The tri-trophic transfer of Zinc to newly emerged seven-spotted ladybirds (Coccinella septempunctata) from sewage sludge amended soil.

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Introduction

The recycling of sewage sludge to agricultural land is widespread and may introduce potentially toxic elements (PTEs), including Zn, into the food chain¹. The exposure to domestic animals and humans to PTEs is well controlled but the fate of PTEs within the invertebrate component of agricultural ecosystems is poorly understood.

Methodology

Grain aphids (Sitobion avenae L.) were harvested from spring wheat (Triticum aestivum L. cv. Alexander) propagated in agricultural soil amended with sewage sludge (see Table 1). Harvested aphids were frozen until they were fed daily to fourth instar seven-spotted ladybird larvae in surplus of the larvae’s daily food requirement. Feeding was continued until pupation and on emergence adults and pupal exuviae were analysed for Zn.

Results

• Bioaccumulation of Zn in wheat plants reflected the level of sludge amendment (see Table 1 & Figure 2).
• Transfer of Zn from the wheat plants to aphids resulted in the largest magnification of Zn (see Table 2).
• There was no bioaccumulation in newly emerged adult ladybirds or in their exuviae.

Discussion and conclusion

• There was no bioaccumulation from prey to predator.
• Zn levels in the exuviae did not differ significantly between treatments. This suggests that Zn is not sequestered and excluded in the exuviae during pupation.
• It was concluded that there must be another mechanism for regulating Zn body burden in the fourth instar. This mechanism is currently under investigation.

References