*Summary*

In this study, we describe the presence of a recently discovered snail’s immune response to nematodes by means of shell encapsulations across the Naesiotus genus radiation of the Galapagos islands. We qualitatively quantify the nematode loads found in the shells, and show that we can measure the nematode diversity found in each host species using DNA sequencing. We discuss the implications of these findings in light of the potential unparalleled advantages of this host-parasite system to investigate the interplay between biogeographic, evolutionary, and ecological processes in snail radiations globally.

INTRODUCTION

**[P1: Interplay between macroevolution and interaction networks]**

* Many prominent evolutionary theories hypothesize that interactions affect macroevolutionary dynamics (adaptive radiations, escape-and-radiate,Red queen theory, Geographic mosaic of coevolution).
* A community perspective was introduced by network theory.
* Theoretical work on network evolution.
* Prominent questions.

[**P2: Lack of empirical data**]

* Lack of empirical systems to test theory.
* Theory also remains underdeveloped and needs feedback from empirical data (example of network roles – macroevol. Patterns found in Burin et al. 2021)

[**P3: Island radiations as key empirical systems to test predictions – but difficult sampling**]

* The characteristics of island radiations make them ideal systems to test these ideas.
* Examples of contributions of island radiations studies to the network-macroevolution questions (competition in Caribbean Anolis, seed dispersal in Galapagos finches-plants or Hawaiian honeycreepers).
* Opportunity to take advantage of well-described evolutionary history and traits in iconic radiations.
* These are still very scarce, and sampling is costly and complex (remote islands, incompleteness of interactions data).

[**P4: Shell encapsulations and island radiations of snails as a suitable system to overcome these challenges**]

* Recently discovered interaction mechanism
* Advantages (time preservation, Nematode DNA, adaptive changes in shell)
* Alongside with these advantages, snail-parasite systems are particularly suitable systems as they protagonize numerous island radiations (Hawaii, Galapagos, Seychelles, Japan, Phillippines, New Zealand, Caribbean islands, Maurittian, Canary islands, Madagascar)
* We therefore think that snails-nematode encapsulations in island radiations could provide unparalleled data to investigate the interplay between evolution, interactions, and adaptation, but it is currently unknown if this defense mechanism is present in these groups and if we can obtain this data.

[**P5: The Naesiotus radiation**]

Our objectives are (1) assess the presence-absence of encapsulations in the Naesiotus group, (2) quantify the nematode load, and (3) test if it is possible to amplify and analyze the DNA of uncapsulated nematodes to obtain their diversity.

RESULTS

* Encapsulations present in the 39 analyzed species, out of the total 47 spp of the radiation. (present in the 11 islands analyzed) (Figure 1)
* Species showed differing nematode loads (Figure 2)
* We can amplify and analyze the DNA of encapsulated nematodes. (Figure 3)
* There is a high taxonomic diversity among the encapsulated nematodes (given that we sampled only 2-3 individuals of 2-3 species). (Figure 3)

DISCUSSION

Potential of the system to investigate questions on:

* Macroevolutionary imprints on interactions
* Biogeographic influence on macroevolution and interactions
* Diversification rates and network roles
* Impact of abiotic and biotic adaptation on evolution and networks
* Codiversification

Caveats:

* Nature of the interaction (what exactly means the encapsulation)
* Observations (potential limitations to observe nematodes)
* DNA analyses (amplification process)

Motivate further research in this and other island radiations of snails.

[FIG 1: Naesiotus phylogeny and sampled species + Galapagos map and species locations]

[FIG2: Nematode loads]

[DIG 3: Nematode phylogeny]