

Physical Plant Defenses Against Herbivory
Annotated Bibliography

Andres, Melissa R., and Connor, Edward F. 2002. The community-wide and guild-specific effects of pubescence on the folivorous insects of manzanitas (*Arctostaphylos* spp.) (in print).

This study examined the effect of variation in foliar pubescence of manzanitas on a community of folivorous insects of various feeding guilds (sap-sucking, leaf-mining, leaf galling, chewing) using linear models. This was the only study I encountered that took into consideration pubescence length, in addition to pubescence density. It was concluded that both longer pubescence and the amount of contact between insect and pubescence quantitatively decrease the abundance of insects, but have no effect on species richness.

Baur, R., Binder, S., Benz, G. 1991. Non-glandular leaf trichomes as short-term inducible defense of the grey alder, *Alnus incana* (L.), against the chrysomelid beetle, *Agelastica alni* L. *Oecologia* 87:219-226.

A slightly different spin on physical plant defense than what I found in most of the literature, since the defense discussed (high-density pubescence) is induced rather than a consistent characteristic of the plant. The results of this study demonstrate that feeding of the alder beetle on young alder trees is followed by increased foliar trichome density in new leaves. This reaction is only temporary. Trichome density decreases after grazing has stopped.

Dimock, Micheal B., and Tingey, Ward M. 1988. Host acceptance behavior of Colorado potato beetle larvae influenced by potato glandular trichomes. *Physiological Entomology* 13:399-406.

This study observes larvae behavior on potato leaves with trichomes in an attempt to explain what it is about trichomes that deters these insects from feeding. In addition to the mechanical barrier presented by trichomes, avoidance due to chemical stimuli of the glandular trichome exudate is considered.

Edwards, Peter J. and Stephen D. Wratten. Ecology of Insect-Plant Interactions. London: Edward Arnold Publishers Limited, 1980.

This book has a brief section on physical plant defenses and trichomes, but aside from that it contains information mostly on chemical defenses. This is an introductory book that covers a broad range of topics. Contains many references for further reading.

Gibson, R.W. 1971. Glandular hairs providing resistance to aphids in certain wild potato species. *Ann. Appl. Biol.* 68:113-119

This study is widely cited in later literature. A simple experiment in which the result is immobilization of aphids by a sticky exudate discharged from the glandular trichomes on *Solanum* species. Higher densities of trichomes on stems, as opposed to leaves, correlate with greater aphid immobilization. This paper also discusses the value of breeding resistance based on glandular hairs into the cultivated potato. A readable, easy to understand paper.

Haddad, Nick M. and Hicks, William M. 2000. Host pubescence and the behavior and permanence of the butterfly *Papilio troilus* (Lepidoptera: Papilionidae). *Environmental Entomology* 29(2): 299-303.

Laboratory experiments were conducted to test for effects of pubescence in *Sassafras albidum* on oviposition, growth, and survival of *P. troilus* with results that indicated that pubescence had negative influences. In addition, field surveys measuring landscape-level variation in *S. albidum*, which varies greatly in pubescence density, showed that the frequency of pubescent individuals was significantly greater in open habitats created by harvesting pine forest than in hardwood forests. It was concluded that forest management techniques may have negative impacts on this butterfly population.

Johnson, Hyrum B. 1975. Plant pubescence: An ecological perspective. *The Botanical Review* 41(3):233-253.

A general discussion about the structure and function of trichomes. There is a brief section on trichomes as defense mechanisms but most of the paper focuses on classification, types of pubescence, and relationships to physical factors such as boundary layer effects of pubescence.

Juniper, B.E. and C.E. Jeffree. Plant Surfaces. London: Edward Arnold Publishers Limited, 1983.

This book has one chapter on plant surfaces in defense and attack but does not go into much depth. I did not find this book very useful.

Levin, Donald A. 1973. The role of trichomes in plant defense. *The Quarterly Review of Biology* 48(1):3-15.

An excellent resource. Gives a broad overview of glandular and non-glandular trichomes (their role in defense) and outlines key studies that have been done on the subject. This is a great place to start.

Pillemer, Eric A. and Tingey, Ward M. 1976. Hooked trichomes: a physical barrier to a major agricultural pest. *Science* 193:482-484

In this study, the frequency of capture and capture mortality were highly correlated with trichome density in 3 field bean cultivars differing in densities (both interspecifically and intraspecifically) of hooked trichomes. Differences in the angles of trichomes and implications for capture are briefly discussed though not examined thoroughly. This would have been interesting. I did not come across anything else concerning trichome angle in my literature search. It is concluded that hooked trichome density may be a valuable selection criterion in applied breeding programs.

Schillinger, J.A. and Gallun, R.L. 1968. Leaf pubescence of wheat as a deterrent to the cereal leaf beetle, *Oulema melanopus*. *Annals of the Entomological Society of America* 61(4):900-903.

A classic study widely cited in later literature. 4 lines of wheat, *Triticum aestivum*, differing in pubescence density were compared for their effect on ovipositional behaviour, viability of eggs, and growth and survival of the young larvae of *O. melanopus*. All factors were adversely affected by increasing pubescence density.

Stamp, Nancy S. 1996. Developing a theory of plant-insect herbivore interactions: are we there yet? *Bulletin of the Ecological Society of America* 77:51-61.

The author of this paper is concerned that on average only 2.3% of an ecology text deals with plant-herbivore interactions. She offers what she perceives to be 12 basic generalizations of plant-insect herbivore interactions important to the field of ecology and evolution dealing with such subjects as costs of defense, herbivore countermeasures to plant defense, herbivore-herbivore competition, and others. This is a nice summary of the topic for those who are new to the subject, however there wasn't much mentioned that I haven't already come across in any basic ecology course or text.

Thurston, E. Laurence, and Lerston, Nels R. 1969. The morphology and toxicology of plant stinging hairs. *The Botanical Review* 35: 393-412.

A detailed review of the research that has been done on the morphology and toxicology of plant stinging hairs from 1665-1968. The paper outlines the 4 families in which stinging hairs are found and mostly consists of classification and morphological description. I did not find this article particularly useful.

Williams, Kathy S., and Gilbert, Lawrence E. 1981. Insects as selective agents on plant vegetative morphology: egg mimicry reduces egg laying by butterflies. *Science* 212(24): 467-469.

This was one of few articles I encountered in the literature on mimicry as a plant defense against herbivory. In this study, the oviposition behavior of *Heliconius* butterflies was examined using *Passiflora cydno*, a natural host plant without mimetic structures and *P. cyanea*, which has egg mimics on stipules. It was concluded that *Heliconius* butterflies are less likely to oviposit on host plants that possess eggs or egglike plant structures than on plants without eggs.