

The Effect of Methionine on the Development of Apple Powdery Mildew

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Decker (1) has reported that *l*-methionine inhibits the development of cucumber powdery mildew, *Sphaerotheca fuliginea*, and that folic acid will reverse this inhibition. The following study was undertaken to determine if this phenomenon occurs with apple powdery mildew *Podosphaera leucotricha* (Ell. & Ev.) Salm.

Freshly unfolded seedling apple leaves were used in this study. All the seedlings from which these leaves were collected were susceptible to *P. leucotricha*. The leaves were washed in running distilled water for 1 hr, then blotted dry with filter paper. Freshly developed mildew spores were removed from infected leaves with a camel's-hair brush and placed in a spot on the top of the washed leaves. The leaves were then floated, inoculated side up, in the solution to be tested. All tests were performed in 100- × 20-mm covered petri dishes. Temperature range was from 24-28 C. If the temp exceeded 28 C, necrotic spots developed on many leaves, especially those in solutions containing folic acid.

Glycine, *dl*-α valine, *dl*-tryptophan, *dl*-aspartic acid, *dl*-arginine, *dl*-serine, *dl*-cystine, *dl*-cysteine were tested at 8×10^{-4} M concn. *dl*-Methionine and its *l* and *d* racemates were tested at 8×10^{-4} M and 4×10^{-4} M concn. Folic acid was added to the methionine solutions at 1×10^{-4} M and 8×10^{-4} M concn; however, the higher concn is not completely soluble and tended to settle out on standing. Also, it was frequently phytotoxic. A distilled water solution was used as a check. Each experiment was replicated 4 times and repeated at least once.

Table 1 gives the averages mildew ratings based on eight samples when leaves were floated in two concn

TABLE 1. The effect of methionine and folic acid (1×10^{-4} M) on the severity of apple powdery mildew

Methionine racemate	Mildew rating ^a		
	Concn	No folic acid	Folic acid
<i>dl</i>	8×10^{-4} M	1.3	1.4
<i>dl</i>	4×10^{-4} M	1.4	1.4
<i>d</i>	8×10^{-4} M	1.0	1.3
<i>d</i>	4×10^{-4} M	1.3	1.6
<i>l</i>	8×10^{-4} M	1.0	1.6
<i>l</i>	4×10^{-4} M	1.1	1.9
Check		3.3	2.6
LSD	.05	1.1	0.5

^a 0 = no mildew; 5 = leaf covered with mildew.

of *dl*-methionine, *d*-methionine, and *l*-methionine with and without folic acid at 1×10^{-4} M concn. Mildew was rated on a 0-5 scale (0 = no mildew; 5 = entire leaf covered with mildew). Each of the methionine racemates reduced the severity of the powdery mildew compared to the check. Folic acid alone also reduced the severity of the powdery mildew. Folic acid partially reduced the inhibition of *l*-methionine at both concentrations, but had no effect on either *dl* or *d*-methionine.

Except for tryptophan, none of the other amino acids tested influenced the development of powdery mildew. Tryptophan increased the powdery mildew rating from an average of 3.5 for the check to 4.3 in one experiment, but this result was not reproducible.

Results agreed in part with Decker's result on cucumber powdery mildew (1). Reversal of inhibition of *l*-methionine occurred, but was not as dramatic. The fact that of the amino acids tested only methionine inhibited mildew development is also in agreement with Decker. I could find no difference, however, among the inhibitions caused by various racemates of methionine. That folic acid did not reverse the inhibition caused by *dl* and *d*-methionine may indicate a difference in the mode of action of the *l*-racemate.

LITERATURE CITED

1. DECKER, J. 1969. *l*-methionine induced inhibition of powdery mildew and its reversal by folic acid. Netherlands J. Plant Pathol. 75:182-185.