

(05-5-05)

Tobacco trichomes exudate Zn-containing Ca carbonate grains

Yong-Eui Choi¹, Emiko Harada², Geraldine Sarret², Alain Manceau²

¹Division of Forest Resources, Kangwon National University, Chunchon 200-701, Korea

²Laboratoire de Geophysique Interne et Tectonophysique, University of Grenoble and Centre National de la Recherche Scientifique (CNRS), Boite Postale 53, 38041 Grenoble cedex 9, France

Objectives

Previously, we showed that the glandular trichomes of tobacco exposed to Cd excreted Cd-containing particles. However, this mechanism is not well understood. The aim of the present work was to clarify several open questions arose from our previous works on tobacco plants. First, can trichomes exude any other heavy metal, such as Zn? The second question concerned the mineralogical nature of the excreted grains. The third concerned the chemical status of heavy metals in these inorganic particles. This information is important to understand the metal homeostasis network and the mobility of metals in plant body and to discuss about their possible release in the environment.

Materials and Methods

1. Material

Plant – *Nicotiana tabacum*

2. Methods:

Tobacco plants were grown in hydroponic and *in vitro* conditions in the presence of toxic level of Zn with or without supplement of Ca. The grains produced on the leaf surfaces were investigated by VP-SEM, electron microscopy coupled with microanalysis (SEM-EDX), synchrotron-based micro x-ray microfluorescence (μ XRF), micro-X-ray diffraction (μ XRD) and micro-extended x-ray absorption spectroscopy (EXAFS).

Results and Discussion

Tobacco was exposed to various Zn and Ca concentrations. Exposure to Zn induced an increase of the trichomes density on the leaves. For plants grown with a high Ca, the predominant mineral in the grains was calcite (Ca carbonate) substituted with Mg and/or Mn, and Ca oxalate was detected as a minor species. When plants were exposed to toxic level of Zn, Zn-containing grains were produced on the trichomes, and in this case amorphous Zn phosphate was the only species identified. When plants were treated with Zn and the supplement of Ca, about half of Zn present in these grains was incorporated in calcite, and the other half was present as amorphous Zn phosphate. Numerous plant trichomes have been shown to concentrate metals. This study shows that tobacco trichomes have an active role in Zn immobilization and discharge, and reports for the first detail characterization of extracellular-crystallized mineral by a higher plant. This mechanism can be enhanced by providing a high Ca supply to the plant.