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Defoliation Dynamics and its Influence on Goldenrod Photosynthesis and Promotion

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Opinion

The effects of removing leaf area from Solidago altissima in a distributed pattern (half of every leaf removed) or a concentrated vdevelopment, and flowering were investigated in comparison to defoliated controls. Gas exchange was assessed in leaves that remained after defoliation as well as post-damage regrowth leaves (at 7, 16 and 26 days post-defoliation).

Both distributed and concentrated damage had no effect on area-based photosynthetic rates of leaves that remained after defoliation, but both forms of damage increased area-based photosynthesis of regrowth leaves at 16 days after defoliation and to a lesser extent at 26 days after defoliation [1].

After defoliation, dispersed damage, but not concentrated damage, encouraged mass-based photosynthesis in the undamaged leaves that remained. After defoliation, undamaged leaves remained, and regrowth leaves on injured plants had a larger specific leaf area (leaf area/leaf mass) than control leaves. Because of the increase in particular leaf area, mass-based photosynthesis was more substantially increased by defoliation than area-based photosynthesis [2].

Plants having distributed damage recovered from defoliation faster than plants with concentrated damage, with greater relative growth rates in the first week after defoliation. Defoliation of both types resulted in similar reductions in bloom yield [3].

These findings add to the growing body of data that scattered damage is less harmful to plants than concentrated damage, and they imply that physiological changes in leaves may play a role. Plant responses to defoliation are influenced by factors other than the overall quantity of leaf area lost. Even though the total degree of leaf area lost remains constant, the distribution of damage within the plant canopy might alter plant recovery after herbivore feeding. Herbivore eating habit varies, resulting in different patterns of damage. Because damage-induced changes in plant chemistry allow herbivores to relocate after eating a little section of a leaf, many invertebrate herbivores feed in a way that causes distributed harm on the host plant. Some insects, on the other hand, feed in a way that concentrates damage on entire leaves. Some caterpillars consume a leaf fully before moving on to another, while others ingest a leaf partially and then excise the remainder by biting through the petiole, causing the plant to lose the entire leaf [4].

Despite the fact that it has the potential to explain plant responses to defoliation, little research has been done to far on how the pattern of damage affects photosynthetic rate. Furthermore, no link has been established between variations in photosynthetic rate and plant growth or reproduction in these experiments. I investigated how scattered and concentrated damage affects gas exchange, growth, and flowering of Goldenrod, Solidago altissima, in this study. The following hypotheses were tested in my experiment: (1) compensatory photosynthesis is more likely in an undamaged leaf than a damaged leaf, for the reasons outlined above; (2) plants should recover more quickly from dispersed damage than concentrated damage, because dispersed damage should enhance photosynthesis more than concentrated damage; and (3) plants should recover more readily from dispersed damage than concentrated damage, because dispersed damage should enhance photosynthesis more than concentrated damage [5].

Solidago altissima L (Composite) is a perennial forb native to North America that thrives in the northeast. Ramets sprout from overwintering rhizomes when the earth warms in the spring, and the unbranched shoots grow swiftly into the summer. Flowering occurs from late summer to early October, seeds are dispersed in the fall, and all above-ground parts die back each winter. Field-collected seeds were planted in a greenhouse on March 24, 1995, using a peat moss-based potting mix. Seedlings were planted in 20 centimetre pots on May 28. The potted Goldenrods were arranged outside on a flat roof adjacent to the greenhouse at Williams College in Williamstown, Massachusetts. The plants had only one stem at first. Buds began to form at the base of the main stem around halfway through the experiment, resulting in a plant with a central stem surrounded by several lateral stems [6].

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