

The bonsai effect: Wounded plants make jasmonates, inhibiting cell division, stunting growth

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It is well known that plants growing under unfavourable conditions are generally smaller than those growing in stress-free conditions: indeed it is estimated that in the US, abiotic stress reduces the yield of agricultural crops by an average of 22%. A spectacular example of the effect of stress – in this case, repeated wounding – on plant growth is given by bonsai trees, in which every aspect of their stature, including height, girth, and size of leaves, is uniformly reduced to as little as 5% of that of their untreated sister trees. However, the mechanism of wound-induced stunting remains obscure.

Plant growth results from divisions of "stem cells" in apical meristems that are located in the very tips of green shoots and roots. The shoot apical meristems are not only tiny, (0.1 to 0.3 mm diameter), but are normally hidden from view by the very young leaves emerging from the base of the meristem. Thus, the initial growth and shape of leaves is by cell division, and more than 90% of leaf growth is by subsequent cell expansion.

Reporting in the online, open-access journal *PLoS ONE* on November 11, Yi Zhang and John Turner at the University of East Anglia found that when leaves of the model plant *Arabidopsis* are wounded, cell division in the apical meristem is reduced, growth of the plant is arrested within days, and the new leaves grow to only one-half of their normal size although the size of leaf cells is unaffected.

Unexpectedly, the suppression of cell division in the apical meristem occurs through a signal pathway initiated by the wound hormone, jasmonate, which is synthesised in the damaged mature leaves. Mutant Arabidopsis lines unable to synthesise or to respond to jasmonate are not only larger than normal plants, but their growth is not reduced by the wound stress.

The researchers note that this finding opens the possibility of improving crop growth through the manipulation of the jasmonate signal pathway.

Citation: Zhang Y, Turner JG (2008) Wound-Induced Endogenous Jasmonates Stunt Plant Growth by Inhibiting Mitosis. PLoS ONE 3(11): e3699. doi:10.1371/journal.pone.0003699
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