2 # Host sanctions and the legume-rhizobium mutualism.

Kiers ET, Rousseau RA, West SA, Denison RF

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Recommendations:

Very Good **11 Sep 2003**

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INTERESTING HYPOTHESIS | NEW FINDING

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This elegant study shows that the mutualism between legumes and rhizobia is maintained, in part, by sanctions that host plants can exert against bacteria that do not fix nitrogen.

The authors supplied nitrogen-free air to whole soybean plants, half-root systems, and individual nodules.

At each scale, nitrogen-deprived Bradyrhizobium populations declined in numbers relative to control populations that had received normal air and could thus supply their hosts with nitrogen. Further experiments seemed to indicate that the non-performing rhizobia were deprived of oxygen, rather than of carbon, by their host plant. Whatever the precise mechanism, sanctions imposed by the host plant should prevent 'cheaters' (mutants that fail to fix nitrogen) from taking over and destroying the mutualism.

Disclosures
None declared

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Abstract:

ABSTRACT

Explaining mutualistic cooperation between species remains one of the greatest problems for evolutionary biology. Why do symbionts provide costly services to a host, indirectly benefiting competitors sharing the same individual host? Host monitoring of symbiont performance and the imposition of sanctions on 'cheats' could stabilize mutualism. Here we show that soybeans penalize rhizobia that fail to fix N(2) inside their root nodules. We prevented a normally mutualistic rhizobium strain from cooperating (fixing N(2)) by replacing air with an N(
2)-free atmosphere (Ar:O(2)). A series of experiments at three spatial scales (whole plants, half root systems and individual nodules) demonstrated that forcing non-cooperation (analogous to cheating) decreased the reproductive success of rhizobia by about 50%. Non-invasive monitoring implicated decreased O(2) supply as a possible mechanism for sanctions against cheating rhizobia. More generally, such sanctions by one or both partners may be important in stabilizing a wide range of mutualistic symbioses.

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