

# *Adaptations of Desert Organisms*

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Edited by J. L. Cloudsley-Thompson

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# Desert Arthropods: Life History Variations

With 51 Figures and 22 Tables



Springer

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*Cover illustrations:* An adult female tarantula spider, *Aphonopelma chalcodes*, from the Sonoran Desert, with her egg sac (front cover), and a femal *Pepsis thisbe* wasp from the Chihuahuan Desert, stinging a tarantula spider, *Aphonopelma echina* (front and back cover). Photographs taken by Fred Punzo.

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## Preface

It is difficult for me to recollect a time when I was not fascinated with the very notion of a desert. Walt Disney's film, *The Living Desert*, which I initially saw when I was 8 years of age, provided me with my first glimpse of this wondrous yet seemingly hostile environment. The images were hypnotic and captivating. I looked on in amazement at the *promenade à deux* of the male and female scorpions during courtship. Their rhythmic and coordinated movements as they grasped one another made them appear to glide in unison over the surface of the sand, each individual totally absorbed with its partner. In the next minute the female had suddenly and utterly transformed herself like some Jekyll and Hyde act, into an aggressive predator whose prior gregarious embrace was now a hold of death for the male. The indomitable desert grasshopper mouse, the ever sentient kit fox, the graceful shovel-nosed snake swimming in an endless sea of sand. The desert spadefoot toad, awakening as Rip Van Winkle from its dormant slumber to the staccato drumbeat of falling rain. All of these strange and compelling creatures against the backdrop of the desert panorama. Sharply delineated escarpments and rock formations with a myriad of shapes and textures, colored in shades of red, purple, and ochre and rising abruptly from desert floodplains painted with soft brush strokes in tans and yellows. The ubiquitous creosote bush and the majestic saguaro, each with their own unique assemblage of squatters and permanent residents.

Growing up in New York, I did not have an opportunity to actually visit the desert until my parents moved to California when I was in high school. We passed through the northern part of the Chihuahuan Desert in New Mexico, the Sonoran Desert in Arizona, and the Mojave Desert in southern California. For the first time I was able to observe (and in some cases collect!) whiptail lizards, bunch grass lizards, desert spiny lizards, the seldom-seen Trans Pecos rat snake, Couch's spadefoot toad, the Gila Monster, and the always entertaining road runner, a reluctant aviator, darting from one mesquite bush to another searching for food in the form of some unfortunate snake or lizard.

I looked on with amusement at the antics of the peccaries as they entered our campgrounds in search of some fast food. I had my first encounters with the denizens of the night. Rattlesnakes, tarantula spiders, vinegarones and scorpions scurrying across the road in a frantic attempt to escape the onrushing metal monster. The casual glimpse of an elusive ringtail cat, stopping at the side of the road with one last furtive glance before disappearing into the blackness beyond our vehicle. I remember the quickening of my pulse the first time that I saw the footprints of a mountain lion on the banks of meandering stream in the Chisos Mountains of Big Bend National Park. The past mental images of Walt Disney's film had now been replaced with first-hand observations. The desert had claimed another devotee.

While pursuing my doctoral studies at Iowa State University (1972–1975), I had the good fortune to study under the direction of Dr. John Mutchmor who was responsible for introducing me to physiological ecology and the comparative physiology of thermoregulation in ectotherms. My initial studies on thermoregulation and the temperature relationships of stored product insects led me to investigate similar parameters in desert arthropods and reptiles. These forays into the realm of thermoregulation would eventually result in my involvement in studies on the behavioral ecology, life history, and neurobiology of desert arthropods, subjects that have held my interest ever since.

The study of life histories has received an ever – increasing degree of attention over the last two decades since it is a necessary prerequisite for any attempt to understand and identify the connections between the diversity of organisms and the intricacies of their life cycles. Life history theory has progressed to the point where it can provide another level of analysis toward our efforts at analyzing the dynamics of natural selection, adaptation, fitness and constraint. In a broad sense it has been an attempt to assess how the ways in which organisms develop, grow, reproduce and die have been shaped by natural selection. It seeks to identify how individual life cycles contribute to overall fitness.

One of the underlying assumptions within this theoretical framework is that the various traits or parameters which are associated with an animal's life history (development time, age and size at maturity, relationship between body size and fecundity, longevity, number of reproductive efforts over the course of adulthood, sex ratios, growth rates, etc.) are coadapted and designed by natural selection to solve certain ecological problems. Although often intricate and perplexing, the study of life histories allows us to determine how life history parameters relate to the phylogeny, ecology, and behavior of the organism.

In this book I have attempted to discuss life history theory in general and its relationship to the specific life cycles of desert

arthropods. Although there have been a number of life history studies on a wide variety of organisms, many desert arthropods have not received a great deal of attention. This book deals primarily with the relationships between embryonic and postembryonic development, reproduction, and behavior, and the life histories of desert arthropods. I have also addressed a number of species, representing several taxa worldwide, whose life cycles have been studied in some detail, under the rubric of life histories: individual case studies.

Tampa, Florida, Autumn 1999

F. PUNZO

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