - (1/N \sum_{i=1}^{s} n_i \log n_i)] \tag{2}$$

$$J = D/\{3.3219 \times [\log N - (\alpha(s - \beta) \log \alpha + \beta(\alpha + 1) \log (\alpha + 1)/N)]\} \tag{3}$$

The correlation coefficient (r)[4] was used to detect and analyse the interspecific correlations of the community.

$$r = (ad - bc)/\sqrt{(a + b)(c + d)(a + c)(b + d)} \tag{4}$$

Population distribution pattern type was determined by using the method of variance (s^2) : mean ($\bar{x}$) ratio[5].

$$\bar{x} = 1/n \sum_{i=1}^{s} x_i \tag{5}$$

$$s^2 = 1/(n - 1) \sum_{i=1}^{s} (x_i - \bar{x})^2 \tag{6}$$

In addition, aggregative intensity was detected by clumping index (I) and negative binomial paramater (K), pattern intensity by $(s^2 - \bar{x})/\bar{x}$ [6].

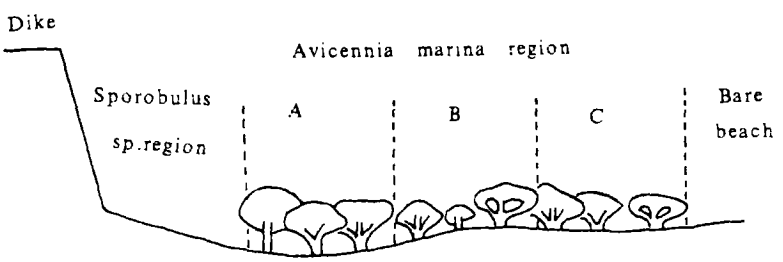

Fig. 1 Sketch diagram of the study area (A: Mud beach, B: Sandy—loam beach, C: Sand beach)

2 Results and Discussion

2. 1 Species Diversity

A community may contain one or a few very common species, the dominant species, for which the community may be named. These are by no means the community' s only members, however. That there are many others and the total number of species and their relative aboundance in a community means species diversity. Diversity tends to be low in communities that are physically

constrained—dry, hot, cold, or otherwise inhospitable environments. In more favorable environments, diversity is usually high. Low diversity refers to few species or unequal aboundances, high diversity to many species or equal aboundance.

The species diversity of *A. marina* communities is presented in Table 1, in which Sandy loam—beach *A. marina* community and Sand—beach *A. marina* community are composed only of one species, so that their Simpson indexes are 1 and their Shannon—Wiener index and evenness 0, while Simpson index, Shannon—Wiener index and evenness of Mud—beach *A. marina* community are 0.7424, 0.7377 and 0.4654 respectively. Compared with those of terrestrial natural communities such as rain forest[1,7], monsoon evergreen broad—leaved forest[1], evergreen broad—leaved forest[1,3], evergreen and deciduous broad—leaved mixed forest[1,3], theropencedrymion[3], dwarf mountainous forest[3] and *Pinus massomiana* forest[3], the species diversity index and evenness of *A. marina* community are much lower, but the ecological dominance is larger. This indicates that the floristic composition and structure of *A. marina* community are rather simple.

Table 1 Species diversity of *A. marina* community in Daguansha, Beihai, Guangxi

Plot	Community type	*S*	*N*	*D*	*H*	*J*
Q_1	Mud—beach *A. marina* comm.	3	271	0.7424	0.7377	0.4654
Q_2	Sandy loam—beach *A. marina* comm.	1	225	1	0	0
Q_3	Sandy—beach *A. marina* comm.	1	198	1	0	0

2.2 Interspecific Correlation

The interrelationships between plants are many and variable. All degrees of bondage or interdependence exist, for example, high positive correlation indicates that there is a mutualistic relationship between two species. The interspecific correlations of *A. marina* community in Daguansha were measured with formula (4). The correlation coefficients (r) between *A. marina* and *K. candel* and *A. corniculatum* are 0, that is, there are no correlations between them. The correlation coefficient (r) between *K. candel* and *A. corniculatum* is -0.017, but this degree of negative correlation is not evidant through χ^2 test. It therefore comes to the conclusion that there are not evidant correlations between species which present in *A. marina community* of Daguansha.

2.3 Population Distribution Pattern

Distribution pattern is the spatial arrangement of the individuals of the population. It is the result of intrapopulation competition for space . Specific biological and ecological characteristics and habitant condition are influences on the distribution pattern type of the population.

Table 2 shows the distribution pattern of *A. marina* community in Daguansha. From the zones A to C, the spatial distribution patterns of *A. marina* populations appear as random distribution. This indicates that the habitat conditions in zone A, zone B and zone C are uniform. The density of *K. candel* population is low—313 n./hm^2.. It is scattered in the fringe and blank of Mud—beach *A. marina* community and shows random distribution. The density of *A. corniculatum* population is 365 n./hm^2., and the individuals usually make up distinct microstand or microcomplex in the gap of Mud—beach *A. marina* community so that it shows aggregated distribution.

Table 2 The distribution pattern of plant populations of *A. marina* community in Daguansha, Beihai, Guangxi

Plot	Q_1			Q_2	Q_3
Population	*A. marina*	*K. candel*	*A. corniculatum*	*A. marina*	*A. marina*
s^2	2.5556	0.2371	0.7636	4.4185	2.3085
$\bar{x}$	3.6250	0.2813	0.3281	3.5156	3.0938
$s^2/\bar{x}$	0.7050	0.8430	2.3273	1.2551	0.7462
T	1.6555	0.8808	7.4483	1.4315	1.4243
Result	Random	Random	Agreggate	Random	Random
I	−0.2950	−0.1570	1.3273	0.2551	−0.2538
K	−12.2878	−1.7903	0.2472	13.6886	−12.1885
Pattern intensity	−0.2950	−0.1571	1.3273	0.2568	−0.2538

It has been confirmed that the distribution pattern of plant population, especially long−lived plant population, changes, along with the development of population and the succession of community. For example, *A. marina* population that presents in Sandy loam − beach *A. marina* community shows an aggregated distribution in its dispersal and developmental stages, and tends to be randomly distributed during its maturing stage (Table 3).

Table 3 The distribution pattern of *A. marina* population of Sandy loam − beach *A. marina* community in Daguansha, Beihai, Guangxi

Individual group	Seedlings	Young tree	Adult tree
Group size	7847	78	225
s^2	5086.6862	2.2688	4.4185
$\bar{x}$	122.6094	1.2188	3.5156
$s^2/\bar{x}$	41.4868	1.8616	1.2551
T	227.1994	4.8351	1.4315
Result	Aggregate	Aggregate	Random
I	40.4868	0.8616	0.2551
K	3.0284	1.4147	13.6886
Pattern intensity	40.4869	0.8615	0.2568

Reference

1 Peng Shaolin, Zhou Houcheng, Chen Tianxing, etc.. The quantitative charaters of organization of community in Guangdong. Acta Phytoecologica et Geobotanica Sinia, 1989, 13 (1): 13～17. (In Chinese).

2 Wen Yuanguang, Li Beinxian, Qin Wuming, etc.. Species diversity of forest community of air−seeded *Pinus massoniana*. Journal Sichuan Teacher College (China), 1991, 12: 35～39. (In Chinese).

3 Zhu Shouqian. Apreliminary study of the species diversity of part of the forest communities in Guizhou. Acta Phytoecoloogica et Gepbotanica Sinia, 1987, 11 (4): 286～295. (In Chinese).

4 Li Yuzhong. Determination and comperison of plant species interconnetions in three types of grassland. Chinese Journal of Ecology, 1991, 10 (6): 6～10. (In Chinese).

5 Liang shichu. Study on dynamics of pubescent hornbeam population in karst mountain of Guiyang. Acta Ecologica Sinica, 1992, 12 (1): 53～60. (In Chinese).

6 Liu Yuchend, Miao Shili. The study on secondary sucession of evergreen broad−leaved forests on Jinyun Mountain. The dynamics of communities and dominant populations. Acta Phytoecologica et Geobotanica Sinia, 1992, 16 (1): 26～35. (In Chinese).

7 Guo Ling, Xu Zhaifu. A research for species diversity of plant in seasonal tropical rainforests in Xishuangbanna. Chinese Journal of Ecology, 1990, 9 (5): 61～62. (In Chinese).