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Extrafloral Nectaries and Ant Attendance: Annotated Bibliography

Beattie, A. J. 1985. *The Evolutionary Ecology of Ant-Plant Mutualisms*. Cambridge: Cambridge University Press.

This book is one of the few sources I found that ventured a hypothesis about the mechanism for the evolutionary development of the mutualistic relationship between plants and ants. It provides a table of plants with their associated assemblages of ant protectors, some of the history of the study of plant-ant interactions, and abundant information on ant-plant interactions that are not limited to ants that attend extrafloral nectaries.

Bentley, B. L. 1976. Plants bearing extrafloral nectaries and the associated ant community: Interhabitat differences in the reduction of herbivore damage. Ecology 57:815-820.

This paper demonstrates that artificially applied nectar attracts pugnacious ants which defend the plants and so reduce tissue removal by herbivores. Bentley also shows that ant protection is most likely in disturbed habitats where the ants are in greatest abundance and extrafloral nectary-bearing plants are most common.

Bentley, B. L. 1977. Extrafloral nectaries and protection by pugnacious bodyguards. Annual Review of Ecology and Systematics 8:407-427.

Bentley provides a good introduction to extrafloral nectaries and ant attendance and so this paper is a good place to start. She reviews the research done on ant attendance of extrafloral nectar bearing plants up to 1977, when the subject was quite hot. She provides a table of plant species that provide extrafloral nectar and she discusses the adaptive significance of extrafloral nectaries.

Bentley, B. L. 1977. The Protective function of ants visiting the extrafloral nectaries of *Bixa orellana* (Bixaceae). Journal of Ecology 65:27-38.

This paper examines the coincidence in the timing of the availability of extrafloral nectar, the presence of ants on the plant and the vulnerability of flower buds to phytophagous insects. Damage to flower buds prior to opening can result in high abortion rates and ant visitation reduces this damage.

Bentley, B. L. and Elias T. 1983. *The Biology of Nectaries*. New York: Columbia University Press. P.174-203. (203pp.)

This book will tell you more than you ever wanted to know about nectaries.

Freitas, A. V. L. and Oliveira, P. S. 1996. Ants as selective agents on herbivore biology: Effects on the behaviour of a non-myrmecophilous butterfly. Journal of Animal Ecology 65:205-210.

This paper presents evidence that the mere presence of ants can inhibit oviposition on a Brazilian shrub by a nymphalid butterfly, the larvae of which feed on the shrub.

Larva mortality is dependent upon the rate of ant visitation on the host-plant and the size of the larva.

Inouye, D. W. and Taylor, O. R. 1979. A temperate region plant-ant-seed predator system: Consequences of extrafloral nectar secretion by *Helianthella quinquenervis*. Ecology 60:1-7.

This paper examines the benefit of ant visitation to the aspen sunflower at different elevations. At high elevations ants significantly reduced damage to seeds caused by larvae that feed on seeds before dispersal. At lower elevations, where all insects were most abundant, seed and ovule predation usually exceeded 60%.

McLain, D. K. 1983. Ants, extrafloral nectaries and herbivory on the passion vine, *Passiflora incarnata*. American Midland Naturalist 110:433-439.

McLain describes a manipulative study that was undertaken to examine the hypothesis that extrafloral nectar attracts pugnacious ants to the benefit of the plant. The author found that the ability of plants to provide ants with extrafloral nectar resulted in greater fruit production and tissue survival compared to plants that had had their extrafloral nectaries removed.

Ruffner, G. A. and Clark, W. D. 1986. Extrafloral nectar of *Ferocactus acanthodes* (Cactaceae): Composition and its importance to ants. American Journal of Botany 73:185-189.

These researchers examined the composition of extrafloral nectar provided by *Ferocactus acanthodes* over time. The nectar comprised sugars and amino acids, with the ratios of the specific components changing with the phenology of the plant. They suggest that water (in the form of nectar) is an important resource provided by *Ferocactus acanthodes* to ants in a xeric environment.

Schemske, D. W. 1980. The evolutionary significance of extrafloral nectar production by *Costus woodsonii* (Zingiberaceae): An experimental analysis of ant protection. Journal of Ecology 68:959-967.

Schemske found that the presence of ants on *Costus woodsonii* decreased the risk of oviposition by a fly, the larvae of which feed upon immature fruits. The protective abilities of two different ant species (one wet season and one dry season) were evaluated with very different results.

Tempel, A. S. 1983. Braken fern (*Pteridium aquilinum*) and nectar-feeding ants: A nonmutualistic interaction. Ecology 64:1411-1422.

Tempel found that the presence of ants on braken fern did not reduce herbivory despite the coincidence of nectar production with frond vulnerability.

Tilman, D. 1978. Cherries, ants and tent caterpillars: Timing of nectar production in relation to the susceptibility of caterpillars to ant predation. Ecology 59:686-692.

This paper explored ant protection on *Prunus serotina* with respect to the distance of trees to ant colonies, tree size, and the timing of protection. Tilman suggests that foliar nectar production coincides with the vulnerability of trees to tent caterpillar herbivory.