

## 星毛委陵菜根系构型对草原退化的生态适应

周艳松, 王立群

内蒙古农业大学生态环境学院, 呼和浩特 010018

ZHOU Yan-Song, WANG Li-Qun\*

College of Ecology and Environmental Science, Inner Mongolia Agricultural University, Huhhot 010018, China

- 摘要
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**摘要** 对轻度、中度、重度和极度退化的草原群落中星毛委陵菜(*Potentilla acaulis*)根系构型参数及相应的土壤水分、容重和硬度等指标进行了分析,以研究星毛委陵菜根系构型对草原退化的生态适应性。结果表明:1)在以大针茅(*Stipa grandis*)为建群种的典型草原中,随着退化程度的加剧,星毛委陵菜在群落中的作用逐渐增强,其根幅、根深、一级垂向根数、分蘖子株数和水平分蘖根长度显著增加;2)根表面积、二级侧根长度、总根长和根分叉数4个根系构型参数是解释星毛委陵菜根系构型对草原退化生态适应的首选指标,解释力依次减小,累计贡献率为92.34%;3)直径2 mm以下的根系对单株星毛委陵菜的根表面积和总根长影响显著;4)阔腰倒锥体三维根系构型是星毛委陵菜适应草原退化并使之成为建群种的优势构型。

**关键词:** 阔腰倒锥体 生态适应 草原退化 星毛委陵菜 根系构型 根系构型参数

**Abstract:** *Aims* Our objectives were to 1) examine the ecological adaptability of *Potentilla acaulis* to grassland degradation from the perspective of root architecture, 2) reveal why it can be a dominant species in extremely degraded grassland and 3) discuss its important roles in vegetation restoration or succession and preventing grassland from desertification.

*Methods* We collected relatively complete *P. acaulis* roots by trenching. The numbers of first vertical roots, length of horizontal root tillering and number of plant tillers were recorded in the field. The root analysis system of WinRHIZO was used to determine total root length, root surface area, total root volume, root average diameter, number of furcations, average branching angle, number of root axes, length of root axes, number of root tips, number of first lateral roots, length of first lateral roots, number of secondary lateral roots, length of secondary lateral roots, root diameters along root length, root surface area and root volume. The data were analyzed by one-way ANOVA and principal component analysis.

*Important findings* In degraded grassland typified by *Stipa grandis*, the function of *P. acaulis* became more important in the community and its root range, root depth, the number of first vertical roots, the number of plant tillers and the length of horizontal root tillering increased significantly. The parameters of root surface area, length of secondary lateral roots, total root length and the number of furcations explained the adaptability of *P. acaulis* to grassland degradation. Roots with a diameter <2 mm had a significant effect on root surface area and total root length of single plants of *P. acaulis*. The three-dimensional root architecture of a broad-waist-inverted centrum was an advantageous configuration for *P. acaulis* to adapt for grassland degradation and can explain *P. acaulis* as a constructive species in extremely degraded grassland.

**Keywords:** broad-waist-inverted centrum, ecological adaptation, grassland degradation, *Potentilla acaulis*, root architecture, root architecture parameter

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通讯作者 王立群 Email: wanglq1007@163.com

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