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The Evolution of Exudativory in Primates

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Why do primates consume exudates? How do they procure and process this resource? How did exudativory evolve and which morphological adaptations are involved? These are the key questions addressed in this book that is based on a symposium held at the 22nd Congress of the International Primatological Society in Edinburgh in 2008. Like the symposium, this book takes a broad perspective and reviews the state of the art of our knowledge on primate exudativory from different viewpoints.

The stage for the whole book is nicely set in Robert D. Martin's personal foreword which not only highlights findings from the different chapters, but ends with an interesting hypothesis/speculation on the evolution of the bizarre dentition of *Daubentonia* from an ancestral condition associated with exudativory. In their introduction, Nash and Burrows identify the major questions and 'remaining sticky issues'. The progress made in understanding exudativory in primates is obvious when peering into Nash's [1986] review of primate gummivory and comparing it with the wealth of information provided in this book. While I generally appreciated and agree with the issues identified by Nash and Burrows, I was surprised not to find a stronger claim for more detailed examination of what kind of exudates (sap, gum, latex) are actually consumed by many primates (e.g. still not known in any detail for marmosets), and chemical analyses of the composition of exudates consumed (and not consumed!) by primates, analogous to the work done with folivorous primates. Such analyses would clearly enhance the understanding of primate exudativory, particularly of the nutritional problems and challenges it imposes (see Power, chapter 3).

Of the many interesting findings and stimulating discussions in the 14 chapters of this book, I will pick out only a few in this review that particularly made me think.

It is clear now that exudativory is far more widespread amongst primates than previously thought, and a broad spectrum of different plant species are exploited for their exudates (Smith, chapter 3). One interesting pattern is the prevalence of plant species from the legume family (Fabaceae) as sources of exudates for primates throughout the tropics. Does this represent a phylogenetic signal, i.e. the reverberation of an ancient association of exudativorous primates with this plant family, does it reflect the pan-tropical distribution of this plant family, or may it relate to specific chemical properties of Fabaceae exudates?

An interesting hypothesis is presented by Génin and colleagues (chapter 6): they suggest that gummivores are found only 'in regions in which El Niño oscillations

provoke recurrent but unpredictable droughts' (p. 137). This hypothesis merits being tested in a more quantitative and rigorous way, not simply by superimposing El Niño-related droughts on a map that very coarsely (and not quite correctly) indicates the geographic distribution of specialised 'gummivorous' (I would have preferred 'exudativorous' here) primates and sugar gliders. Interestingly, the most specialised exudativorous marmoset, *Cebuella pygmaea*, is actually found in western Amazonia, an area that experiences droughts associated with El Niño events [Williams et al., 2005]; amazingly this pertinent case is not discussed. To test the hypothesis of Génin et al., it would also be worthwhile taking a look at rodents (particularly sciurids), some of which perhaps exploit exudates more intensively than generally appreciated [Heymann and Knogge, 1997], and exudativorous birds [Blendinger, 1999].

The chapter by Rosenberger includes an in-depth discussion of 'adaptive profile versus adaptive specialisation' and examines the anterior dentition of living gummivores (again, exudativores would probably have been more appropriate) with that of plesiadapiforms and sugar gliders. Two points occurred to me in his discussion of the evolution of the strepsirrhine tooth comb. First, if early strepsirrhines were folivores but exploited gums seasonally, as originally suggested by Gingerich and Martin [1981], why do we not find dietary strategies in extant primates that combine large proportions of leaves and gums (exudates)? Second, I was surprised not to see tree shrews included in the discussion on the evolutionary and dietary significance of the tooth comb. They possess a tooth comb (which is different from the strepsirrhine tooth comb by including 3 incisors, but not the canine) that is employed in scooping fruit pulp and breaking off dry bark [Buettner-Janusch and Andrew, 1962; pers. obs.].

These comments are not meant as criticism. Rather they reflect the fact that this very well-edited book is stimulating and thought provoking. It will be the major reference for anyone looking for detailed information on primate exudativory. I am convinced it will stimulate further in-depth studies of primate exudativory. Beyond this, the book will be of interest and appeal to primate ecologists and evolutionary biologists, and to anthropologists and mammalogists interested in feeding strategies and adaptations. I can highly recommend this book to everyone.

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