



ECOPHYSIOLOGY OF DESERT REPTILES

S. DONALD BRADSHAW*

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Abstract: Reptiles have radiated widely in the deserts of the world and have long been regarded as the acme of adaptation to aridity among the vertebrates, but recent ecophysiological studies question this conventional wisdom. It has proven difficult, if not impossible, to identify discrete behavioral and physiological adaptations in desert reptiles that are unique to these animals and not also found in species inhabiting temperate and mesic environments. It is suggested that this apparent paradox may be resolved by analyzing the extent to which desert reptiles maintain physiological homeostasis (homeostasis) under natural conditions in the field, and by documenting instances of exposure to stress in field populations.

INTRODUCTION

AS HERPETOLOGISTS, WE ARE NATURALLY interested in every aspect of the life of reptiles, but physiologists primarily study them for one of two major reasons: (1) although now widely separated from the birds and mam-

mals, reptiles are nonetheless their progenitors, and the close study of living reptiles may provide heuristic insights into the factors responsible for the evolution of the more complex systems of control seen in these two classes; and (2) the spectacular radiation of reptiles in the deserts of the world, which implies the existence of novel or other mechanisms adapting them to the exigencies of life in regions normally regarded as inhospitable.

This second common assumption underlying much of the research on reptilian ecophysiology over the past two decades—that desert reptiles are uniquely adapted to the harsh environments in which they occur—has only recently been questioned in the light of detailed studies of both desert and non-desert species, comparing their physiological performance under both laboratory and field conditions (see Bradshaw 1981, 1986a, 1988). Gould and Lewontin (1979) drew attention to what they termed the Panglossian excesses of the "adaptationist programme" and the widespread tendency of biologists to interpret any measurable differences between species as adaptations per se, thereby ignoring possible non-genetic changes resulting from acclimation or acclimatization. This possibility is always entertained, but usually dismissed summarily, and most statistically significant differences that confirm one's initial hypothesis are effectively considered as heritable modifications of the phenotypes, rendered through the agency of natural selection.

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Ecophysiology Of Desert Reptiles

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Ecophysiology Of Desert Reptiles:

Ecophysiology of Desert Arthropods and Reptiles John L. Cloudsley-Thompson, 2012-12-06 Ecophysiology of Desert Arthropods and Reptiles starts with a new classification of the world's deserts based upon the type of precipitation and the effect on their faunas of arthropods and reptiles. This is followed by an account of microclimates and the avoidance of environmental extremes. Whereas thermoregulation is primarily behavioural, responses to water shortage are largely physiological. Seasonal activity and phenology are described. Adaptations for burrowing, the avoidance of enemies and defence are also outlined. A comparative account of interspecific relationships, feeding specializations and species diversity in the two taxa is described. The purpose of the book is to provide a new and up-to-date analysis that will stimulate further research along these lines.

Ecophysiology of Desert Reptiles Sidney Donald Bradshaw, 1986-01-01 **Peer-to-Peer Video Streaming** Eric Setton, Bernd Girod, 2008-11-01 Peer-to-Peer Video Streaming describes novel solutions to enhance video quality, increase robustness to errors and reduce end-to-end latency in video streaming systems. This book will be of use to both academics and professionals as it presents thorough coverage and solutions for current issues with Video Streaming and Peer-to-Peer architectures. The book provides an overview of today's state-of-the-art video streaming technology. It presents adaptive video coding and streaming techniques for performance enhancement of conventional client-server systems and P2P multicast. The detailed appendix incorporates various additional experiments.

Ecophysiology of Desert Reptiles Sidney Donald Bradshaw, 1986 **Ecophysiology of Small Desert Mammals** Allan A. Degen, 2012-12-06 Since small mammals have a large surface-to-mass ratio, one would expect them to quickly dehydrate and perish at high environmental temperatures. Nonetheless, a large number of small mammal species inhabit deserts. This fascinating phenomenon is investigated by Prof. A. Allan Degen in his book. The majority of small desert mammals are rodents, but shrews of several grams and small foxes of 1 kg are also present. Their survival is due mainly to behavioural adaptations and habitat selection; however, physiological adaptations also contribute to the success. Interestingly, many small mammals that live in different deserts of the world show similarities in their adaptive traits, although they have different taxonomic affinities.

Ecophysiology of Amphibians Inhabiting Xeric Environments Michael Warburg, 2012-12-06 Scarcity of water has brought about a number of structural, behavioural, physiological and ecological adaptations in amphibians inhabiting seasonally xeric habitats. This book describes structural and functional adaptations of key organs such as skin, kidneys, bladder, lungs and ovaries. Behavioural responses to high temperatures mainly involve thermoregulation and the selection of optimal temperatures and humidity. Special emphasis is placed on physiological adaptations: water, electrolyte, nitrogen and thermal balance, and their endocrine control are treated in detail. Development and metamorphosis, larval competition for food resources and reproductive strategies are only a few of the exciting topics in the chapter on ecological aspects.

Ecophysiology of Economic Plants in Arid and Semi-Arid Lands Gerald E. Wickens, 2013-04-17 This book deals with arid

and semi arid environments and their classification and the physiological restraints and adaptations of plants to the environment Further it discusses economic botany and the needs and methods of conserving economic plants A broad view is taken regarding the definition of economic plants taking into account their value to the environment as well as to man and to livestock The individual deserts and associated semi arid regions are described in separate chapters providing background information on the regional environments in terms of climate and major plant formations The economic plants within these formations their usages geographical distribution together with their morphological and physiological adaptations are treated in detail

Physiological Ecology of North American Desert Plants Stanley D. Smith, Russell Monson, Jay E. Anderson, 2012-12-06 This book begins with the physical and biological characterization of the four North American deserts and a description of the primary adaptations of plants to environmental stress In the following chapters the authors present case studies of key species representing dominant growth forms of the North American deserts and provide an up to date and comprehensive review of the major patterns of adaptations in desert plants One chapter is devoted to several important exotic plants that have invaded North American deserts The book ends with a synthesis of the adaptations and resource requirements of North American desert plants Further it addresses how desert plants may respond to global climate change

Vertebrate Ecophysiology Don Bradshaw, 2003-04-24 Ecophysiology attempts to clarify the role and importance of physiological processes such as digestion and respiration in the ecological relations of species in their natural habitats The basic principles and methods that are central to any ecophysiological study are outlined and discussed including animal capture blood collection and the measurement of plasma components and hormone levels Attention is paid to animal welfare and ethical considerations and the question of stress and how to identify its presence in animals in their natural environment is approached through a series of case studies Examples are given from a wide range of vertebrates living in deserts cold climates and oceans and recent findings on the physiological adaptations of Antarctic birds and mammals are a highlight of the book This textbook will provide an introduction to the study of ecophysiology for advanced undergraduates and postgraduate students as well as researchers in ecology biodiversity and conservation

Ecophysiology of Desert Arthropods and Reptiles J. L. Cloudsley-Thompson, 1991 **Desert Arthropods: Life History Variations** Fred Punzo, 2013-03-14 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 Cl 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 unis on over the surface of the sand each individual totally absorbed with its partner In the next minute the fern ale 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

Homeostasis in Desert Reptiles Sidney Donald Bradshaw, 2012-12-06 Deserts whether hot or cold are considered to be one of the most difficult environments for living systems lacking the essential free water which accounts for approximately 60-70% of their body mass and more than 98% of their constituent atoms Macfarlane 1978 Amongst vertebrates reptiles are usually thought of as the animals most adapted or suited to such environments because of their diurnal habit based on a need for external heat and their ability to survive far from obvious sources of water This impression is reinforced when one examines the composition of vertebrate faunas characteristic of deserts and arid zones reptiles predominate and they are often the only vertebrates to be found in hyper arid areas such as some parts of the Sahara Monod 1973 I recently had occasion to examine this assumption carefully however and was led inexorably to the conclusion that reptiles represent a particularly successful desert group not because of their evolution of superior adaptations but because of their possession of a basic suite of behavioural and physiological characteristics that suit them uniquely to this very resource limited environment Bradshaw 1986a These fundamental reptilian characteristics are 1 their low rates of metabolism compared with birds and mammals which result in extremely low rates of resource utilisation and lead to considerable economy in the handling of water 2

Spatial Ecology of Desert Rodent Communities Georgy I. Shenbrot, Boris R. Krasnov, Konstantin A. Rogovin, 2012-12-06 Rodents are conspicuous and important components of the desert biome Many general concepts in modern community and behavioral ecology use them as a main model This volume compiles and generalizes data on the spatial structure of desert rodent communities taking into account both global biogeographic and local ecological patterns It is based on studies of rodents in different deserts of the Northern Hemisphere Karakum Kyzylkum Bet Pak Dala Gobi Thar Chihuahua Negev and North Caspian deserts as well as on a thorough analysis of the literature

Physiological Ecology William H. Karasov, Carlos Martínez del Río, 2020-05-05 Unlocking the puzzle of how animals behave and how they interact with their environments is impossible without understanding the physiological processes that determine their use of food resources But long overdue is a user friendly introduction to the subject that systematically bridges the gap between physiology and ecology Ecologists for whom such knowledge can help clarify the consequences of global climate change the biodiversity crisis and pollution often find themselves wading through an unwieldy technically top heavy literature Here William Karasov and Carlos Martínez del Río present the first accessible and authoritative one volume overview of the physiological and biochemical principles that shape how animals procure energy and nutrients and free themselves of toxins and how this relates to broader ecological phenomena After introducing primary concepts the authors review the chemical ecology of food and then discuss how animals digest and process food Their broad view includes symbioses and extends even to ecosystem phenomena such as ecological stoichiometry and toxicant biomagnification They introduce key methods and illustrate principles with wide ranging vertebrate and invertebrate examples Uniquely they also link the physiological mechanisms of resource use with

ecological phenomena such as how and why animals choose what they eat and how they participate in the exchange of energy and materials in their biological communities Thoroughly up to date and pointing the way to future research Physiological Ecology is an essential new source for upper level undergraduate and graduate students and an ideal synthesis for professionals The most accessible introduction to the physiological and biochemical principles that shape how animals use resources Unique in linking the physiological mechanisms of resource use with ecological phenomena An essential resource for upper level undergraduate and graduate students An ideal overview for researchers *Survival Strategies of Annual Desert Plants* Yitzchak Gutterman, 2012-12-06 Annual desert plant species of unrelated taxa in the Negev Desert of Israel have developed complementary sets of adaptations and survival strategies as ecological equivalents with physiological morphological and anatomical resemblances in the various stages of their life cycles After 40 years of research in hot deserts Yitzchak Gutterman provides a comprehensive treatise of such adaptations and strategies In doing so he covers the following topics post maturation primary seed dormancy which prevents germination of maturing seeds before the summer seed dispersal mechanisms with escape or protection strategies cautious or opportunistic germination strategies seedling drought tolerance The day length is an important factor in regulating flowering as well as the phenotypic plasticity of seed germination which is also affected by maternal factors **Nomadic Desert Birds** W. Richard J. Dean, 2013-06-29 My interest in the behaviour and movements of birds of arid and semi arid ecosystems began when my wife Sue Milton and I were Roy Siegfried Director at that time of the Percy approached by Prof FitzPatrick Institute of African Ornithology to set up a project to investigate granivory in the South African Karoo Sue and I spent some time finding a suitable study site setting up accommodations and an automatic weather station at Tierberg in the southern Karoo near the village of Prince Albert and planning projects Among our first projects was a transect where we noted plant phenology measured seed densities on the soil surface counted birds observed ant activity measured soil surface temperatures and collected whatever climate data we could at 40 sites along a 200 km oval route Along the way we became interested in the marked presence and absence of birds at certain sites abundant birds one day and very few birds at the same site a month later Subsequent counts along fixed transects through shrublands confirmed that a number of bird species were highly nomadic over short and long distances locally and regionally leading to speculation on how widespread these movements were in the arid ecosystems of the world *Plants in the Deserts of the Middle East* Kamal H. Batanouny, 2013-11-11 Usually authors write introductions for their books although they know that not many readers will read it Despite this authors insist on writing an introduction and no publisher will publish a book without one I would like to inform my dear readers that I have spent almost all of the first quarter of my life in a village in the Nile Delta 65 km north of Cairo The everyday scenery there was the beautiful green landscape dissected with canals full of running water All of these were bordered with the huge sycamore mulberry and acacia trees The desert was something unknown to me at that time except for the very basic information given in geography

books which explained that the desert is a place without water or cultivation Some of my ideas about the desert came to me from the stories in the history of Islam and the desert lands where Islam originated My real attraction to the desert developed in the last year of my undergraduate studies This was during the field courses in Ecology Prof A M *Avian Desert Predators* William E. Cook, 2012-12-06 Birds are not particularly well suited to desert life Unlike mammals they are generally active during the day and do not usually go underground to escape the intense desert heat Among the few types of birds that have successfully invaded the desert ecosystem are the predators Many species of hawks owls roadrunners vultures and shrikes survive very well in deserts What attributes make this group especially suited to desert life How have they augmented their abilities to cope with the harsh constraints imposed by the desert habitat These are among the issues explored in this new volume which brings together much of the current research on adaptations of avian desert predators

Structure-Function Relations of Warm Desert Plants Arthur C. Gibson, 2012-12-06 For centuries biologists have been extremely interested in the structure of desert plants as examples of natural selection to harsh environmental conditions Indeed desert plants are frequently used as examples in many biology classes and textbooks to illustrate natural selection but this has led to an unfortunate litany of errors and misconceptions about desert plant adaptations This new synthesis focuses on plants of lowland tropical and subtropical arid deserts Readers will be surprised to discover that many features commonly ascribed to desert plants are rarely observed in the most common species Instead the typical structural adaptations of nonsucculent warm desert plants are now viewed as ways to maximize photosynthetic rate **Dispersal Biology of Desert Plants** Karen van Rheede van Oudtshoorn, Margaretha W. van Rooyen, 2013-03-09 Dispersal processes have important effects on plant distribution and abundance Although adaptations to long range dispersal telechory are by no means rare in desert plants many desert plant species do not possess any features to promote dispersal atelechory while others have structures that hamper dispersal antitelechory The high frequency with which atelechorous and antitelechorous mechanisms are present in plants inhabiting arid areas indicates the importance of these adaptations Among the benefits derived from these adaptations are the spreading of germination over time the provision of suitable conditions for germination and subsequent seedling establishment and the maintenance of a reservoir of available seeds seed bank This book describes the ways and means anatomical morphological and ecological by which dispersal in desert plants has evolved to ensure the survival of these species in their harsh and unpredictable environment

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