# Distribution and frequency of VKORC1 sequence variants conferring resistance to anticoagulants in *Mus musculus*

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House mouse tissue samples from 30 populations in Germany, Switzerland and the Azores were analyzed for sequence changes in the gene VKORC1, which potentially confer resistance to anticoagulant rodenticides. Except for one population originating from south Germany, sequence variants were found in individuals from all locations analyzed (29 out of 30 sites surveyed), with less than 10 % of the individuals matching the wild-type genotype. The most frequent and widespread amino acid substitutions were Leu128Ser, Tyr139Cys and a group of linked sequence changes (Arg12Trp/Ala26Ser/Ala48Thr/Arg61Leu). These three genotypes occurred either alone or in combination with each other or with other less frequent sequence changes. Where they occurred as the sole variant, the proportion of homozygous animals was 72-83 %, suggesting a high selection pressure due to permanent pest control in these populations.

An evaluation of published data revealed that the three frequent sequence changes found are associated with a substantial loss of rodenticide efficacy of first generation anticoagulants (e.g. warfarin, coumatetralyl) as well as the second generation compound bromadiolone and most probably also difenacoum. Further studies are required to investigate the effect on compounds of higher potency, in particular, where combinations of sequence changes occur in one individual.