The complexity of mutualistic networks from an eco-evolutionary perspective

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Mutualism, or the type of positive interaction in which species exploit each other for reciprocal benefits, plays a central role in the maintenance of life on earth. Since all species need to interact with others for survival, mutualistic interactions are not isolated but assemble into complex networks. Known examples of such networks are those formed by the reciprocal dependence of flower plants on their insect pollinators, or that of fruit trees on their animal seed-dispersers. Albeit their complexity, mutualistic networks are self-organized in nature for ecosystem functioning, with detectable non-random network structures and architectures [1]. However, whether network complexity and structures contribute to network stability remain an ongoing debate [2,3]. The universality of network structures suggests the existence of some general mechanisms underlying network functioning. These mechanisms are often related to both past evolutionary history and current ecological processes [4]. By using an eco-evolutionary model based on adaptive dynamics theory [5], we explore the evolution of mutualistic network complexity through time at both fast ecological and slow evolutionary time scales. The model depicts simultaneously the evolutionary dynamics of functional traits and the ecological dynamics of population densities. Specifically, we explore the relationship between mutualistic network structures and network stability and investigate on how this relationship changes as time evolves.

References

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