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Morphological diversity of *Puccinellia tenuiflora* and its relationship with the environment in Song Neng Plain

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Abstract This study examined morphological variation diversity with environment of 6 populations of *Puccinellia tenuiflora* in Song Neng plain . Each population had 25~30 individuals . The results showed that environmental factors had obviously effects on the morphology , especially rainfall and temperature . The plant height and other parameters increased as the rainfall and temperature increased . It is concluded that greenhouse effect may have the same impact on morphological diversity of *Puccinellia tenuiflora* as climatic conditions .

Key words : *Puccinellia tenuiflora* , morphology , rainfall

Materials and methods Alkali grass (*Puccinellia tenuiflora*) , a monocotyledonous halophyte , can serve as a model of salt tolerance in monocotyledon crops which is widely spread in salt marsh and coast all around the world (Jerrold I . D . , 1993 ; D . R . Bazely , et al . , 1989) . The experiment collected 175 individuals from Changling (CL) , Da'an (DA) , Daqing (DQ) , Anda (AD) , Hailaer (HLE) , Baokang (BK) . The region studied ranged over 43°58'-48°58' N and 119°41'-125°24' E .

Table 1 The data measured and geographic locations of *Puccinellia tenuiflora* .

	CL	DA	DQ	AD	HLE	BK
Number of individuals	30	30	25	30	30	30
Latitude (°N)	44°35'	45°28'	46°59'	46°28'	48°58'	43°58'
Longitude (°E)	123°30'	124°15'	124°35'	125°24'	119°41'	123°12'
Altitude/m	142	123.6	142	145	635	133
Annual mean temperature/°C	4.9	4.3	4.9	3.2	-2.3	5
Annual rainfall /mm	470	413	437	420	350	360
Mean stem diameter	1.82	1.52	1.50	1.69	1.32	1.41
Mean panicle length	19.43	15.43	21.81	17.54	15.14	14.60
Mean total length	72.50	49.75	69.68	60.07	48.10	50.68
Offshoot angle	38.6	58.7	30.8	32.8	49.7	48.8
Height	85.3	54.7	77.6	68.3	53.2	57.8
Stem diameter/panicle length	0.0963	0.1030	0.0746	0.1018	0.0975	0.1001
Panicle length/total length	0.2699	0.3295	0.3161	0.2919	0.3197	0.2924

Results There was significant difference in morphology between areas , but the ratios of variables were not significant (Table 1) . The results showed that morphology had a close correlation with the rainfall . The stem diameter increased linearly as rainfall increased ($R^2=0.92$) . The correlation coefficients between rainfall and panicle length , total length and height were 0.42 , 0.64 , 0.66 , respectively . The correlation was 0.6 between rainfall and stem diameter / panicle length and 0.99 between rainfall and panicle length / total length and rainfall excluding data from DQ . But no significant relationship when DQ was added .

Discussions Environments have great effects on plants . *Puccinellia tenuiflora* grows better in the area where there are more rainfall and higher temperature . Its morphology changes greatly in different locations , while the ratios of the plants height , panicle length , stem diameter , and total length were similar , which can be used to identify the varieties of the same genus . Greenhouse effect can affect plants growth greatly . Daqing , known as a petroleum city , has great effect on environments , Table 1 showed that the temperature in Daqing is much higher than other locations in the same Latitude . This may be the reason lead to the changes of morphological characteristics of *Puccinellia tenuiflora* in this area .

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