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Can hemiparasitic plants stabilize coexistence of multiple competing hosts?

Hemiparasitic plants are photosynthetic flowering plants that draw water and minerals from the roots of other plants. They also have the capability to exploit soil water and nutrients. Thus, they are parasitic exploiters of their hosts and potential competitors for soil nutrients and light with their hosts. Enemies like parasites and predators can enhance the diversity of a community when they exploit competing victims and have more detrimental impacts on better competitors than on poorer competitors, an effect known as keystone predation or parasitism. We developed a differential equation model of a hemiparasite exploiting more than two competing hosts and asked these questions: Given the complex interactions between a hemiparasite and its victims, would a hemiparasite be able to stabilize coexistence of more than two competing hosts? If so, what specific conditions lead to the stabilization of the multi-host and hemiparasite system? We focused on how differences in impact of shading by hosts reducing light for the hemiparasite, differential vulnerability of the hosts to the hemiparasite, and difference in soil exploitation ability of hosts affect coexistence. Using deterministic simulations, we searched for the range of conditions leading to multispecies coexistence. Thresholds for persistence of the hosts and hemiparasite will be displayed graphically. Determining whether hemiparasites can stabilize coexistence of multi-competitor systems may have important implications for use of hemiparasites in prairie restorations.