

## **Study on population distribution, morphological structure and physiological-biochemical characteristics of *Dactylis glomerata* in different geographical areas of Tianshan mountains of Xinjiang in China**

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### **Introduction**

As one important cool-season grass with high resource value, *Dactylis glomerata* has many characteristics such as good adaptability, high nutritional value and so on. It is one of the major cultivated species planted in high quality artificial grassland in the world. Xinjiang is one of the major areas have rich germplasm resource of wild *Dactylis glomerata*, and it is a natural gene pool. In order to protect and make good use of wild plant resources, this study focused on the distribution patterns, distribution regulation, morphological structure and physiological-biochemical characteristics of wild *Dactylis glomerata* grown in different geographical areas of Tianshan mountain of Xinjiang. It aims to reveal the effects of geographical space and habitat on the population distribution in, morphological structure and physiological-biochemical characteristics of *Dactylis glomerata*.

### **Materials and Methods**

**Study sites:** Naturalized populations of *Dactylis glomerata* were studied along a latitudinal gradient in different geographical areas of Tianshan mountains of Xinjiang in China. The study sites was from 1800m to 2200m in eastern and western of Tianshan Mountain North Slope.

**Methods:** The relative abundances of *Dactylis glomerata* in each site was measured as follows. First,  $\alpha$  diversity and  $\beta$  diversity to analysis the diversity of *Dactylis glomerata* in different region, and interspecific associativity and distribution characteristic were studied by investigation in different region, The morphological characteristics and Physiological-biochemical characteristics and Photosynthetic characteristics of *Dactylis glomerata* populations was studied by experiment.

### **Results and Discussion**

**Diversity of population distribution of wild *Dactylis glomerata* in different areas:** The results of species diversity index analysis showed significant differences on distribution of *Dactylis glomerata* between eastern and western of the north of Tianshan Mountain.  $\alpha$  diversity index showed a rising and decline trend following the altitude increasing. The  $\beta$  diversity index was between 0.4-0.5 of eastern mountain with altitude at 1800m, 2200m and the western mountain with altitude at 1800m, 2000m and 2200m. One negative correlation relationship appeared among species diversity, altitude and aboveground biomass.

**The interspecific associativity of wild *Dactylis glomerata*:** The results of total associativity analysis indicated significant positive correlation between the *Dactylis glomerata* growing with altitude at 1800m and 2000m of the eastern north slope of Tianshan Mountains. However, one significant negative correlation appeared with the increasing altitude at 2200m. Associativity index showed that the associativity of species pairs has greater positive association than negative association at altitude of 1800m-2200m of the eastern north slope of Tianshan Mountains. However, the associativity of species pairs has less positive association than negative association the communities with altitude at 1800m-2200m of the western part of Tianshan Mountains. Correlation analysis showed that *Dactylis glomerata* populations grew at different altitudes showed positive association or negative association with other major dominant plant.

**Distribution characteristic of wild *Dactylis glomerata* in different areas:** The distribution characteristic of two *Dactylis glomerata* population was studied by diffusion coefficient and t test methods. The results showed that the distribution types of *Dactylis glomerata* populations were clumped at both eastern and western part of the mountain. According to the analytical results of clustered index I, gathered strength k, mean crowding  $m^*$ , poly-mass index  $m^* / m$ , Cassie index, the population distribution intensity of *Dactylis glomerata* at eastern mountain was moderate, while the intensity was strong at altitude of 1800m and 2200m at western mountain. The pattern size analysis showed the *Dactylis glomerata* population had obvious peak values at block 4, block 8, block 32 and block 64 at different altitudes.

**The morphological characteristics of *Dactylis glomerata* population in different areas:** The results of vegetative organs of *Dactylis glomerata* showed significant differences in the flag leaf length and width, node number, internode length, stem diameter, etc of *Dactylis glomerata* in different areas, the *Dactylis glomerata* grow in eastern mountain has better morphological characters than the western. Results of reproductive organs character showed: there was a significant difference in the length of the inflorescence, inflorescence width, anther length, spike length, seed length, seed width and grain weight indicators ( $P < 0.05$ ), while no significant difference ( $P > 0.05$ ) in stamen length, anther width, spike width and tiller number. The correlation analysis between vegetative organs and reproductive organs showed that the various forms of index and geographic location, correlation analysis altitude, latitude, longitude and altitude and there was a certain correlation between the various indicators, especially with spikelets showed a significant positive correlation. The result of leaf anatomical structure of *Dactylis glomerata* showed a significant difference ( $P > 0.05$ ) in Stomatal density, the length of the epidermal cells and the width of the epidermal cells, while no significant difference ( $P > 0.05$ ) in the porosity degree of subsidence of upper and lower epidermis, cuticle thickness and length and width of lower epidermis.

**Physiological-biochemical characteristics of *Dactylis glomerata* populations in different areas:** The result of 5 Physiological and biochemical indices for *Dactylis glomerata* populations of three distribution areas showed there were significant differences in chlorophyll, malondialdehyde (MDA) and POD active substance content in plants between eastern and western mountains. And there were no significant differences in other indexes.

**Photosynthetic Characteristics of *Dactylis glomerata* populations in different areas:** The results of diurnal dynamic changes indicated that the diurnal variation curve of the three regions of *Dactylis glomerata* decreased first and then increased and then decreased, and reached to peak at 11: 00-12: 00 am and then decreased. The results of photosynthetically active radiation intensity, transpiration rate, stomatal conductance, leaf temperature and air temperature measurement showed that the peak position of the diurnal variation of all the curves was at 12: 00-15: 00, then followed a downward trend. The light use efficiency diurnal variation curves of the three regions showed an inverted "V" type, appeared trough at around 15:00 noon. while, the whole day transformation curve of water use efficiency showed a high - low - high - low trend, the light use efficiency and water use efficiency of *D. glomerata* at three regions was better than the western part of the eastern mountain.