Fluctuation and fixation of rodenticide resistance alleles in *Rattus norvegicus*

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Abstract

Worldwide control of commensal rodents relies on anticoagulant rodenticides (AVKs). As with many other pesticides used continuously over long periods of time, the target species, in particular Norway rats (*Rattus norvegicus*) and House mice (*Mus musculus domesticus*), are increasingly becoming resistant. Several allelic forms of the gene involved in the resistance (VKORC1) have been recently identified in *R. norvegicus* (Grandemange et al., 2007, 2009, 2010). The occurrence and frequency of resistance alleles in rodent populations depends on selection pressures, such as the frequency and intensity of anticoagulant rodenticide treatments, and rodent population dynamics, including spatial structure, population size and dispersal. In commensal situations, the spatial distribution of favorable conditions for the establishment of rat infestations depends on the density and configuration of the human habitat. In an agricultural landscape rats will occur as a metapopulation, with sub-populations mainly located within the farmsteads, where resources are most easily available. The mean dispersal distance for commensal rats across non-commensal habitats is known to be highly restricted, i.e. 300 meters (Le Louarn and Quéré, 2003). Passive dispersal may however occur over longer distances due to human transportation (Le Louarn and Quéré, 2003). In such a context, the genetic structure of rat populations will be shaped by interplay between migration (gene flow), genetic drift and local selection (cost and benefit of the resistance). To disentangle the relative influence of these three evolutionary forces on the fluctuation and fixation of resistance alleles, we compared the genetic structure of rat populations at the VKORC1 gene and microsatellite markers (Bryja et al., 2007). This comparison was firstly done in a metapopulation context, considering two groups of seven and eleven farms, respectively, located near the city of Lyon in France. Rats were trapped and genetic material collected within each farm before a rodenticide treatment was carried out at one of the farms. A second sampling was then conducted to follow the restoration/recolonisation of the rat population that had undergone the rodenticide treatment. In a further experiment, the same comparisons will be carried out for an isolated population, using samples collected from an island in Brittany, before and after the population was treated with rodenticides.

Keywords: microsatellites, population dynamics, *Rattus norvegicus*, resistance, rodenticides, selection pressure

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