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Mutualistic network maximizing species abundance under exploitative competition

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The abundance of a pollinator species can be affected by other pollinators sharing the nutrients from the same plants. Such an exploitative competition between the animal species may affect the species abundance the network structure of plant-pollinator mutualistic communities, which remains to be understood. Here we study a model of the mutualistic network evolution towards increasing the species abundance with the exploitative competition between pollinators and mutualism in the abundance dynamics. We show that hub plants having many pollinators are very rare while a few super-hub pollinators appear with the generalized interaction, contrasted to equally many hubs of both types without the exploitative competition. More interestingly, it turns out that the abundance of plant species increases slightly with increasing the exploitative competition strength. To understand the origin of this phenomenon, we obtain the inverse of the generalized interaction matrix approximated in the weak-interaction limit. The leading structural factors relevant to the species abundance are identified, which are shown to be instrumental in optimizing the network structure to increase the mutualistic benefit and lower the cost of exploitative competition.

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