Preference: Lightning Talk or Poster
Type of research: Ongoing research with preliminary results

Networks meet mating systems – a new approach to studying animal behaviour

Keywords: behavioural ecology, evolutionary biology, mating behaviour, mating rates, spiders, Araneae

Extended Abstract

In biology, animal mating systems describe the number of mating partners per sex within a population or species, as well as the ecological and social contexts in which reproduction occurs [1]. The diversity of mating systems across species as well as their variation within species has captured the interest of evolutionary biologists for centuries and researchers use a range of empirical and theoretical approaches to study them, incorporating methods from behavioural ecology, genetics, comparative biology and mathematical modelling. Most studies focus on testing different selection pressures of the sexes in regard to their number of mates (mating rates), however there is a wide knowledge gap concerning the complex interactions of traits and how they influence the mating system. We still lack a fundamental understanding of the conditions which give rise to certain mating systems and how they are maintained in a population or species. Recent studies within behavioural ecology address the need for large-scale, trait-based approaches [2] and it has been repeatedly argued that complexity plays an important role in population dynamics and behaviour of individuals [3-5].

Here, we propose a framework that incorporates a complex systems perspective and methods from network science to better understand and explore animal mating systems. The core idea behind this approach is that interconnected sets of behavioural and live history traits displayed by individuals within a population give rise to different mating systems, which can be visualized and analyzed as large trait-based networks. The overall aim of this study was to determine whether mating systems can be identified from real data trait networks using similarity metrics and community detection algorithms. Therefore, we quantitatively tested this framework using a comparative dataset from twelve spider species. We chose spiders as our model taxon, as this animal group shows highly variable mating systems and reproductive strategies. Our example revealed consistent trait-associations that cluster with certain sex-specific mating rates, demonstrating that mating systems can be identified from complex trait-networks.

We therefore argue that mating system studies can benefit from a systems perspective, and that methods from network analysis can help to better understand how traits might influence each other and how they can give rise to a certain mating system. Future extensions of this approach could involve the investigation of the structure and properties of different mating systems, as well as the role of particular traits in the emergence of certain mating systems.

References

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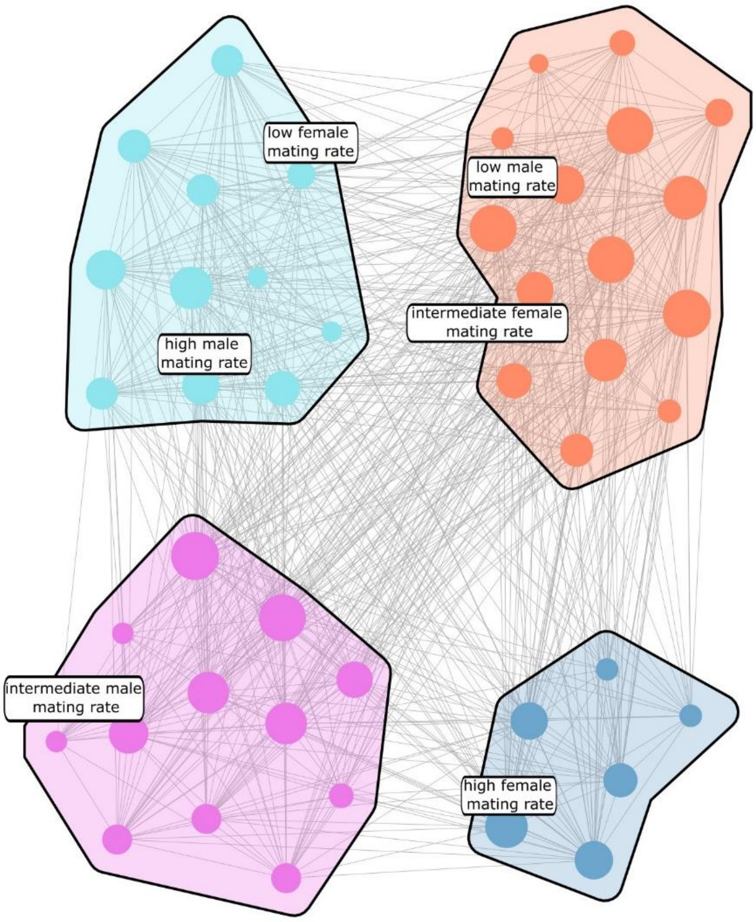

Figure 1. **Mating Behaviour Networks.** This figure shows the connection of behavioural and life history traits, derived from a dataset of 12 spider species. Communities (i.e., clusters, modules) were identified using a Frequency-weighted Louvain Community Detection algorithm. The traits of each community were found to cluster with specific mating rates of males and/or females (see labels), which indicates that these communities can be seen as proxy for a mating system. Size indicates the degree of each vertex.