Crop and urban systems

Efficacy of anticoagulant rodenticides applied to Norway rats (*Rattus norvegicus*) in the sewer system of Berlin, Germany

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When second generation anticoagulant rodenticides used to control rats in sewers come in contact with water, the active substances accumulate along the aquatic food chain. Residues of these substances have already been detected in fish and their predators, such as Eurasian otters (*Lutra lutra*), cormorants (*Phalacrocorax carbo*), and common merganser (*Mergus merganser*). Despite their potentially detrimental effects to the wider ecosystem, rodenticides are still used to control urban rats in sewage systems. However, some cities like Zurich (Switzerland) and Erfurt (Germany) are managing urban rats without using rodenticides in the sewers.

Against this background, we investigated the efficacy of chemical rat control in sewers of six study areas in Berlin. We determined with two non-invasive monitoring methods the degree of rat infestations in the sewage system and adjacent parks, backyards or waste disposal sites at three time points: before, after, and six months after rodenticide application in the sewers. Underground, we applied wildlife cameras and measured feeding of a non-toxic bait; aboveground, we counted rats with a thermal camera and conducted a feeding census. Furthermore, we caught 262 rats and used their muscle tissue for genetic analysis. For the latter, an array with 96 SNPs (single nucleotide polymorphisms) was established to determine individual genotypes using 89 samples from rats of different parts of Berlin. Comparison of genotype frequencies at sampling sites before and after the treatment will show whether local gene pools have changed in size and allele frequencies after rodenticide application, and if rat packs have recovered within six months through reproduction or migration. In addition, we studied if individuals from above and underground were reproductively connected or separated. The latter would question the efforts to control rats in sewers, as they pose a neglectable health threat if they only occur underground.

First results show that the chemical control in the sewers initially reduced the number of underground rats, but to a degree only that allowed the populations to recover within six months. The aboveground populations appeared to be largely unaffected by the chemical control in the sewers. These results and the insights into the ecology of urban rats will help to develop a new urban rat management plan in order to use rodenticides only where necessary and effective.

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