ANTIMROBIAL PROPERTIES OF CATECHOL DERIVATIVES

Alexander Pauli
ReviewScience, 90513 Zirndorf, Fürther Str. 13, Germany

Soil microorganisms excrete special substances which either activate plant growth or are toxic to plant tissues and organs. It would therefore be desirable to inactivate growth of microorganism-inhibitors of agricultural plants or to activate growth of weed pathogens. Because of specific microorganism-plant interactions in soil, selective acting activators or inhibitors of microbial growth are needed to influence the fate of plant species of interest.

Catechol derivatives play an important role in mammalian metabolism and many compounds of this type are known to be secondary metabolites of higher plants. In contrast, only 2 of over 1800 examined antibiotics (1) of microbial origin contain a catechol sub-structure. Therefore, the catechol derivatives are a promising group of compounds worthwhile for further investigation, which may lead to the discovery of selective acting, biodegradable agrochemicals having high human, animal and plant compatibility.

A database search revealed that none of the catechol derivatives has been tested systematically *in vitro* on its growth inhibitory properties against microorganism-inhibitors belonging to important bacterial (*Bacillus, Pseudomonas, Actinomyces*) and fungal genera (*Alternaria, Botrytis, Cladosporium, Fusarium, Helminthosporium, Penicillium, Pythium, Trichoderma* and *Trichothecium*).

Catechol itself and monosubstituted catechols (-OH, -CH3, -OCH3, -CHO, -COOH) are active in part against *Pseudomonas, Bacillus*, but not *Penicillium* species. The lignin degradation product protocatechuic aldehyde is inactive against almost all bacterial and fungal species, while the corresponding acid has weak antibacterial, but no antifungal activity (*Fusarium, Penicillium* sp.). The results of gallic acid vary among different strains of one bacterial species, while inhibition of fungi was observed only at very high concentrations. The smaller homologues of their n-primary esters (C1 to C12) are capable to inhibit bacteria of the genera *Bacillus* and *Pseudomonas*, however, their effect on soil fungi is unexamined. Caffeic acid is inhibitory to soil bacteria and fungi, but species differences exist, while its methyl ester has more pronounced activity against *Bacillus* and *Pseudomonas* species. Chlorogenic acid was found to be inactive against *Pseudomonas* and *Helminthosporium* species. Hydroxychavicol inhibits a greater number of microorganisms including *Pseudomonas, Cladosporium* and *Pythium* species. 4-Cinnamyl-pyrogallol has been studied against fungi and it is inhibitory towards *Alternaria, Botrytis* and *Penicillium* species. Among flavonoids sigmoidin A and B inhibit selectively *Bacillus* species, but not several fungi. Fisetin and isoluteolin have been tested only in part and showed activity against *Pseudomonas* and *Bacillus* species, respectively. Many other flavonoids and catechol derivatives turned out to be as antimicrobial agents, but their growth inhibitory properties against phytopathogenic microorganisms are unexamined.

These results suggest that diversity exists between inhibition of bacteria and fungi by catechol derivatives, however, final conclusions can not be made before systematic investigations have been conducted.

Reference

1) AMICBASE-EssOil: Database on Natural Antimicrobials, ReviewScience, Germany (1999-2002)

Citation:

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