Eusociality, life underground and parasites

In their recent review, Wcislo and Danforth provided evidence of a secondary loss of social behaviour in halictid and apid bees. Their unorthodox view may help to illuminate the evolution of social behaviour in other organisms or will, at least, provide a new stimulus for discussion.

One of their conclusions was that the maintenance of eusocial behaviour might be too costly because of an increased likelihood of disease and parasite transmission. However, very little was said about this in the reference cited by them to support their argument. It would be interesting to know what the evidence really is for increased risks of being parasitized in eusocial bees compared with their solitary relatives.

Recently, we have shown that very similar arguments to those of Wcislo and Danforth may also apply to the evolution of sociality (or solitariness) in other small rodents. In particular, the African bryophytypid mole-rats (Cryptomys and Heliophobius), which we examined, are the only vertebrate examples of caste-based societies and, therefore, provide excellent opportunities for comparative studies with social invertebrates. The findings by Scharff and Burda now open the door to secondarily solitary species. According to Scharff and Burda, a similar phenomenon occurs in naked mole-rats.

The major transitions in evolution: what has driven them?

John Maynard Smith and Eörs Szathmáry (JMSES), in their milestone book, present a fascinating theoretical view of the various steps in evolution that resulted in the major transitions such as the emergence of chromosomes, of sex, of multicellular organisms, of social groups, etc. JMSES emphasize that although their book is speculative, the major transitions 'must be explained in a way that is consistent with a general theory of evolutionary change, the theory of evolution by natural selection'. They do this by showing for each major transition the likely properties that had ensured the persistence and the further development of the new structures (that is, why selection did not wipe them out).

References


William T. Wcislo
Smithsonian Tropical Research Institute, Unit 0948, APO AA 34002-0948, USA (wcislow@cti.net)

Bryan N. Danforth
Dept of Entomology, Cornell University, Ithaca, NY 14853, USA (bnd1@cornell.edu)

The above quotations demonstrate the reluctance of JMSES to extend speculation beyond

Reply from W.T. Wcislo and B.N. Danforth

We are grateful to Drs Scharff and Burda for bringing to the attention of readers the proceedings of a recent conference that have bearing on evolutionary gain or loss of social behaviour. Our review examined the phylogenetic patterns of halictid and apid bees, to assess the assumption that social behavior is always derived. In some lineages, this assumption is not supported; social behavior can be lost, thus giving rise to secondarily solitary species. According to Scharff and Burda, a similar phenomenon occurs in naked mole-rats.

To date, there are no examples of caste-based societies in vertebrates. In fact, our discussion of patterns of seasonality. In our final paragraph, we speculated that social living is, presumably, expensive to maintain if group-living facilitates disease transmission among genetically related individuals. Scharff and Burda point out that there is little evidence for this hypothesis in the cited reference by Alexander et al. and references therein. We agree that there is a dearth of data and acknowledge that Alexander et al. only briefly mention the costs of sociality, in an earlier publication, Alexander lists automatic costs associated with group-living, including increased likelihood of disease and parasite transmission. A paper by Merriam might have been a more appropriate recent citation because it thoroughly discusses proposed relationships between parasitism rates and sociality (although there is still very little empirical evidence).

Scharff and Burda have found evidence indicating that solitary mole-rats (Heliophobius) are less infected by parasitic helminths than the social mole-rat, Cryptomys, and we look forward to reading their published work. Like them, we think reading their published work. Like them, we think there are still too few comparative data to understand the role of parasites and pathogens in shaping the expression of social behavior. Other factors besides disease transmission may also help account for evolutionary reversals in social behavior. We lack sufficient data to assess these factors and hope that others are stimulated to conduct further studies.

Andreas Scharff
Hynek Burda

Dept General Zoology, FB 9 – Biology, University of Essen, D-45117 Essen, Germany (andreas.scharff@uni-essen.de) (hynek.burda@uni-essen.de)

References