J. MARK ROWLAND, PhD
Research Associate Professor
Department of Biology

STUDIES IN ARTHROPOD BIOLOGY

Behavioral ecology and the expression of alternative tactics in male polyphenic mating systems.

Facultative Male Trimorphism

Recently, Doug Emlen and I described a novel mating system in which males are facultatively trimorphic (Rowland & Emlen 2009). Remarkably, we found that this phenomenon is widespread in beetles. The evidence was based on comparative morphology, thus we are examining correlated social behaviors in natural populations of trimorphic species. Intransitive fitness interactions will be tested among the facultative tactics inasmuch as RPS-like systems have been implicated in maintenance of the rare "allelic" trimorphisms that occur in reptiles, birds and invertebrates.

Morph Ratio Dynamics

Development of a coherent quantitative system, in collaboration with Clifford Qualls, models demographic and evolutionary change in the expression of the alternative phenotypes produced by complex allometries in male polyphenic beetles (Rowland et al. 2005; Rowland & Qualls 2005). This new conceptual model and numerical methodology—*the morph ratio dynamics model*—derives *the morph ratio characteristic function*, an index for characterizing conditional morph ratio strategies across populations and taxa. For example, dung beetle population dynamics promises to provide the basis for setting conservation priorities and management practices for broader invertebrate communities (Scarabaeine Research Network). Elements of the morph ratio dynamics model will function as sensitive and unique quantitative indices for detecting demographic changes in social structure in dung beetle populations due to environmental degradation in human-dominated landscapes.

Patterns of Male Polyphenism in Phanaeine Dung Beetles

Phanaeine dung beetles represent an excellent, but largely unexplored model for discerning the roles of ecological and competitive factors in the evolution of status-dependant phenotypes. The horns of phanaeines vary from absent to extravagant, scaling patterns are diverse, taxonomic diversity is well documented, phylogenetic and ecological relationships are under increasing study, and comparative reproductive behaviors are, in large part, well known. Thus, with contributors (especially Scarabaeine Research Network), I am exploring the patterns of male polyphenism broadly in phanaeines in relation to the social and community environments in which they are expressed (Draft Prospectus available).

Threshold Behavior in Horned Beetles

Macroevolutionary behavior of the threshold mechanisms in male-polyphenic horn expression is discerned by mapping specific threshold parameters as a function of defined phylogenetic scale in phanaeine dung beetles (Rowland & Emlen 2009) and rhinoceros beetles of the genus *Xylotrupes* (Rowland 2003, 2006a,b).

Relevant Publications in Arthropod Biology

Rowland, J. M. and Emlen, D. J. 2009. Two thresholds, three male forms result in

facultative male trimorphism in beetles. ***Science*** 323:773-776. [article PDF] [supplemental materials PDF]

Rowland, J. M. 2006a. Continued revision of the systematics of rhinoceros beetles of the genus *Xylotrupes* (Scarabaeidae, Coleoptera). Privately published. Albuquerque. 49 p.

Rowland, J. M. 2006b. Partial revision of the systematics of rhinoceros beetles of the genus *Xylotrupes* (Scarabaeidae, Coleoptera). Privately published. Albuquerque. 41 p.

Rowland, J. M, and Qualls, C. R. 2005. Likelihood models for discriminating alternate phenotypes in morphologically dimorphic species. ***Evolutionary Ecology Research*** 7:421-434. [PDF]

Rowland, J. M., Qualls, C. R., Beaudoin-Ollivier, L. 2005. Discrimination of alternative male phenotypes in *Scapanes australis* (Boisduval). ***Australian Journal of Entomology*** 44:22-28. [PDF]

Rowland, J. M. 2003. Male horn dimorphism, phylogeny and systematics of rhinoceros beetles of the genus *Xylotrupes* (Scarabaeidae, Coleoptera). ***Australian Journal of Zoology*** 51:213-258. [PDF]

ACADEMIC OVERVIEW

Doctorate in zoology from the Department of Biology, Texas Tech University. Graduate research concerned the biology of an early-derived group of terrestrial arthropods. Postdoctoral positions in the Department of Pharmacology and Therapeutics at the TTU Health Sciences Center and with the Glaucoma Section of the National Eye Institute. As postdoc, discovered profound endogenous component for sympathetic regulation of ocular hydrodynamics in mammals. As Visiting Assistant Professor at TTUHSC, awarded RO1 funding to investigate the role of the mammalian circadian system in regulating aqueous humor formation and intraocular pressure as a model for therapeutic intervention in primary open-angle glaucoma. Took dual positions as Research Associate in the Department of Ophthalmology at Yale University and as Senior Research Scientist of Ocular Projects at CIBA Corporation. Our team patented two drugs for ophthalmic indications, one of which answered a largely unmet therapeutic need, reached market and $24M contribution in 1994. At UNM have held academic title as Associate Professor in the Division of Ophthalmology, and Research Associate Professor in the Department of Biology. At UNMHSC conducted clinical research on the etiology of glaucomatous field defects in diabetes, and on an endogenous component for central regulation of ocular hydrodynamics in normotensive humans.

J. Mark Rowland, PhD
Department of Biology
MSC03 2020
1 University of New Mexico
Albuquerque, NM 87131-0001

Email: rowland@unm.edu
Tel: 505/823-9320