



# RELEASE OF PENTENOLS FROM WOUNDED AND SENESCING LEAVES AS A RESULT OF LIPOXYGENASE-TYPE REACTIONS - OBSERVATIONS OF HIGH MIXING RATIOS ON THE SONNBLICK

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## ABSTRACT

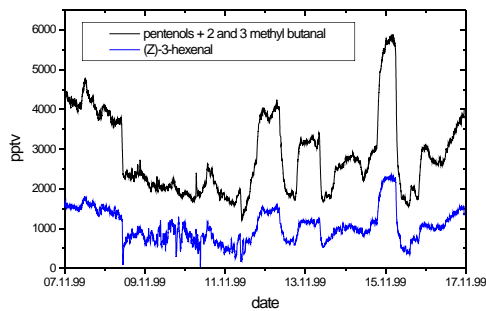
We used a PTR-MS-GC system to identify lipoxygenase peroxidation products during freezing induced wounding, senescing and general wounding in various plants. In all laboratory experiments we observed substantial production of 1-penten-3-ol, cis-2-penten-1-ol, hexenal and hexenol isomers, all reactive oxygenates that contribute to tropospheric chemistry. We want to draw special attention to the production of pentenols, compounds which have not been reported to be present in large amounts in the atmosphere.

PTR-MS (LINDINGER et al) online measurements on the Sonnblick observatory in the Austrian Alps (3106m) show that even in the free troposphere substantial amounts of pentenols can be present as the result of ongoing freezing and senescing in deciduous plants. We also observed high mixing ratios of hexenals, acetaldehyde, methanol, 2-methylbutanal, 3-methylbutanal, EVK and acetone, all coming from local vegetation near the Sonnblick.

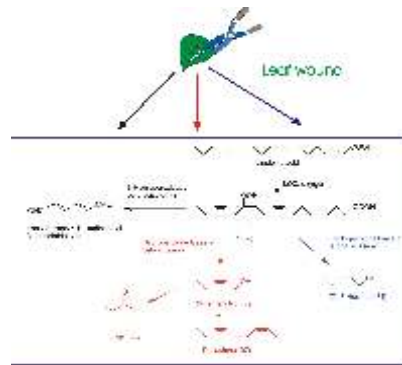
## RESULTS

Extremely high concentrations of pentenols, methylbutanals and (Z)-3-hexenal were measured at the Sonnblick (3106 m) using PTR-MS.

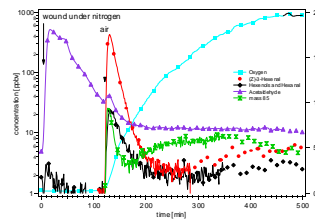
These compounds are important precursors for Ozone formation.  
Where do they come from?



## Enzymatic Production of Wound Induced Compounds

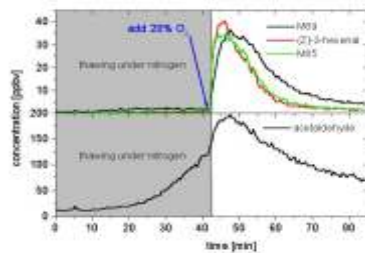


Whenever a leaf is wounded, wound compounds are produced under aerobic conditions along the scheme shown here.



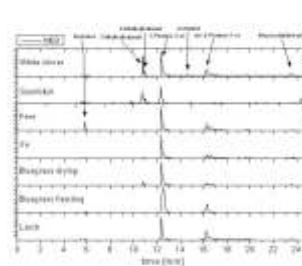
This was confirmed in laboratory experiments using PTR-MS (FALL et al). Leaves were wounded in a nitrogen atmosphere. As soon as O<sub>2</sub> was added, strong production of wound compounds occurred.

## Release of wound compounds with white clover (trifolium repens) after freeze thawing

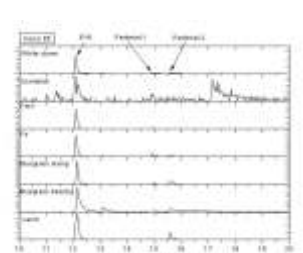


Freezing is also an efficient way of leaf wounding, as the formation of ice crystals destroys the cells in plants. Laboratory experiments show the appearance of strong emissions of (z)-3-hexenal, acetaldehyde and compounds appearing at masses 69 and 85, which were identified by GC-PTR-MS as being predominately pentenol and EVK respectively.

## Identification of mass 69<sup>+</sup> with GC-PTR-MS



## Identification of mass 85<sup>+</sup> with GC-PTR-MS



## REFERENCES

Fall R., T. Karl, A. Hansel, A. Jordan, W. Lindinger; Volatile organic compounds emitted after leaf wounding: On-line analysis by proton-transfer-reaction mass spectrometry; JGR, Vol 104, 15963-15974, 1999  
Lindinger, W., A. Hansel, and A. Jordan, On-line monitoring of volatile organic compounds at pptv levels by means of Proton-Transfer-Reaction Mass Spectrometry (PTR-MS). Medical applications, food control and environmental research, *Int. J. Mass Spectrom. Ion Proc.*, 173, 191-241, 1998.

## ACKNOWLEDGMENTS

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