The Tempo & Mode of Toxicant Sensitivity Evolution

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macroevolution, ecotoxicology, phylogenetic comparative methods

We use data from standardised ecotoxicological dose-response experiments to model how species' sensitivity to a wide range of toxicants have evolved in a phylogenetic comparative framework. Here we show results from a subset of this dataset, focusing on acute toxicity in fish species.

Here's what we did:

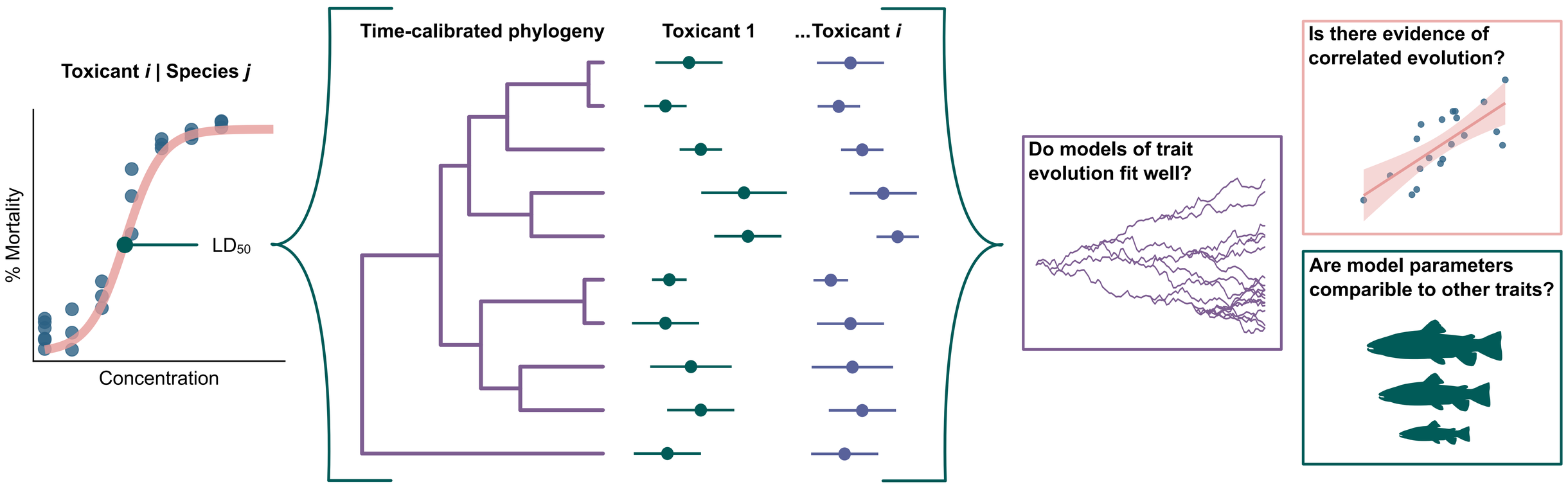


Figure 1: Species sensitivities for various toxicants (LD_{50}) were extracted from EPA ECOTOX knowledgebase, and modelled as quantitative traits using time-calibrated phylogenies from TimeTree5.

Phylogenetic diversity

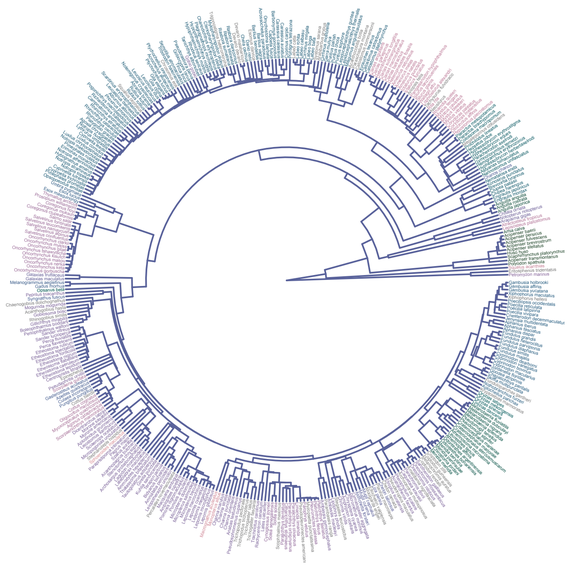


Figure 2: Within the fish subset we have 300+ species across 28 orders with sufficient data.

Toxicant diversity

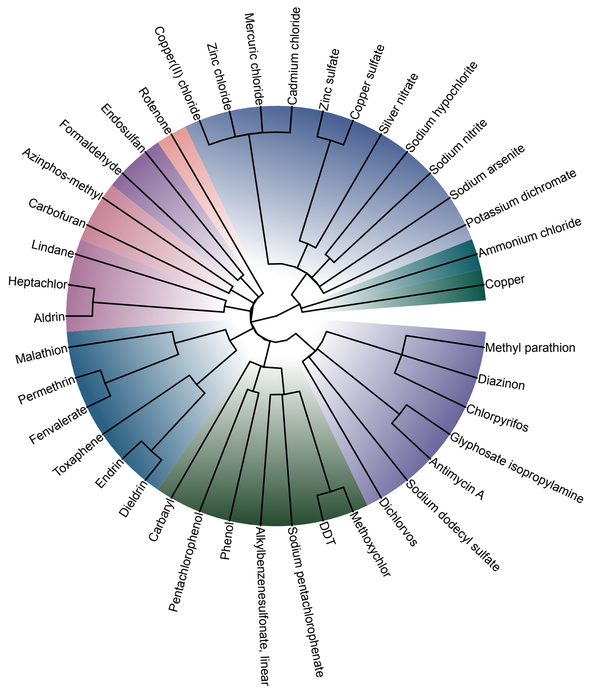


Figure 3: Our dataset contains responses for a wide variety of toxicants.

Mode of evolution

Figure 4: Generally, an OU model fits better than a BM model, as is often found in other large trait datasets.

Correlated evolution

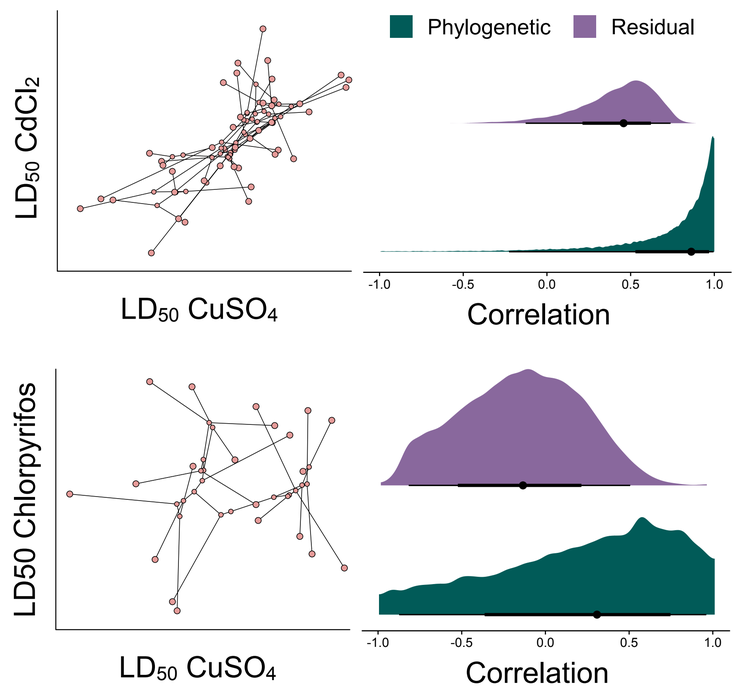


Figure 5: Phylogenetic correlations between toxicants are highly variable, but often positive.

Evolutionary rates σ^2

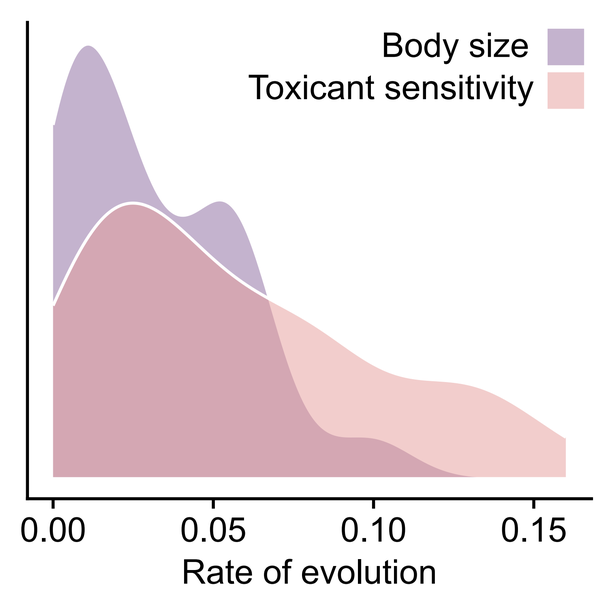
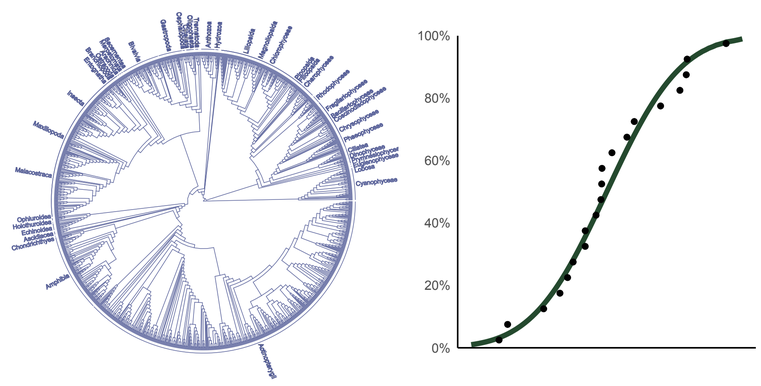


Figure 6: Brownian motion rate of evolution (σ^2) across toxicants is of a similar magnitude to published estimates of other log scale traits.

Future directions & challenges



- Further explore multi-rate/peak models.
- Implications for ecotoxicological modelling assumptions?
- What stands out to you? What questions do you have? Help us to summarise this dataset!

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