Release Level of Momilactone B from Rice Plants

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In one of the recent trials searching for rice allelochemicals, a putative compound causing the growth inhibitory effect was isolated from root exudates of rice seedlings and identified as momilactone B from its spectral data (Kato-Noguchi et al., 2002). In addition, momilactone B was found to be released from rice seedlings at an early developmental stage (Kato-Noguchi et al., 2003). These findings together with the growth inhibiting activity of momilactone B suggest that momilactone B might play an important role in rice allelopathy. However, there is no information whether developmental rice plants release momilactone B into neighboring environment.

Momilactone B was first isolated together with momilactone A from rice husks as growth inhibitors involved in seed dormancy (Kato et al., 1973; Takahashi et al., 1976), and both momilactones were later found in rice leaves and straw as phytoalexins (Cartwright et al., 1977; 1981; Kodama et al., 1988). The function of momilactone A has been extensively studied (Nojiri et al., 1996; Araki et al., 1999; Takahashi et al., 1999; Tamogami et al., 2000; Agrawal et al., 2002). Although the inhibitory activity of momilactone B is much greater than that of momilactone A (Takahashi et al., 1976; Kato et al., 1977), the function of momilactone B is obscure.

In this paper, the concentrations of momilactone B in 80-day-old rice plants and the level of momilactone B released from the plants into the culture solution were determined, and the possible involvement of momilactone B in rice allelopathy was discussed.

Materials and Methods

Seeds of rice (Oryza sativa L. cv. Koshihikari) were surface sterilized in 3 mM solution of methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate (Dupont, Wilmington, Delaware) for 24 h, rinsed several times with distilled water and germinated at 25 °C under a 12-h photoperiod for 3 days as described by Kato-Noguchi et al. (2002). Then, three uniform seedlings were transferred onto a plastic float in a plastic pot containing 3 L of one-half-strength Kimura B culture solution (0.18 mM (NH₄)₂SO₄, 0.27 mM MgSO₄·7H₂O, 0.09 mM KNO₃, 0.09 mM KH₂PO₄, 0.05 mM K₂SO₄, 0.18 mM Ca(NO₃)₂·4H₂O, 0.04 mM Na EDTA-Fe·H₂O and 0.8 mM Na₂SiO₃; pH 5.0) in a plastic pot (24 cm id x 30 cm height), and grown for 80 days (from May to July, 2002) in greenhouse under natural day light condition. The culture solution in the pot was renewed every two days and only the roots of the rice plants were immersed in the solution during the incubation.

According to the methods described by Kato-Noguchi et al. (2003), release level of momilactone B from 80-day-old rice plants into the culture solution and concentrations of momilactone B in shoots and roots of the rice plants were determined.

Results and discussion

Momilactone B, 12.5 µg, was detected in culture solution in which three 80-day-old rice plants were grown hydroponically. At this time, the stage of these rice plants was panicle initiation, and length of their shoots and roots was about 110 and 35 cm, respectively. Since the culture solutions were renewed every two days during the experiment, one rice plant considered releasing 2.1 µg of momilactone B into the solution per day (Fig. 1). This release probably occurred from their roots because only the rice roots were immersed in the culture solution as described in Materials and Methods.

Momilactone B was detected in shoots and roots of 80-day-old rice plants and the level of momilactone B released from the plants into the culture solution were determined, and the possible involvement of momilactone B in rice allelopathy was discussed.
of the strategies for survival, many plant species release allelochemicals to inhibit the germination and growth of their neighboring plants (Rice, 1984; Putnam et al., 1986). Rice was also found to produce and release growth inhibiting allelochemical(s) into their neighboring environments (Dilday et al., 1994; 1998; Olofsdotter et al., 1995; 1999; Hassan et al., 1998; Matiice et al., 1988; Kim et al., 1999; Azmi et al., 2000). However, the chemical structures of these allelochemicals are still unknown.

Momilactone B inhibited the germination and growth of other plant species, and the inhibitory activity was comparable to that of ABA (Takahashi et al., 1976; Kato et al., 1977). The rice seedlings at an early developmental stage released momilactone B into their neighboring environment and the level released was enough to inhibit the growth of their neighboring plants (Kato-Noguchi et al., 2002; Kato-Noguchi et al., 2003). In the present research, we found that developmental rice plants also produce momilactone B and release momilactone B into their neighboring environment. Thus, momilactone B may act as an allelochemical and play an important role in the competition with neighboring plants.

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