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This Week's Citation Classic

Cruickshank I A M. Phytoalexins. *Annu. Rev. Phytopathol.* **1**:351-74, 1963.
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This review summarized the phytoalexin theory of disease resistance originally proposed by K.O. Müller and H. Börger[1] some 20 years previously. It reviewed the state of the art in relation to the physiology of the plant's response to infection by fungi and the accumulation of several chemically identified phytoalexins. [The *SCI*® indicates that this paper has been cited over 160 times since 1963.]

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"In 1940, K.O. Müller and H. Börger[1] proposed the phytoalexin theory of disease resistance in plants which offered an explanation of certain aspects of disease resistance based on the post-infectional formation of warding-off-compounds (phytoalexins) by the plant. It proposed *interalia* that these compounds were primarily involved in the toxicological syndrome associated with host-pathogen interactions. The resistant state was considered not to be constitutive but to be developed after the fungus had attempted infection. The sensitivity of the host cell, which was considered to determine the rate of the host reaction and the speed of the accumulation of phytoalexins, was considered to be specific and genotypically determined. This paper lay neglected for almost 20 years. The ideas were too radical for their time.

"Due to the fortunes of war, Müller left Germany and joined CSIRO in 1953 where he initiated further research. I was privileged to work with him in the late 1950s. As a result of this association and my collaboration with a chemist, Dawn R. Perrin, a multidiscipline research program was initiated which led to the isolation and chemical identification of the first phytoalexin, pisatin, 6a-hydroxypterocarpan from infection droplets on the endocarp of pea pods.

"The review focussed on recent results from my laboratory, much of them unpublished at the time, and results of a few other pioneers in this field who had recently initiated related research programs. It looked at the limited available data and the potential significance of the ideas associated with the phytoalexin theory. It contributed to the initiation of a major debate in plant pathology between believers and nonbelievers in the theory. This debate has resulted in a quiet revolution in this area of physiological plant pathology against concepts involving static and towards concepts involving dynamic bases as explanations of the outcome of host-pathogen interactions. Debate and experiment continue today. Much correlative evidence in support of the theory has been reported but more definitive evidence is sought.

"This review appeared well before the great new surge of interest in the physiology of host-pathogen interactions. The trickle which has become a flood had just started. The research results from this laboratory contained in the review together with subsequent research from this laboratory on phytoalexins were recognized by the American Phytopathology Society in 1975 by its award to me of the Ruth Allen Award. This award is made by the Society to 'individuals who have made an innovative research contribution that has changed or has the potential to change, the direction of work in any field of plant pathology.'

"One possible reason that my review has become a *Citation Classic* is that it was the first review of research on phytoalexins Another was good timing. The physiological era in plant pathology was just beginning. Several recent reviews on the chemistry of the pathogen's attack and the host's response to invasion have been published "[2,3]

1. **Müller K O & Börger H.** Experimentelle Untersuchungen über die *Phytophthora-Resistenz* der Kartoffel. *Arb. Biol. Reichsanst. Landwirtsch. Forstwirtsch.,Berlin-Dahlem* **23**:189-231, 1940.
2. **Cruickshank I A M.** Defenses triggered by the invader: chemical defenses. (Horsfall J G & Cowling E B, eds.) *Plant disease.* New York: Academic Press, 1980. Vol. 5. p. 247-67.
3. **Keen N T & Bruegger B.** Phytoalexins and chemicals that elicit their production in plants. *Amer. Chem. Soc. Symp. Ser.* **62**:1-26, 1977.