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This Week's Citation Classic®

Shaw M. The physiology and host-parasite relations of the rusts.
Annu. Rev. Phytopathol. 1:259-94, 1963.
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This review discussed the physiology of rust uredospores, the establishment of rust infections, and their effects on respiratory and nitrogen metabolism, growth substances, growth, and the accumulation of radiotracers. Possible roles of phenolic compounds, the dominance of infection sites, and redox conditions were assessed in relation to host resistance. [The *SCI*® indicates that this paper has been cited in over 125 publications.]

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This review is testimony to the political impact of the epidemics of wheat stem rust that struck Western Canada in the early 1950s. I began research on the "physiology" of rust in 1953 at the invitation of W.P. Thompson, president, University of Saskatchewan,[1] with support from the United Grain Growers and the Canada Department of Agriculture. When Thompson sought further support from the Canadian Wheat Board, the minister responsible, the Honorable C.D. Howe, asked the president of the National Research Council, E.W.R. Steacie, for advice. On a visit to Saskatoon, Steacie spent an hour with me in my laboratory. He must have been impressed because Howe soon wrote to say that "the National Research Council" had praised my research and that an Order-in-Council had authorized a grant to me from "undistributed balances in the hands of the Canadian Wheat Board," a euphemism for unclaimed farmers' grain checks! The order stated that the Privy Council advised the Governor General: "Your Excellency may be pleased to deem the use of the above sums of money for research on the basic physiology of rust to be for the benefit of producers of wheat and other grains."

G.A. Ledingham, director, Prairie Regional Laboratory, National Research Council, and I were originally invited to write the review for volume 14 of the *Annual Review of Plant Physiology*. With Ledingham's blessing, I undertook the task and later accepted J.G. Horsfall's invitation to publish in the new *Annual Review of Phytopathology*. In another review I considered the physiology of rust uredospores in greater detail.[2]

The literature that I assessed reflected the availability of radiotracers and other new techniques after World War II; only 13 of the 238 papers cited were published before 1950. In 1962 the obligately biotrophic cereal rusts had not been grown on laboratory media. I suggested that this would eventually be achieved, and it was—four years later in Australia.[3] H.H. Flor's gene-for-gene theory of host-parasite interactions had gained prominence, and its theoretical basis and predictive value had been established by C. Person.[4] I suggested that investigations on the effects of infection on cellular fine structure, phenolic compounds, and nucleic acid and protein synthesis would be rewarding. I envisaged the possibility of qualitative changes in host RNA and stated that it was "not yet possible to relate the effects of specific genes for resistance or virulence to particular biochemical processes." This remains true today, but recombinant DNA techniques are now transforming plant pathology and will undoubtedly lead to new levels of understanding of gene action in host-pathogen specificity.

Does its frequent citation[5,6] reflect the review's insights? The real reasons may be more mundane. The rusts cause greater crop losses than any other cereal pathogens and the *Annual Reviews* are widely read.

1. **Shaw M.** Fine structure in detached, senescing wheat leaves. *Can. J. Bot.* 43:747-55, 1965. (Cited 135 times.)
[See also: **Shaw W.** Citation Classic. *Current Contents/Agriculture, Biology & Environmental Sciences* 18(47):20, 23 November 1987.]
2. ————. The physiology of rust uredospores. *Phytopathol. Z.—J. Phytopathol.* 50:159-80, 1964.
3. **Williams P G, Scott K J & Kuhl J L.** Vegetative growth of *Puccinia graminis* f. sp. *tritici in vitro*. *Phytopathology* 56:1418-9, 1966. (Cited 85 times.)
4. **Person C.** Gene-for-gene relationships in host:parasite systems. *Can. J. Bot.* 37:1101-30, 1959. (Cited 125 times.)
5. **Heitefuss R & Williams P H,** eds. *Physiological plant pathology*. Berlin: Springer-Verlag, 1976. 890 p.
6. **Bushnell W R & Roelfs A P,** eds. *The cereal rusts, vol. I: origins, specificity, structure, and physiology*. Orlando, FL: Academic Press, 1984. 546 p.

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