植物生态学报
se Journal of Plant Ecology
ISSN 1005-264X
CN 11-3397/Q
邮发代号：82-5

植物生态学报 » 2011, Vol. 35 » Issue (1) :35-44 DOI: 10.3724/SP.J.1258.2011.00035

研究论文

川西亚高山65年人工云杉林种子雨、种子库和幼苗定居研究

尹华军[1,2], 程新颖[1,2], 赖挺[1], 林波[1,2], 刘庆[1,2*]

[1]中国科学院成都生物研究所, 成都 610041;
[2]中国科学院山地生态恢复与生物资源利用重点实验室, 成都 610041

YIN Hua-Jun[1,2], CHENG Xin-Ying[1,2], LAI Ting1, LIN Bo[1,2], LIU Qing[1,2*]

[1]*Chengdu Institute of Biology, Chinese Academy of Sciences, Chengdu 610041, China;*
[2]*Key Laboratory of Mountain Ecological Restoration and Bioresource Utilization, Chinese Academy of Sciences, Chengdu 610041, China*

- 摘要
- 参考文献
- 相关文章

Download: PDF (456KB) HTML (1KB) Export: BibTeX or EndNote (RIS) Supporting Info

摘要 川西亚高山人工针叶林已成为亚高山森林的重要组成部分，它们是否具有持续的自然更新能力，是决定川西亚高山针叶林群落演替方向和维持该区针叶林大面积存在的基础。以川西米亚罗亚高山人工云杉(*Picea asperata*)林(65 a)为研究对象，对种子雨量年际变化、土壤种子库动态、种子萌发和幼苗定居等更新过程的关键环节进行了连续7年(2002－2008年)的野外观测，以研究人工云杉林更新潜力及影响其更新的限制因素。结果表明：该区云杉林种子雨一般从每年的10月初开始下落，一直到翌年的1月底或2月初结束；云杉种子散落存在明显的大小年现象，种子散落周期为4年，且大小年之间种子产量差异极大；云杉种子从下落到土壤到种子完全失去活力不到1年时间，属于Thompson和Grime定义的第II类土壤种子库类型。腐烂死亡和动物取食是土壤种子库损耗的主要因素，而种子通过萌发真正转化为幼苗的比例非常低，仅占2002年下落种子总量的3.6%。种子萌发后，环境筛的作用导致云杉幼苗大量死亡，尤其是在种子萌发后的一个生长季节内，其死亡率高达78%。凋落物和苔藓是构成人工云杉林下地表的两种主要地被物类型，二者占所有调查幼苗数量的93%左右；两种地被物类型上0－2cm层幼苗存活率最高，分别占存活幼苗总数的76.07%和86.72%，随地被物厚度增加，幼苗存活率呈明显下降趋势，而幼苗死亡率呈明显升高的趋势，表明林下地被物厚度也是影响云杉幼苗定居的重要因素。两种地被物对幼苗生长的影响不同，除株高之外，分布在苔藓上的云杉幼苗生长参数(地径、分枝数、干重以及干重年增长率)明显高于分布于凋落物上的幼苗，表明苔藓地被物更有利于云杉幼苗定居。尽管该区大量云杉种子下落，但由于种子的高损耗率、幼苗的低输出率以及萌发幼苗的高死亡率，使得人工云杉林下种子通过萌发转为实生幼苗的数量非常少，最终真正能补充到云杉种群的个体数量非常有限。

关键词： 云杉 人工林 更新 种子雨 土壤种子库 亚高山针叶林

Abstract: *Aims Picea asperata* is one of the keystone spruce species used for reforestation in subalpine coniferous forest of western Sichuan, China. A total of ca. 13 000 hm^2 of plantations are dominated by this species in this region. Our objective was to assess (a) potential for natural regeneration and (b) critical factors limiting regeneration of this tree species in spruce plantations. *Methods* We conducted field studies on the seed rain, soil seed bank dynamics and seedling establishment in a 65-year spruce plantation in Miyaluo subalpine coniferous forest of western Sichuan, China from 2002 to 2008. We used seed traps, sieved to determine the soil seed bank, and recorded seedlings. *Important findings Pinus asperata* seed rain commonly lasted from early October to the end of January or early February. There was a large annual variation in seed production, with mast years at 4-year intervals. We concluded that seed availability was not a limiting factor for natural regeneration, at least in mast years. The seed bank was transient, with losses from seed decay and seed predation being the two most important factors affecting seed bank dynamics. Only a small fraction of seeds germinated and produced seedlings, e.g., 3.6% in 2002. Higher seedling mortality greatly reduced the total number of germinated seedlings, and few seedlings survived after one growing season. Deep litter and moss were the most common substrates for *P. asperata* regeneration, having 93% of all germinated seedlings. Most surviving seedlings occurred with a substrate depth of 0－2 cm, and seedling mortality increased with greater depth, suggesting substrate depth is an important constraint on natural regeneration. Seedlings on moss substrate had greater root collar diameter, number of green shoots, estimated dry weight and annual dry weight increment but less height than those on litter substrate. In conclusion, despite a substantial seed production, high depletion of soil seed, low germination and high seedling mortality limit natural regeneration of *P. asperata*.

Keywords: Picea asperata, plantation, regeneration, seed rain, soil seed bank, subalpine coniferous

Service
- 把本文推荐给朋友
- 加入我的书架
- 加入引用管理器
- Email Alert
- RSS

作者相关文章
- 尹华军
- 程新颖
- 赖挺
- 林波
- 刘庆

forest

收稿日期: 2010-04-14; **出版日期**: 2011-01-01

基金资助:

成熟林土壤碳积累过程沿海拔梯度的动态变化与机理;国家科技支撑计划重点项目

通讯作者 刘庆 Email: liuqing@cib.ac.cn

引用本文:

尹华军, 程新颖, 赖挺, 林波, 刘庆. 川西亚高山65年人工云杉林种子雨、种子库和幼苗定居研究. 植物生态学报, 2011,35(1): 35-44.

YIN Hua-Jun, CHENG Xin-Ying, LAI Ting, LIN Bo, LIU Qing. Seed rain, soil seed bank and seedling regeneration in a 65-year *Picea asperata* plantation in subalpine coniferous, western Sichuan, China. Chinese Journal of Plant Ecology, 2011,35(1): 35-44.

链接本文:

http://www.plant-ecology.com/CN/10.3724/SP.J.1258.2011.00035 **或** http://www.plant-ecology.com/CN/Y2011/V35/I1/35

[1]

[2] Aizen MA, Woodcock H.1996.Effects of acorn size on seedling survival and growth in Quercus rubra following simulated spring freeze.Canadian Journal of Botany,74:308-314.

[3] An SQ (安树青), Lin XY (林向阳), Hong BG (洪必恭).1996.A preliminary study on the soil banks of the dominant vegetation forms on Baohua mountain.Acta Phytoecologica Sinica (植物生态学报),20:41-50.

[4] Bonfil C.1998.The effect of seed size, cotyledon reserves and herbivory on seedling survival and growth in Quercus rugosa and Q.laurina (Fagaceace). Journal of Ecology,85:79-85.

[5] Collaborating Group for Vegetation of Sichuan (四川植被协作组) (1980).Vegetation of Sichuan. Sichuan People s Press, Chengdu. (in Chinese)

[6] Ellsworth JW, Harrington RA, Fownes JH.2004.Seedling Emergence, Growth and Allocation of Oriental Bittersweet: Effects of Seed Input, Seed Bank, and Forest Floor Litter.Forest Ecology and Management,190:255-264.

[7] FAO.State of the World’s Forests. Food and Agriculture Organization of the United Nations [R]. Rome, 2001.

[8] Feller MC.1998.Influence of ecological conditions on Engelmann spruce (Picea engelmannii) and subalpine fir, (Abies lasiocarpa) germinant survival and initial seedling growth in south-central British Columbia.Forest Ecology and Management,107:55-69.

[9] Grime JP, Simpson RL.1989.Ecology of soil seed bank.USA: Academic,Press:1-21.

[10] Guariguata MR, Pinard MA.1998.Ecological knowledge of regeneration from seed in neotropical forest trees: implications for natural forest management.Forest Ecology and Management,112:87-99.

[11] Hanssen KH.2003.Natural regeneration of Picea abies on small clear-cuts in SE Norway.Forest Ecology and Management,170:199-213.

[12] Howlett BE, Davidson DW.2003.Effects of seed availability, site conditions, and herbivory on pioneer recruitment after logging in Sabah, Malaysia.Forest Ecology and Management,184:369-383.

[13] Hu R (胡蓉), Lin B (林波), Liu Q (刘庆) (2010).The effects of forest gap and litter on the early regeneration of Picea asperata plantations. Chinese Journal of Applied Ecology (应用生态学报), 2010. (in Chinese with English abstract) (Accepted)

[14] Hunziker U, Brang P.2005.Microsite patterns of conifer seedling establishment and growth in a mixed stand in the southern Alps.Forest Ecology and Management,210:67-79.

[15] Ito S, Ishigami S, Mitsuda Y, Buckley GP.2006.Factors affecting the occurrence of woody plants in understory of sugi (Cryptomeria japonica D.Don.) plantations in a warm-temperate region in Japan. Journal Forest Research,11:243-251.

[16] Kitajima K, Fenner M (2000).Ecology of seedling regeneration. In: Fenner M. ed. The Ecology of Regeneration in Plant Communities. CAB International, Wallingford, UK. p 331-359.

[17] Kjersti HH.2003.Natural regeneration of Picea abies on small clear-cuts in SE Norway.Forest. Ecology and Managment,180:199-213.

[18] Li CB (李承彪) (1990).Ecological study of Sichuan forest (四川森林生态学研究). Sichuan Published House of Science & Technology, Chengdu. (in Chinese)

[19] Liu Q(刘庆) (2002).Ecological research on subalpine coniferous Forests in China (亚高山针叶林生态学研究). Sichuan University Press, Chengdu. (in Chinese)

[20] Mary T, KalinA A, Lohengrin C.1999.Persistent soil seed bank and standing vegetation at a high alpine site in the central Chilean Andes.Oecologia,119:126-132.

[21] Masaki T, Tanaka H, Shibata M, Nakashizuka T.1998.The seed bank dynamics of Cornus controversa and their role in regeneration.Seed Science Research,8:53-63.

[22] Mori A, Mizumachi E, Osono T, Doi Y.2004.Substrate-associated seedling recruitment and establishment of major conifer species in an old-

growth subalpine forest in central Japan.Forest Ecology and Management,196:287-297.

[23] Yang YP (杨玉坡).1983.The spruce in China.Journal of Sichuan Forestry Science and Technology (四川林业科技),4:28-32.

[24] Yin HJ (尹华军), Liu Q (刘庆).2005.Seed rain and soil seed bank of Picea asperata in subalpine spruce forsests, Western Sichuan, China.Acta Phytoecologica Sinica (植物生态学报),29:108-115.

[1] 闫兴富, 杜茜, 石淳, 周立彪, 张靠稳.**六盘山区辽东栎的实生苗更新及其影响因子**[J]. 植物生态学报, 2011,35(9): 914-925

[2] 彭守璋, 赵传燕, 许仲林, 王超, 柳逸月.**黑河上游祁连山区青海云杉生长状况及其潜在分布区的模拟**[J]. 植物生态学报, 2011,35(6): 605-614

[3] 李广起, 白帆, 桑卫国.**长白山红松和鱼鳞云杉在分布上限的径向生长对气候变暖的不同响应**[J]. 植物生态学报, 2011,35(5): 500-511

[4] 安然, 龚吉蕊, 尤鑫, 葛之葳, 段庆伟, 晏欣.**不同龄级速生杨人工林土壤微生物数量与养分动态变化**[J]. 植物生态学报, 2011,35(4): 389-401

[5] 刘成刚, 薛建辉.**喀斯特石漠化山地不同类型人工林土壤的基本性质和综合评价**[J]. 植物生态学报, 2011,35(10): 1050-1060

[6] 高露双, 王晓明, 赵秀海.**长白山过渡带红松和鱼鳞云杉径向生长对气候因子的响应**[J]. 植物生态学报, 2011,35(1): 27-34

[7] 俞筱押, 李玉辉.**滇石林喀斯特植物群落不同演替阶段的溶痕生境中木本植物的更新特征**[J]. 植物生态学报, 2010,34(8): 889-897

[8] 张鹏, 王刚, 张涛, 陈年来.**祁连山两种优势乔木叶片$\delta^{13}C$的海拔响应及其机理**[J]. 植物生态学报, 2010,34(2): 125-133

[9] 何茜, 李吉跃, 陈晓阳, 陈红跃, 彭华贵, 樊顺江.**2008年初特大冰雪灾害对粤北地区杉木人工林树木损害的类型及程度**[J]. 植物生态学报, 2010,34(2): 195-203

[10] 马泽清, 王辉民, 王绍强, 李庆康, 王义东, 汪宏清.**雨雪冰冻灾害对中亚热带人工林的影响——以江西省千烟洲为例**[J]. 植物生态学报, 2010,34(2): 204-212

[11] 陈智, 尹华军, 卫云燕, 刘庆.**夜间增温和施氮对川西亚高山针叶林土壤有效氮和微生物特性的短期影响**[J]. 植物生态学报, 2010,34(11): 1254-1264

[12] 翟树强, 李传荣, 许景伟, 刘立川, 张丹, 周振.**灵山湾国家森林公园刺槐林下垂序商陆种子雨时空动态**[J]. 植物生态学报, 2010,34(10): 1236-1242

[13] 赵传燕, 沈卫华, 彭焕华.**祁连山区青海云杉林冠层叶面积指数的反演方法**[J]. 植物生态学报, 2009,33(5): 860-869

[14] 张涛, 安黎哲, 陈拓, 代春艳, 陈年来.**不同海拔青海云杉与祁连圆柏叶片抗氧化系统**[J]. 植物生态学报, 2009,33(4): 802-811

[15] 马姜明, 刘世荣, 史作民, 张远东, 缪宁.**川西亚高山暗针叶林恢复过程中岷江冷杉天然更新状况及其影响因子**[J]. 植物生态学报, 2009,33(4): 646-657