

## Salivary cues: Simulated deer browsing induces changes in plant hormones and defense compounds in tree saplings

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Young trees in temperate forests are often browsed by mammalian herbivores, such as deer. Studies on insect herbivory have shown that plants respond to herbivory by upregulating growth hormones and producing defense compounds. However, it remains unknown whether the same response mechanisms are induced when young trees are browsed by mammals. We also wanted to know if tree saplings can detect whether they are just injured mechanically, or whether they are browsed by deer. To answer these questions, we simulated deer browsing on field grown sycamore maple (*Acer pseudoplatanus*) and European beech (*Fagus sylvatica*) saplings by clipping their buds in winter and leaves in summer. For some of the saplings we additionally applied deer saliva with a pipette on the cut surface.

We found that two hours after clipping, wound hormones, called jasmonates, increased in the remaining maple buds and beech leaves. This is a well-known response to herbivory, but differed here between tree species and developmental stages. In maple buds, growth hormones (cytokinins) also increased after clipping, probably because if maple loses its one main apical bud through browsing, the upregulated growth hormones will help activate lateral buds for regrowth. Beech has more equal buds and may therefore not respond as strongly to clipping when losing one. Saliva application did not amplify wound hormone responses, but led to increased levels of the signaling



*Simulating deer browsing by clipping a tree sapling's apical bud and applying deer saliva on the fresh cut (here on *Acer pseudoplatanus*). Photo by Bettina Ohse.*

hormone salicylic acid in beech leaves, suggesting that the trees were able to detect something in the deer saliva. Interestingly, changes in defense compounds were found only when deer saliva was also applied, which means that these compounds are only regulated specifically after deer browsing and not after any mechanical damage. Not all defense compounds changed in the same way. Mainly hydrolysable tannins increased, although they are not harmful to deer. Condensed tannins, which occurred only in beech and are known to be avoided by deer because they negatively impact digestion, did not change, and may rather act as a constitutive defense, i.e. one that is permanently present.

We conclude that tree saplings are able to detect and specifically respond to mammalian herbivory, although strategies to respond to mammalian browsing seem to be species-specific, probably based on distinct combinations of morphological and chemical characteristics.