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Pyrrolnitrin Interferes with Osmotic Signal Transduction in *Neurospora crassa*

Akiyoshi Okada[1)], Shinpei Banno[1)], Akihiko Ichiishi[1)], Makoto Kimura[2)], Isamu Yamaguchi[2)] and Makoto Fujimura[1)]

1) Faculty of Life Sciences, Toyo University
2) Plant Science Center, RIKEN

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Abstract:
Pyrrolnitrin, produced by several bacteria that are used in biological control, has an inhibitory effect on the electron transport system of respiration in *Neurospora crassa*. We have previously described that fludioxonil, a derivative of phenylpyrroles, affects osmotic signal transduction. Both pyrrolnitrin and fludioxonil were highly active against *Botrytis cinerea*, *Fusarium oxysporum*, *Rhizoctonia solani*, and *N. crassa*. However, a high concentration of pyrrolnitrin (more than 10 μg/ml) inhibited the growth of fludioxonil-insensitive fungi such as *Pythium ultimum*, *Phytophthora capsici*, and *Saccharomyces cerevisiae*. In order to clarify the difference in the antifungal mechanisms between pyrrolnitrin and fludioxonil, we observed cross-resistance in mutants of the osmotic signal transduction pathway, namely, *os-1* (histidine kinase), *os-4* (MAPKK kinase), *os-5* (MAPK kinase), and *os-2* (MAP kinase) of *N. crassa*. All *os* mutants that were resistant to fludioxonil showed cross-resistance to pyrrolnitrin without exception. The levels of resistance to pyrrolnitrin correlated well with those to fludioxonil in the 10 *os-1* mutant alleles with single amino acid substitutions. However, at a concentration of 6.1 μg/ml, pyrrolnitrin inhibited the growth of all strains including the *os* mutants insensitive to fludioxonil even at 25 μg/ml. When the conidia of the wild-type strain were grown on a medium containing either fungicide at a concentration of 0.1 μg/ml, both fungicides induced the swelling and rupture of conidia without germ-tube formation. At a concentration of 25 μg/ml, pyrrolnitrin inhibited conidia germination without any morphological change in the

fludioxonil-insensitive *os-5* mutant. Both fungicides at a concentration of 1 μg/ml stimulated glycerol synthesis in the wild-type strain, but the glycerol content was reduced to a considerable extent on treatment with 25 μg/ml pyrrolnitrin. These results suggest that a primary antifungal mechanism of pyrrolnitrin against *N. crassa* is interference with the osmotic signal transduction pathway rather than inhibition of respiration. © Pesticide Science Society of Japan

Keywords:
dicarboximide, glycerol, two-component signal transduction, biocontrol, histidine kinase, respiration

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