

# Black rat (*Rattus rattus*) and brown rat (*Rattus norvegicus*) vitamin K 2,3-epoxide reductase single nucleotide polymorphisms in Spain

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## Introduction

Resistances to anticoagulant rodenticides (Ars) are mainly associated with mutations or SNPs in the *vkorc1* gene. The aim of this study is to monitor the presence of SNP that can favour resistance in rodent populations in Spain. Furthermore, we aim to characterize binding properties of Ars to VKORC1 with new SNP by in silico analysis of binding properties.

## Materials & Methods

### Sampling

- Using a kit designed together with ANECPLA
- Stool and tail samples
- Specie identification (cyt b)

### SNP monitoring

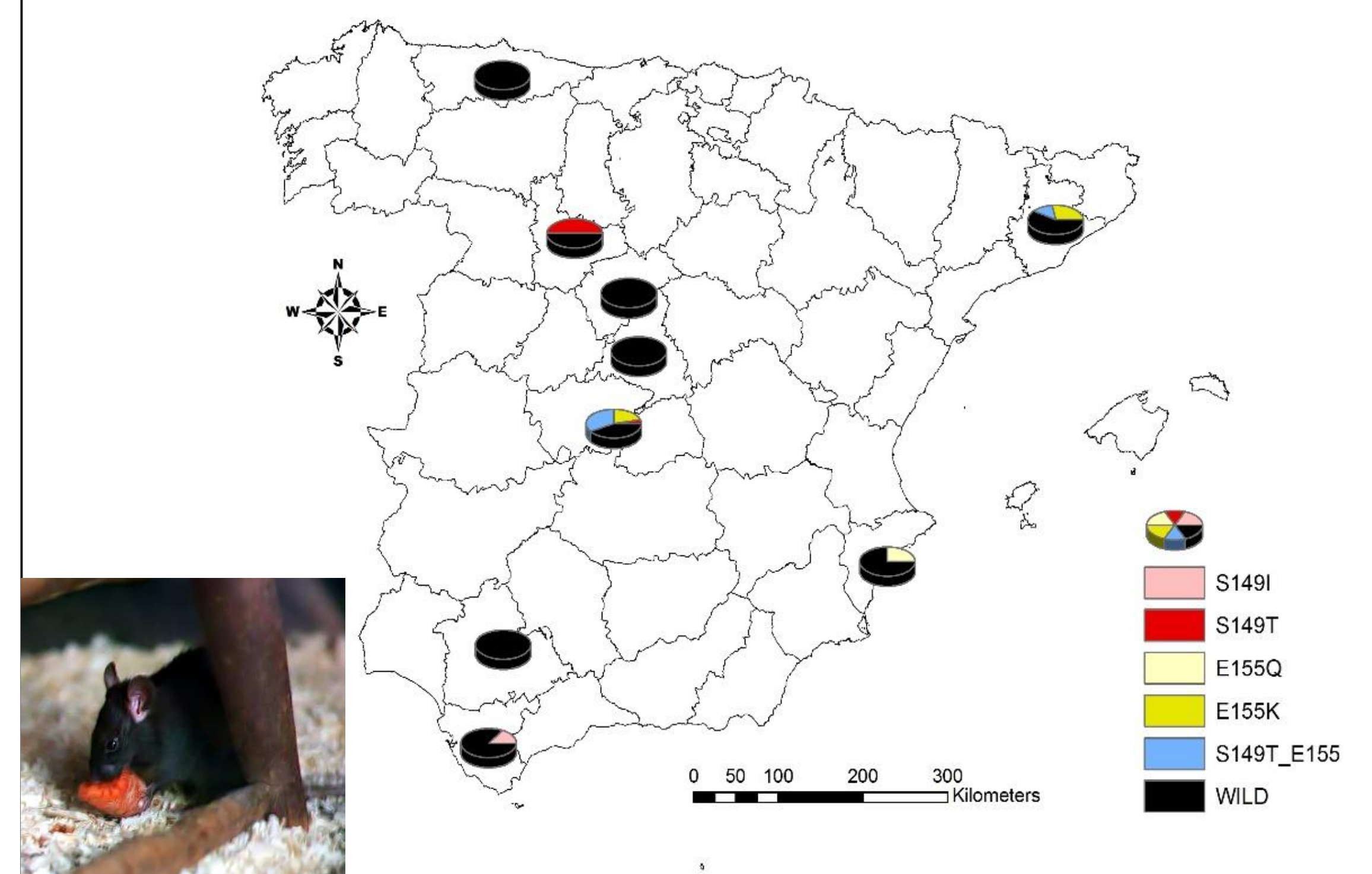
- Homogenization (1)
- DNA extraction (BIOTOOLS)
- Vkorc1 exon 3 gene amplification (2)
- Sequencing (ABI PRISM)

### Molecular Docking

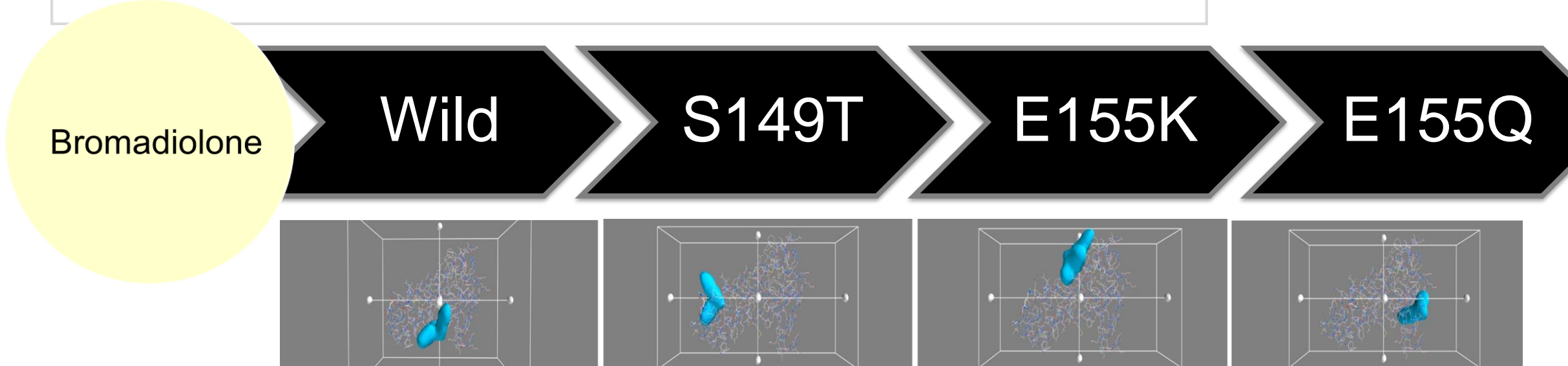
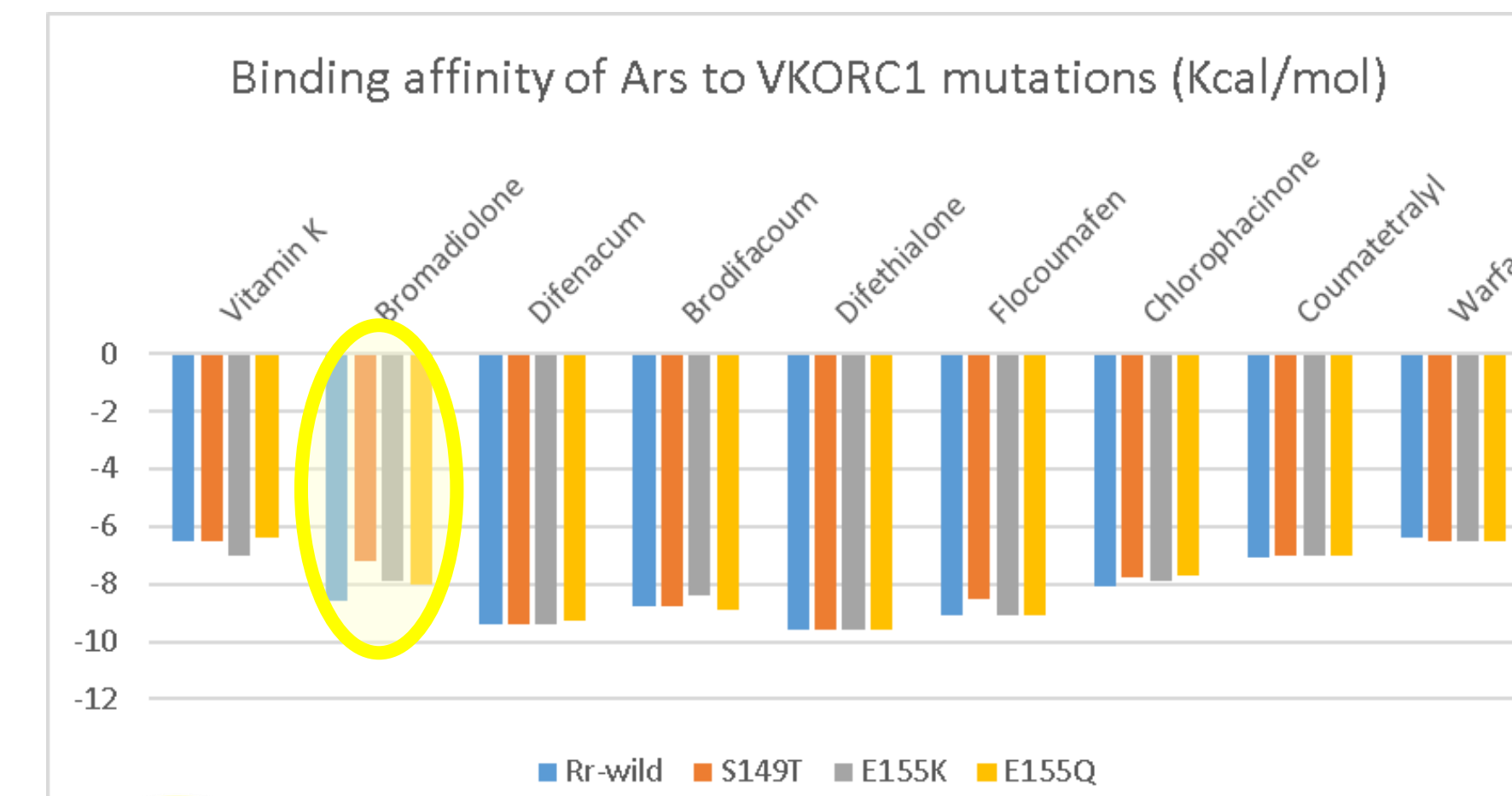
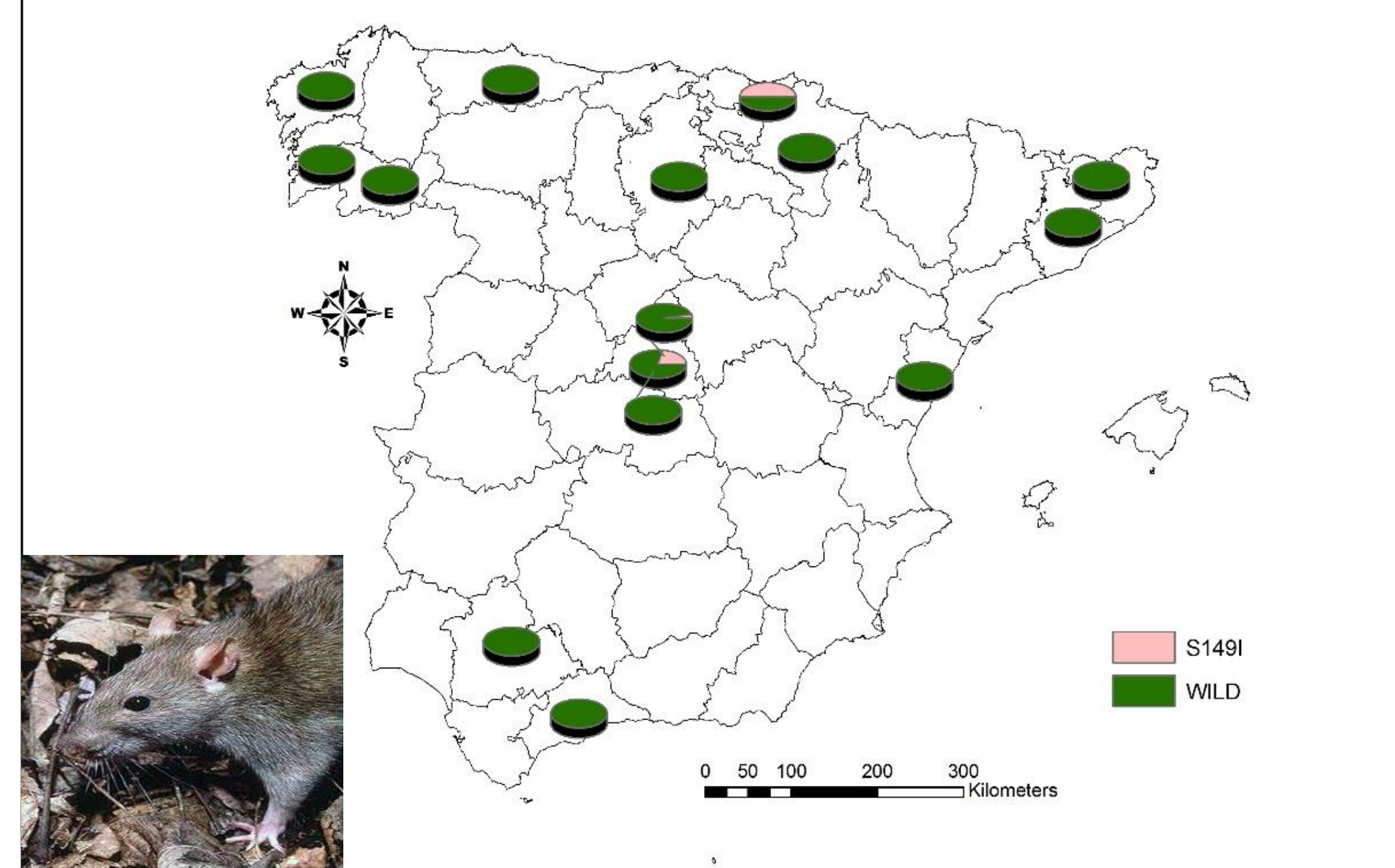
- Ars Ligands
- VKORC1 models
- AutoDock Vina virtual screening (PyRx 0.9.4)

## Results

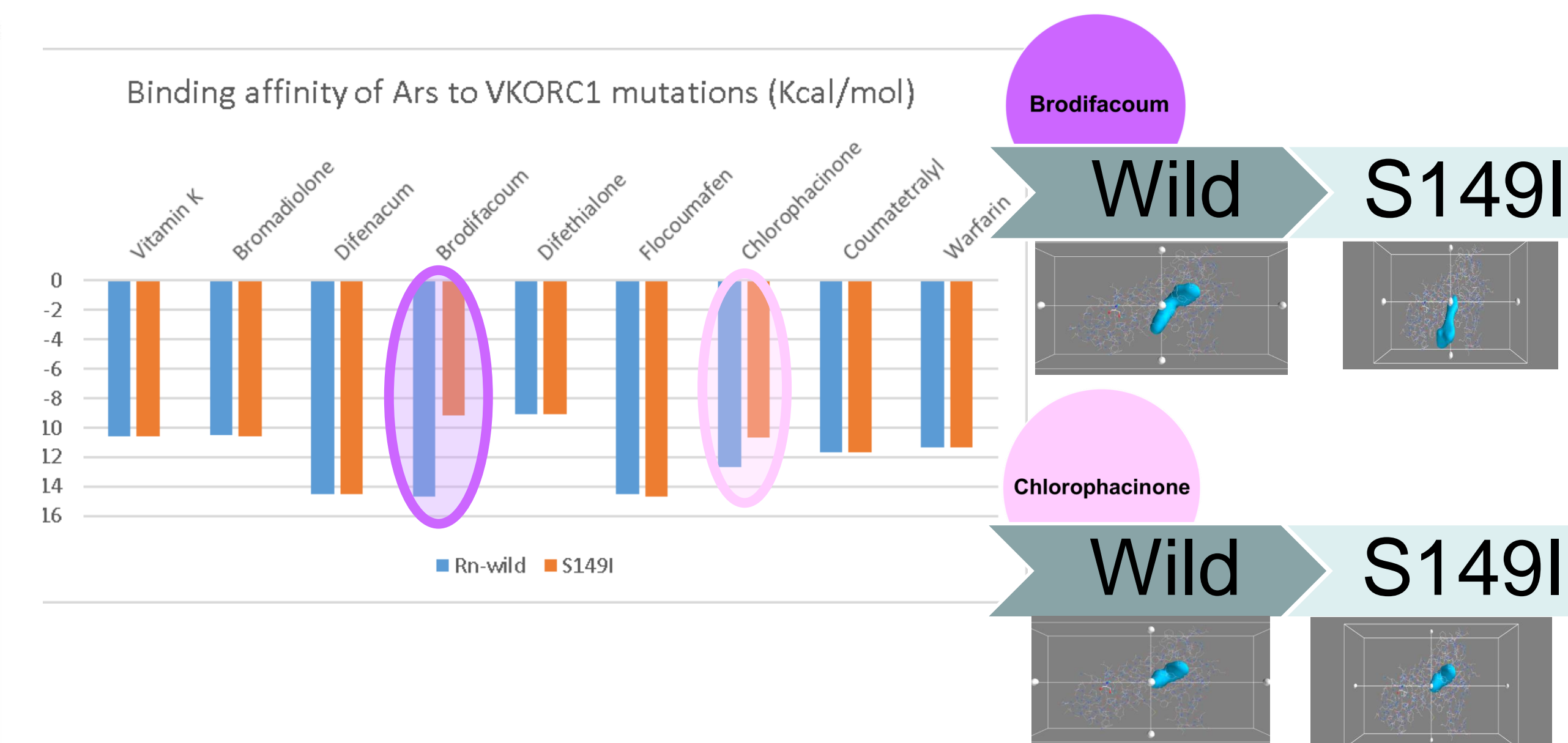
### Black rat SNPs located at different positions



### Brown rat SNPs located at different positions



Black rat mutants diminished the binding affinities of Bromadiolone in a ranking: S149T (16%) > E155K (8%) > E155Q (7%).



Brown rat S149I mutant diminished the binding affinities of Brodifacoum (37%) and Chlorophacinone (17%).

## Conclusions

This study first describes targeting genetic resistance in rat species populations in Spain.

The polymorphic genomic positions detected showed variations in either brown rat and black rat, changing with area of research.

First estimation of possible correlations of the mutations detected with AR resistance were also obtained by studying the effects of mutations in the binding of Ars by computational binding predictions.

## Further Research

Pest control management may best follow resistance evolution in a time and area dependent manner by monitoring the genetics of *vkorc1* or other metabolic pathways in rodent populations

## References and cited literature

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- Grandemange, A., Lasseur, R., Longin-Sauvageon, C., Benoit, E., Bery, P., 2009b. Distribution of VKORC1 single nucleotide polymorphism in wild *Rattus norvegicus* in France. Pest Manage. Sci. 66, 270-276.



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