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**Schroth M N & Hildebrand D C.** Influence of plant exudates on root-infecting fungi. *Annu. Rev. Phytopathol.* **2**:101-32, 1964.
[Dept. Plant Pathology, Agricultural Experiment Station, Univ. California, Berkeley, CA]


Plant exudates greatly influence the saprophytic and pathogenic activities of root fungi. With *Fusarium solani* f. sp. *phaseolicoli*, a pathogen of bean, the infection process is triggered by the exudation of specific chemicals which stimulate dormant spores to germinate, followed by colonization and infection of roots. [The *SCI*® indicates that this paper has been cited in over 110 publications since 1964.]



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"W.C. Snyder told his graduate students that life is full of opportunities, but one must recognize them when they arrive. Accordingly, this review paper, which includes a commentary on much of my thesis work at the University of California, Berkeley, was the result of such an opportunity. It was written in response to a plea for help by J.G. Horsfall, editor of the *Annual Review of Phytopathology*, who needed a filler article within a month because of a last-minute default of a paper. Whether or not I would have written this paper at a later time is conjectural. D.C. Hildebrand, although primarily a plant bacteriologist, was enlisted as a coauthor because of his considerable analytical ability. He remains a valuable colleague.

"The phenomenon that plant exudates affect the growth of specific organisms is a century-old observation. However, the mechanisms by which they trigger specific events in a pathogen's life cycle, such as spore germination, were generally unknown. Perhaps a principal reason that this paper has been frequently cited is that it provides a critical review, as well as a synthesis of concepts of how root exudates affect the ecology of soilborne pathogens. We emphasized in particular how certain chemicals from bean, *Phaseolus vulgaris L.*, influenced the pathogenic and saprophytic activities of *Fusarium solani* f. sp. *phaseoli*. This research, being part of my thesis, showed that specific chemicals were exuded from bean roots and seeds in sufficient quantities to trigger germination of *Fusarium* chlamydospores (dormant spores) and to initiate the infection process. The same chemicals, when exuded from roots and seeds of nonsusceptible plants, or plant residues, cause the fungus to vegetate briefly, resulting in the production of new propagules. This enables it to maintain effective inoculum until a susceptible host is planted. The model seems to apply to any number of root diseases.

"I believe my research was the culmination of a logical sequence of events building on others' observations and reports. Being in the right place at the right time with highly capable colleagues has much to do with the production of new knowledge. My thesis work, in many respects, was part of a team effort with my associates, S. Nash Smith, T.A. Toussoun, F.F. Hendricks, R.J. Cook, and my major professor, W.C. Snyder. They all contributed greatly to the understanding of the physiology and ecology of *Fusarium* root rot of bean. Hendricks and I subsequently received the American Institute of Biological Sciences Campbell Award for our research on *Fusarium* root rot of bean.

"Knowledge of the role of plant exudates in the disease process, disappointingly, has not yet led to the development of effective disease controls, although exudation patterns have been altered by topical applications of various chemicals and by plant breeding. The rhizosphere represents a highly complex environment and there needs to be a better understanding of the many biotic and abiotic interactions before diseases can be effectively controlled by biological means. The rapid advances in recombinant DNA technology offer some provocative possibilities for developing new disease controls on the basis of the exudate phenomenon. It should be possible to change the composition of plant exudate by gene manipulation or to improve the colonizing ability of beneficial antagonists by altering their capacity to use certain exuded substrates. Present efforts to understand the interactions between root colonizing microflora and pathogens are providing encouraging leads. Several papers discuss this subject."[1,2]


1. **Schroth M N & Hancock J G.** Disease-suppressive soil and root colonizing bacteria. *Science* **216**:1376-81, 1982.
2. **Suslow T V.** Role of root-colonizing bacteria in plant growth. (Mount M S & Lacy G H, eds.) *Phytopathogenic prokaryotes*. New York: Academic Press. 1982. Vol. 1. p. 157-223.