

# This Week's Citation Classic

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Muller C H. The role of chemical inhibition (allelopathy) in vegetational composition. *Bull. Torrey Bot. Club* 93:332-51, 1966.  
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Toxic terpenes of aromatic shrubs create bare areas and stunt growth in grassland adjoining thickets. Volatilized compounds are adsorbed on dry soil colloids and released the following moist winter growing season on contact with cuticular waxes of seedling roots. Lipophilic terpenes pass via plasmodesmata and lipoidal plasma membranes throughout the plant body. The inhibition of seedlings controls dominance, invasion, and succession in this vegetation. [The SCI® indicates that this paper has been cited in over 125 publications since 1966.]

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"I felt in the 1950s, and still feel, a general distaste for invasion of ecology by reductionism. My prejudice against oversimplification was no secret and I came on a bit strong when denying simplistic chemical explanations of intricate vegetational behavior.<sup>1</sup> With a field class in Santa Barbara County, California, I got a well-deserved jolt from an undergraduate who pointed to a broad band of bare soil adjoining a thicket of *Salvia leucophylla* and asked if that was not chemical inhibition of grasses by shrubs. I answered that I would investigate it but doubted it. Years later the investigation had convinced me, but the student was long since gone and, to my regret, his identity lost to me. The skepticism I had harbored now seemed widespread, for seeking financial support for the investigation elicited my own earlier objections. The National Science Foundation (NSF) nonetheless gambled on a joint proposal with my colleague, W.H. Muller. The literature showed several water-soluble phytotoxins implicated in similar phenomena, and the general idea was traceable to Theophrastus,<sup>2</sup> but we got no help with volatile toxins.

"Our first successful experiments involved contrived techniques for volatile phytotoxin bioassays and formed the basis of a report in *Science*<sup>3</sup> together with a cover photograph of the field phenomenon which proved more convincing than our data. A series of papers followed quickly as our

techniques developed, including gas-liquid chromatography (GLC) (the first operational GLC on our campus was run by a 'muddy boot' ecologist!). When the intricacies of the aromatic shrub-grassland interaction were revealed, a summary treatment became desirable to organize the multiple facets from several papers of different authorship. I questioned the fit of the theoretical mechanism into the total environmental complex and began to realize that I had permitted myself to be too thoroughly seduced by the joys of controlled experimentation and that my field activities had become too organized, too hurried. The remedy was pleasant. I reverted to my old self, drew on the observational habits of my cowboy youth, and found several comfortable logs and rocks on which to sit while contemplating the scene before me. The result was a reconciliation of the results of GLC monitoring of soil and atmospheric terpenes, laboratory studies of terpene behavior, and plant susceptibilities with field studies of the calendar of edaphic and meteorological flux, animal predation experiments, the dynamics of plant demographic patterns, and the place of allelopathy in the discipline of ecology—that is, the summary paper here discussed.

"The photogenic qualities of the phenomenon contributed more to the popularity of the paper than did the evidence cited. One photograph submitted with a renewal proposal to NSF attracted a request to publish precisely that picture before I could even use it myself. A three-foot shelf of textbooks, symposia, and monographs roughly reflects the solicitations for permission to republish photographs from the summary paper and others. Controversy is very likely the basis of much of the citation record. The importance of phytotoxicity in plant ecology has been questioned for nearly two centuries, and the latest polemics have involved the work on aromatic shrubs here discussed. But as I write this, I see on my desk the announcement of yet another positive evidence of acceptance, the North American Symposium on Allelopathy being held at the University of Illinois for three days in November 1982. A review of allelopathy has been published by Elroy Rice, his second.<sup>4</sup>

"This summary paper gained me invitations to speak at various symposia and assorted American and European universities, and it culminated, together with subsequent papers, in my receiving from the Ecological Society of America its citation of 'Eminent Ecologist' for 1975."

1. Muller C H. The association of desert annuals with shrubs. *Amer. J. Bot.* 40:53-60, 1953.
2. Theophrastus. *Enquiry into plants and minor works on odours and weather signs.* (Hort A, translator) New York: Putnam's Sons, 1916. p. 411-13.
3. Muller C H, Muller W H & Haines B L. Volatile growth inhibitors produced by aromatic shrubs. *Science* 143:471-3, 1964.
4. Rice E L. Allelopathy—an update. *Bot. Rev.* 45:15-109, 1979.