

# Studies on the copper uptake by the plant-feeding nematode, *Xiphinema vuittenezi*

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## ABSTRACT

Copper is an important microelement released both into natural and agro-ecosystems in considerable amounts. Some pesticides with  $\text{CuSO}_4$  or  $\text{Cu}_2\text{OH}_3\text{Cl}$  content are accepted as fungicides even in organic agriculture. This way a plant feeding nematode may be affected by copper treatment two important ways. Technically, it can be considered a non-target organism, while copper toxicity can still be important in decreasing its population levels in vineyards or fruit orchards. Therefore, a set of experiments have been carried out on the dagger nematode *Xiphinema vuittenezi* Luc, Lima, Weischer & Flegg 1964 to explore its responses to copper treatment and study the characteristics of copper uptake and distribution in it.

First, a mortality test was performed from which the responses to different concentrations of  $\text{CuSO}_4$  were recorded. Second, copper uptake was studied after 1, 3, 6, 24 48, 120 hours and copper content in nematodes was measured by Total X-Ray Fluorescence (TXRF) from single specimen samples. Third, single specimens were studied with focussed ion beam electron microscopy (FIB SEM) and distribution of copper was observed along a cross section of the body with energy dispersive X-ray spectrometry.

*Xiphinema* test showed a stepwise increase in mortality along the logarithmic concentration gradient and sensitivity much higher than the rhabditid bacterivore nematodes also tested. TXRF measurements also showed a clear increase in *Xiphinema* copper uptake in the function of concentration and time. FIB SEM and XRS revealed the highest copper concentrations in the cuticle both dorsally and ventrally. Besides, another peak of copper content was noticeable in the intestinal region. This distribution pattern can be a consequence of copper uptake through the cuticle and probably also from the test substance through the alimentary system (to a lower extent).

Based on our results, *Xiphinema vuittenezi* was proved to be a sensitive indicator to copper treatment and a relatively easy to handle organism for microanalytical measurements. Furthermore, determination of nematode elemental composition seems to be a feasible and useful tool to reveal the physiological background of toxicity effects.

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