Crabs, Flies, Yeast, Drip: A Maggot’s Take on Evolution and the Origin of Pee-cies.

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In February 1974, Hampton Carson gave the presidential address for the annual meeting of the American Society of Naturalists. He described his discovery of three species of *Drosophila* that had adapted to live part or all of their lives as obligate commensals of land crabs, spending the larval stages in the patch on the carapace where crabs excrete nitrogenous waste. There the maggots feed in a “microorganism-laden urinal” (Carson, 1974). These species arose from three independent phyletic lines. Carson ends by asking what genetic and evolutionary mechanism allowed this sort of innovation to occur in different genetic backgrounds?

In the audience of the presidential address was the eminent population geneticist Bruce Wallace. Wallace wondered if he could encourage flies to adapt to conditions similar to those found in the nephritic patch of a land crab in the lab (Wallace, pers. comm.). And thus the artificial land crab was created: a 3-5 cm piece of synthetic turf affixed inside a sealed Lucite box, inoculated with a suspension of soil and yeast, and subjected to slowly dripping urine (Wallace’s own) (Wallace, 1978, and pers, comm.). A few *Drosophila virilis* managed to survive in the artificial crab, and after a year, Wallace observed a steady population of approximately 40 individuals. In an effort to clean the artificial crab, the adults were removed and placed on standard *Drosophila* media. The adult flies laid hundreds of eggs, and from these eggs hatched hundreds of larvae. But these larvae remained small and eventually died, apparently unable to survive on the food their ancestral stock had lived on for years in the university laboratory (Wallace, 1987).

In the current study, I reproduced Wallace’s artificial land crab with the goal of examining previously unasked questions about the early stages of adaptation, especially changes in the growth, anatomy, and behavior of the larvae. In addition, I produced a population of *D. virilis* raised on media made up with human urine. The morphologies of the various life stages of the stock population were compared to the morphologies of *D. virilis* raised under the experimental conditions. I tried to make sense of the entire project in terms of theories of macroevolution operating at a micro level.


Wallace, Bruce. (October 2010). Personal communication.