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北京暖温带次生林种群分布格局与种间空间关联性

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Population distribution patterns and interspecific spatial associations in warm temperate secondary forests, Beijing

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摘要 种群分布格局和种间空间关联性研究有助于深入理解物种共存机制。本研究在北京地区5个1 ha典型暖温带森林样地, 在0–50 m尺度范围内综合分析了常见种的种群分布格局及成年树种间的空间关联性。研究发现: (1)所有检验的物种都表现了聚集格局, 主要发生在较小(0–15 m)的尺度范围内, 并且同种聚集强度峰值普遍出现在目标个体周围1 m的距离内; 在>15 m的较大尺度上, 随着尺度增加, 随机和规则格局成为物种分布的主要形式; (2)种间不相关联的比例高(~50%), 即使种间存在显著的关联性, 也是以隔离和部分重叠为主要的关联形式; 很少的物种对(~4%)呈混合分布。种子扩散限制和生境异质性在某种程度上解释了种群普遍聚集的格局, 种群聚集分布又促使种间分布不相关联, 或者种间呈现隔离和部分重叠格局, 反映了物种分布与生境存在紧密的关联性。另外, 种间隔离的格局会阻止种间个体相互竞争。然而, 由于同种个体聚集分布, 密度制约成为调节种群分布的主要形式。本结果将有助于揭示森林群落物种共存的潜在维持机制。

关键词: 物种共存 聚集 隔离 扩散限制 生境异质性 生境关联 密度制约

Abstract: Exploring tree population distribution patterns and interspecific spatial associations are helpful in elucidating the mechanisms underlying species coexistence in forest communities. We analyzed population distribution patterns and interspecific adult–adult spatial associations of common tree species at scales of 0–50 m in five 1-ha warm temperate secondary forest plots near Beijing, China. We found that: (1) all species showed aggregated spatial patterns at some scales; aggregation occurred mainly at neighborhood scales of < 15 m, tended to peak within a 1-m radius around focal conspecific trees, and the percentage of species exhibiting a random or regular pattern increased with scale, mainly occurring at scales of > 15 m; (2) the proportion of species pairs showing non-significant associations was high (~50%), and even in those species pairs that showed significant associations, segregation and partial overlap were dominant association types. Few species pairs (~4%) showed mixing. We feel that population spatial distribution of trees, particularly the observed prevalence of conspecific aggregation, in these plots was regulated by seed dispersal limitation and environmental heterogeneity. Moreover, aggregated distributions also promoted interspecific segregation and partial overlap. It is possible that distribution patterns were associated with habitats. Few species pairs showed interspecific mixing, in this case, interspecific competition exclusion difficultly occured, but in the interior of conspecific aggregation, density dependence should be a dominant mechanism regulating population distributions. Our findings contribute to a clearer understanding of the mechanisms influencing the structure of these forests.

Keywords: species coexistence aggregation segregation seed dispersal limitation environmental heterogeneity habitat associations density dependence

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