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Factors Influencing Mountain Maple Growth

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Technical Note

Silviculture

Introduction

Mountain maple (*Acer spicatum* L.) is an important woody shrub in the understory of boreal forests. It persists and grows slowly under the forest canopy for a long period of time. However, it can rapidly dominate canopy gaps caused by the removal of overstory vegetation**.** Mountain maple often interferes with the establishment of growth-desired tree species by competing for environmental resources such as light. Therefore, an understanding of the factors influencing mountain maple growth is crucial for forest management.

Highlights

- ***High soil temperature increases seedling height, root dimeter growth and total biomass accumulation.***
- ***Soil warming may enhance shade-tolerance in mountain maple but reduces seedling growth potential in high-light conditions.***

Methodology

For this experiment, we used mountain maple seeds collected from Jack Haggerty Forest in Thunder Bay, Ontario, Canada (48°22′56″ N, 89°14′46″ W). Germinated seedlings were subjected to two levels of CO_2 (392 and 784 µmol/mol), two levels of soil temperature (low 17 ºC and high 22 ºC), and two different light intensities (low and high) for two months in a greenhouse. At the end of this experiment, five seedlings per treatment were measured for growth and biomass.

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Results

In the high-light treatment. seedlings height and root collar diameter were significantly greater in both T_{soil} (Figure 1A and 1B), but soil warming also increased seedlings' height at low-light. Leaf area decreased under high-light at both T_{soil} treatments (Figure 1C), but was generally higher at low-light and warmer T_{soil}.

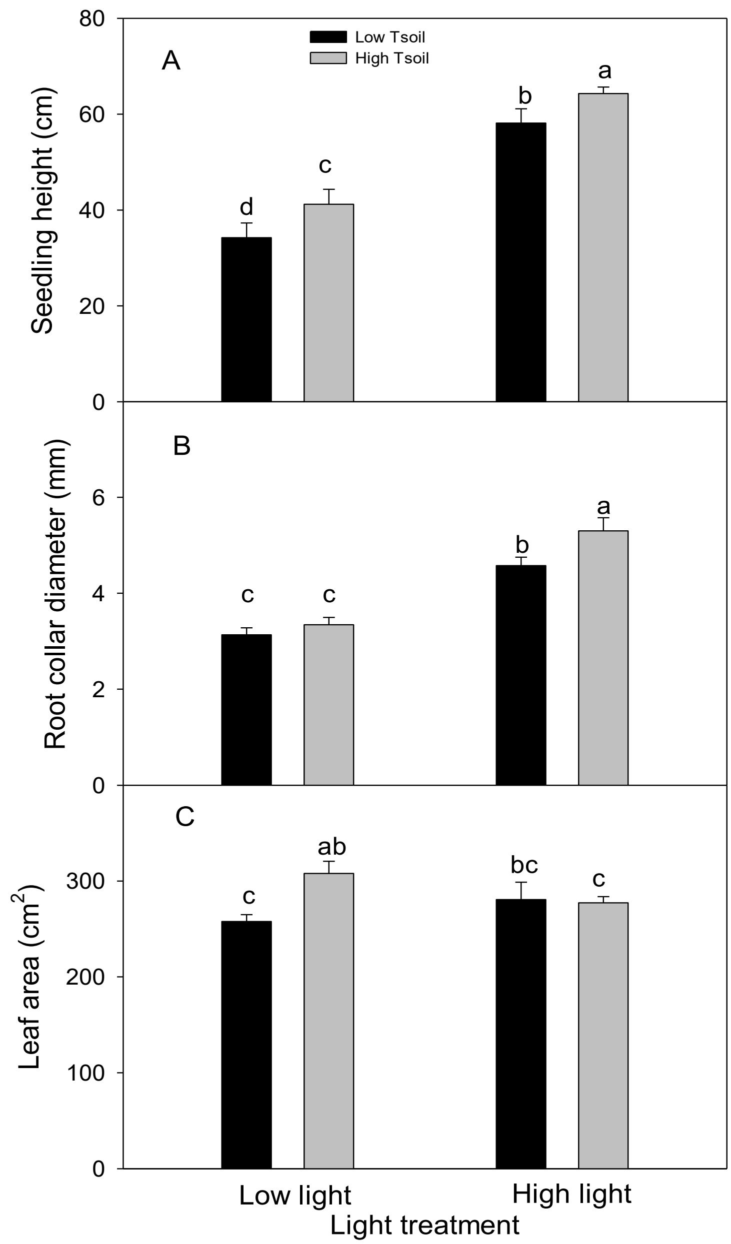

Figure 1: Effects of soil temperature (T_{soil}) and light treatment on seedling height, root collar diameter and leaf area (mean ± SE, n = 10) of mountain maple. Seedlings were exposed to two T_{soil} (17 and 22 °C) and two light treatments (low and high) for two months. Bars with same letter(s) are not significantly different (p > 0.10) from each other or one another.

Leaf area ratio (LAR) and specific leaf area (SLA) generally decreased in response to high light under both T_{soil} (Figure 2). Although, the magnitude of reduction was greatest under warmer T_{soil}. Soil warming significantly increased SLA only under low light but had no significant effect on LAR at low light (Figure 2).

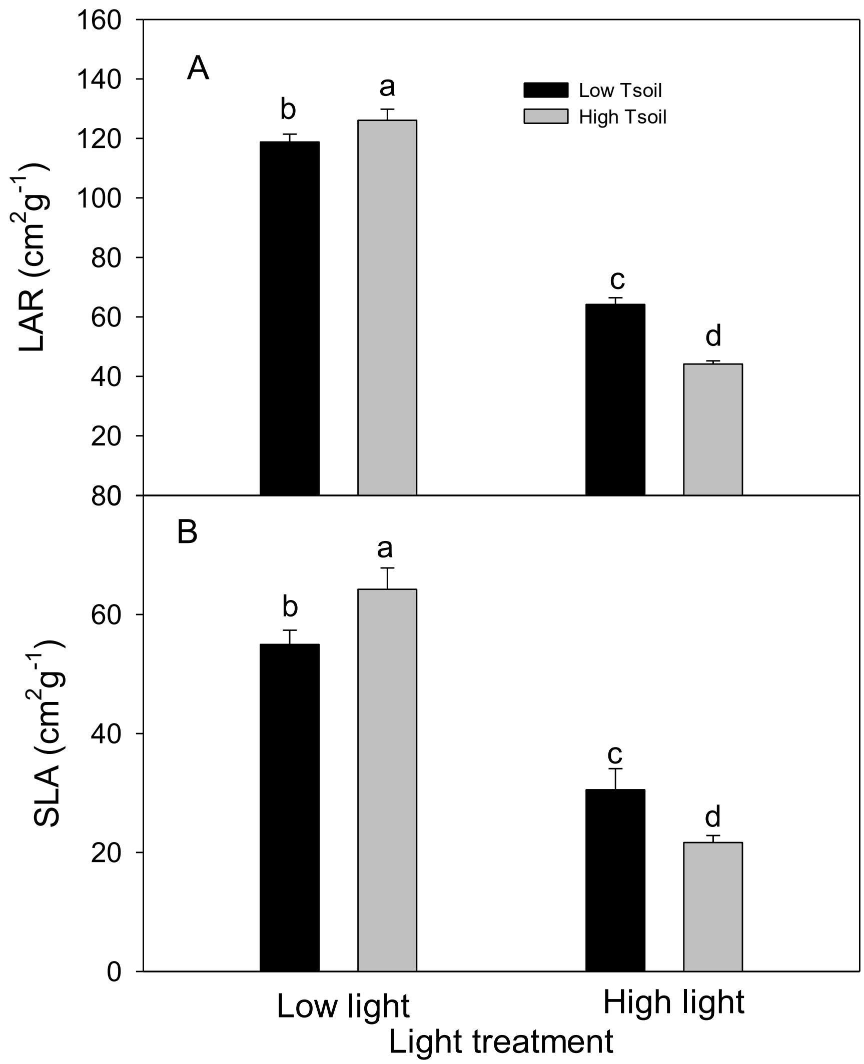

Figure 2: Effects of T_{soil} and light on specific leaf area (SLA) and leaf area ratio (LAR) (mean ± SE) of mountain maple. Refer to Figure 1 for other explanations.

Soil warming significantly increased seedling biomass and biomass allocation to root (root-shoot-ratio, RSR) under the high light (Figure 3). Both total biomass and RSR also increased at high light compared with low light treatment.

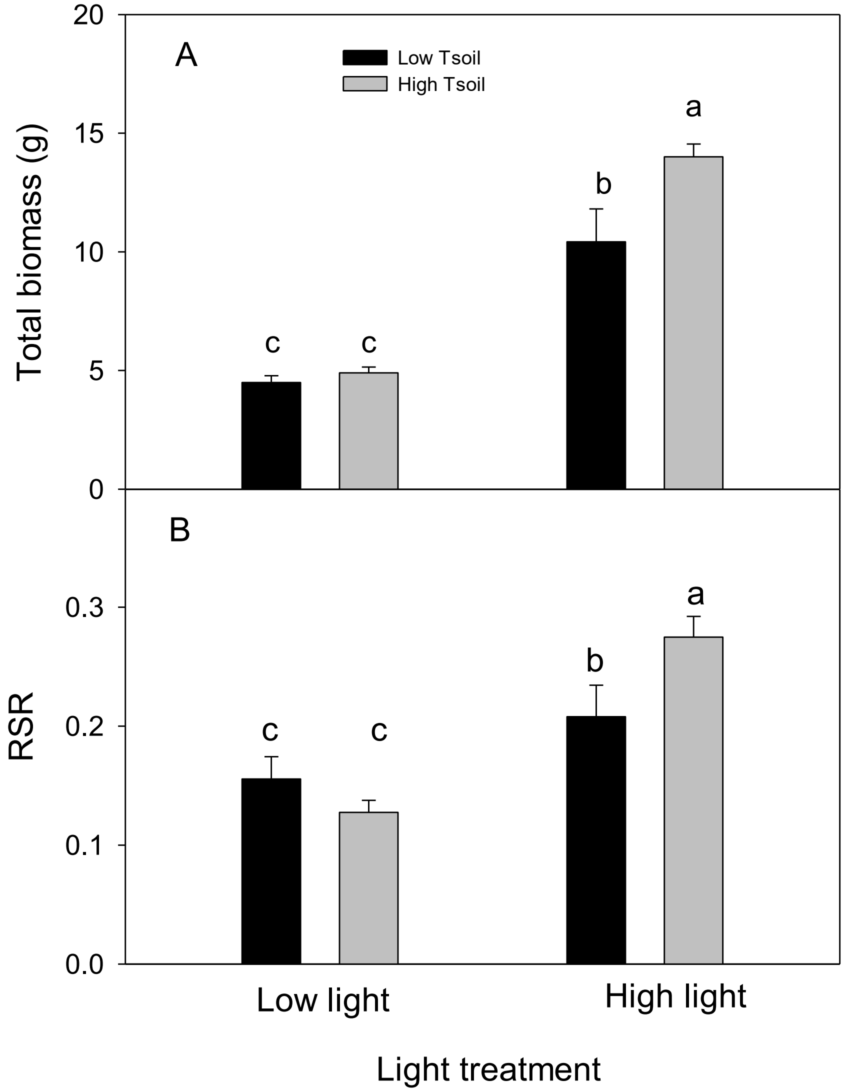

Figure 3. Effects of T_{soil} and light on total seedling biomass and root-shoot ratio (RSR) (mean ± SE) of mountain maple. Refer to Figure 1 for other explanations.

Conclusion

Mountain maple seedlings showed vigorous height and root collar diameter growth, and biomass accumulation in response to the light treatment. At high-light treatment only, soil warming increased seedling root collar diameter growth and total biomass. However, the leaf area relative to the total seedling biomass (leaf area ratio) decreased significantly in the high-light and warmer soil temperature combination. This observed reduction in leaf area ratio possibly limited the potential growth response of mountain maple to high-light and warmer soil temperature. Under the low-light environment, warmer soil temperature enhanced seedling height growth and reduced biomass allocated to root.

However, the early vigorous growth of mountain maple seedlings in high-light and warmer soil temperature can inhibit desired species establishment especially in heavy cut areas. Thus, silvicultural regimes that limit early growth of mountain maple should be implemented in areas where mountain maple is relatively abundant.

References

Archambault, L., J. Morissette and M. Bernier-Cardou. 1998. Forest succession over a 20-year period following clearcutting in balsam fir yellow birch ecosystems of eastern Quebec, Canada. Forest Ecology and Management. 102:61-74.

Aubin, I., C. Messier and D. Kneeshaw. 2005. Population structure and growth acclimation of mountain maple along a successional gradient in the southern boreal forest. Ecoscience. 12:540-548.

Lei, T.T. and M.J. Lechowicz. 1997. Functional responses of *Acer* species to two simulated forest gap environments: leaf-level properties and photosynthesis. Photosynthetica. 33:277-289.

Sullivan, J. 1993. *Acer spicatum*. In: U.S. Department of agriculture, Forest Service, Rocky Mountain Research Station. Fire Sciences Laboratory. Fire effects information system.

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