REDISCOVERY OF MOMILACTONE B AS AN ALLELOCHEMICAL

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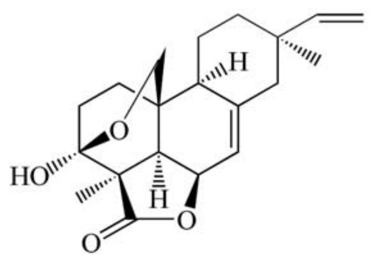
INTRODUCTION

Rice has been extensively studied with respect to its allelopathy as part of a strategy for sustainable weed management, such as breeding allelopathic rice strains. A large number of rice varieties were found to inhibit the growth of several plant species when these rice varieties were grown together with these plants under the field or/and laboratory conditions. These findings suggest that rice probably produces and releases allelochemical(s) into the environment. This paper focuses on identification of an allelochemical released from rice plants and evaluation of the role of the allelochemical in natural ecosystems.

IDENTIFICATION OF AN ALLELOCHEMICAL RELEASED FROM RICE

Rice (*Oryza sativa* L. cv. Koshihikari) seedlings inhibited the growth of cress (*Lepidium sativum* L.) and lettuce (*Lactuca sativa* L.) seedlings when the cress and lettuce were grown with rice seedlings. The putative compound causing the inhibitory effect of rice seedlings was isolated from their culture solution and purified with several chromatographies, and the chemical structure of the inhibitor was determined by spectral data as 3,20-epoxy-3α-hydroxy-9*β*-pimara-7,15-dien-19,6*β*-olide (momilactone B).

BIOLOGICAL ACTIVITY OF MOMILACTONE B



Momilactone B

Momilactone B inhibited the root and hypocotyl growth of cress seedlings at concentrations greater than 3 nmol mL^{-1}. The inhibition was increased with increasing concentrations of momilactone B. The concentrations required for 30 % inhibition in the assay were 12 and 16 nmol mL^{-1} on cress roots and hypocotyls, respectively, and for 50 % inhibition on cress roots and hypocotyls were 36 and 41 nmol mL^{-1}, respectively. Thus, inhibitory activity of momilactone B is comparable to that of ABA.

RELEASE LEVEL OF MOMILACTONE B FROM RICE PLANTS

Momilactone B was released into the neighboring environment from rice roots throughout its life cycle. The rate of momilactone B release from rice roots increased until flowering initiation, and then decreased. The release rate of momilactone B at the day of flowering started was 2.1 μg $plant^{-1}$ day^{-1}, which was 44-fold greater than that at day 30. On average, a single rice plant released about 100 μg of momilactone B into the neighboring environment over its life cycle. Rice usually plants with very high density in the paddy field and the water in the field is not replaced usually during their growing season. Thus, accumulation of momilactone B released from rice plants may occur in the field conditions sufficiently to inhibit the growth of neighboring plants.

CONCLUSION

The release level of momilactone B from rice plants and the effectiveness of momilactone B on the growth inhibition suggest that momilactone B may act as an allelochemical by inhibiting growth of neighboring plants. This was the first finding that the potent growth inhibitor momilactone B is released from living rice roots to the environment in sufficient quantities to inhibit the germination and growth of neighboring plants, which is very important for allelopathy because, while a number of phytotoxic compounds have been isolated from many plants with aqueous and/or organic solvents, those released by living roots are more likely to have ecological relevance.