

Phytoalexins in Plant Disease Defense

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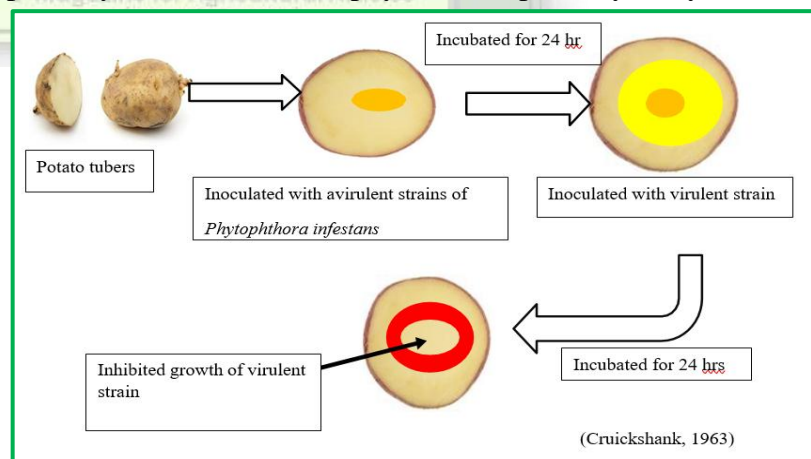
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The concept of phytoalexins was first introduced over 70 years ago by Muller and Borger after observing that infection of potato tubers with a strain of *Phytophthora infestans* capable of initiating hypersensitive reactions, significantly inhibited the effect of a subsequent infection with another strain of *P. infestans*. This inhibition was linked to a “principle” produced by the plant cells reacting hyper sensitively that they named phytoalexin. The term “phytoalexin” is derived from Greek word, “phyton” which means “plant” and “alexin” which means “a warding off compound”. Phytoalexins have been defined as antibiotics which are produced as a result of the interaction of two metabolic systems, host and parasite, and which inhibit the growth of microorganisms pathogenic to plants (Cruickshank, 1963).

Muller studied responses of the seed cavity of french bean pods to spores of the peach pathogen, *Monilinia fructicola*. While water droplets from uninoculated cavities stimulated fungal growth, inoculated cavities became necrotic and diffusates became inhibitory to fungal growth within 24 h of inoculation. The unidentified inhibitor was extracted with organic solvents and was termed a phytoalexin. This inhibitor was subsequently purified and found to be a “phaseollin” (Guest and Brown, 1997). Phytoalexins with their chemical structure produced by a range of crop plants belonging to the family Brassicaceae, Vitaceae, Solanaceae, Fabaceae Poaceae, Malvaceae, Orchidaceae, Piperaceae, Rosaceae, and Rutaceae etc., (Shukla et al., 2013). Various pathways are utilized for producing different phytoalexins viz., the phenyl-propanoic-polymalonic acid pathway, the methylerythritol phosphate and geranyl-geranyl diphosphate pathway and the indole phytoalexin pathway. Phytoalexins involved in antifungal, antibacterial activities (Jeandet et al., 2014).

Four Chickpea cultivars (Digvijay, Vijay, Jaki and JG-62) were analyzed *in vivo* and *in vitro* for natural and induced level of antimicrobial compound *i.e.*, phytoalexin “medicarpin” in their leaves to confirm their resistance status against Fusarium wilt. In leaves of



cultivar Digvijay and Vijay it was found to increase in medicarpin till fruiting stage and maturity with disease incidence of 7 and 12 %, respectively. In cultivars Jaki and JG-62, it starts declining from flowering onwards with disease incidence of 34 and 38 % respectively. The *in vitro* studies showed that, the medicarpin content in cotyledons and seedlings elicited with Fusarium cell wall elicitor (FCWE) was highest on fourth day of elicitation but the content was significantly lesser in Jaki and JG-62 as compare to Digvijay and Vijay (Chavan and Koche, 2021). Phytoalexins produced by sorghum (luteolinidin, apigeninidin) and maize (zealexin, kauralexin). For these molecules, biosynthetic pathways, known intermediates, proposed enzymes, and mechanisms of elicitation are highlighted. Finally, the involvement of phytoalexins in plant resistance are discussed and their possible applications (Poloni and Schirawski, 2014). Most phytoalexins identified in rice are diterpenoid compounds. Recently, flavonoid sakuranetin was the only known phenolic phytoalexin in rice. However, recent studies have shown that phenylamides are involved in defense against pathogen attacks in rice. Phenylamides are amine-conjugated phenolic acids that are induced by pathogen infections and abiotic stresses including ultra violet (UV) radiation in rice. Phenylamides also have been implicated in cell wall reinforcement for disease resistance and allelopathy of rice (Cho and Lee, 2015).

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