生态学报 2006 26 (2006(07)): 2308～2312 ISSN: 1004-616x CN: 44-1063/R

研究论文

内蒙古高原西部荒漠区锦鸡儿属(*Caragana*)优势种的形态适应特征

马成仓[1,2],高玉葆[1,*],郭宏宇[1],吴建波[1],王金龙[1]

1.南开大学生命科学学院，天津300071
2.天津师范大学生物学系，天津300074

收稿日期 2005-10-2 修回日期 2006-4-2 网络版发布日期: 2006-7-25

摘要 研究内蒙古高原西部荒漠区锦鸡儿属(Caragana)4种优势植物——柠条锦鸡儿、狭叶锦鸡儿、垫状锦鸡儿和荒漠锦鸡儿的地理分布和叶形态适应特征。通过地理分布和生长发育研究发现：4种锦鸡儿均能在阿拉善荒漠区分布和正常生长，它们能够适应阿拉善荒漠区环境。叶形态结构研究表明：狭叶锦鸡儿叶片呈瓦状，在一定程度上阻碍了水分散失和气体交换，缩小受光面积；垫状锦鸡儿叶片卷成筒状，水分散失和气体交换阻力更大，受光面积更小。柠条锦鸡儿密被伏帖绢毛、狭叶锦鸡儿多被灰白色柔毛、垫状锦鸡儿密被绢毛和荒漠锦鸡儿密被直立绢毛，对光线反射能力强，使叶温降低，减少蒸腾。狭叶锦鸡儿和垫状锦鸡儿具有的长条型叶，4种荒漠区锦鸡儿都具有更小的叶面积、更大的厚度/面积比值、更低的叶片生物量和更小的比叶面积(SLA), 减小了蒸腾和受光面积，提高了荒漠区锦鸡儿的保水能力。荒漠区锦鸡儿这些叶片形态特性有利于适应干旱、高温和强辐射的荒漠区环境。叶绿素含量测定和叶色研究结果表明：4种荒漠区锦鸡儿叶绿素含量低，更低的叶绿素含量和密被灰白色柔毛或绢毛导致叶色浅、反光性能好，有利于减少对辐射的吸收，避免强辐射对植物的伤害，同时也使叶温低，减轻高温伤害和水分蒸发，以适应环境。这是荒漠区锦鸡儿适应高光强、高气温、极干旱的荒漠区环境的特性。垫状锦鸡儿和柠条锦鸡儿叶绿素a/b高也是适应强辐射的特性。比较4种荒漠区锦鸡儿的叶形态特性发现，4种荒漠区锦鸡儿植物对荒漠环境的形态适应方式是不同的。

关键词 锦鸡儿属；荒漠区；适应性；形态结构；叶绿素含量

分类号 Q948.1

Morphological adaptation of four dominant *Caragana* species in the desert area of the Inner Mongolia Plateau

MA Cheng-Cang[1,2], GAO Yu-Bao[1,*], GUO Hong-Yu[1], WU Jian-Bo[1], WANG Jin-Long[1]

1. College of Life Science, Nankai University, Tianjin 300071, China;
2. Department of Biology, Tianjin Normal University, Tianjin 300074, China

Abstract Caragana species grow mainly in the arid and semi-arid areas of Asia and Europe. Geographically, the number of Caragana species declines with increasing precipitation and temperature, as well as increases with rising altitude. They may be found in forest, grassland and desert ecosystems, but more often in grassland and desert. The adaptation of these *Caragana* species to the climatic conditions of the desert has made them become dominant plants in the desert. In desert region there is very little precipitation, high temperature and strong solar radiation. Among these environmental factors, precipitation affects most the growth and development of the plants there. What made these species be adaptive to the climate of a desert region? To answer this, the distribution and morphological adaptation of four dominant *Caragana species —C. korshinskii, C. stenophylla, C. tibetica* and *C. roborovskyi* in the desert area of the Inner Mongolia Plateau were studied. An analysis on geographical distribution, growth and developmental pattern indicated that these four Caragana species grew normally in the Alashan region, and were adapted to the desert environment there. The leaf of C. stenophylla took the form of tile (tegular), which hindered gas exchange to a certain extent and reduced the area receiving solar radiation. The leaf of C. tibetica was tube-shaped, which resulted in a potentially greater obstruction for gas exchange and a smaller area receiving solar light. The *C. korshinskii* with densely fallen silky villis, C. stenophylla with densely offwhite villis, C. tibetica with densely silky villis, and *C. roborovoskyi* with densely straight silky villis had strong reflecting ability, which could lower their leaf temperatur

e, and therefore reduce their transpiration rate. The strip-shaped leaf in *C. stenophylla* and *C. tibetica*, and small leaf area, great ratio of thickness to area, less leaf biomass, and specific leaf area (SLA) in four desert Caragana species led to the reduction in area of transpiration and radiation reception, thus enhancing these four desert *Caragana species'* ability to preserve water. All these features enable these desert *Caragana* species to adapt to the arid environment where atmospheric temperature is high and solar radiation is intensive. These desert Caragana species had low chlorophyll content. Such low chlorophyll content and offwhite villis or silky villis resulted in a paleness of leaf color, which enabled the four Caragana species to avoid strong solar radiation. For this reason, the plants had lower leaf temperature and their transpiration was decreased so that they were able to adapt to their habitats well. This was a characteristic in adaptation to intensive sunlight, high temperature and long-lasting drought. Higher Chl. a/b in *C. korshinskii* and *C. tibetica* was an adaptation to intensive sunlight. By comparing the morphological characteristics of these four species, we found that the patterns of adaptation to the arid environment were different from each other in the four desert *Caragana* species.

Key words *Caragana* _ desert _ adaptation _ morphology _ chlorophyll content

DOI

通讯作者 高玉葆 ybgao@nankai.edu.cn