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Development of marker-free rice with stable and high resistance to rice black-streaked dwarf virus disease through RNA interference

发布日期：2020-08-02 浏览次数：6

Plant Biotechnology Journal, n/a(n/a). doi: 10.1111/pbi.13459

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Abstract

The rice black-streaked dwarf virus (RBSDV) disease causes severe rice yield losses in Asia. RNA interference (RNAi) has been widely applied to develop antiviral varieties in plants. So far, only a few studies reported the application of RNAi in rice against RBSDV and most of them are lack of enough data to support its breeding potential, which limited the progress on developing RBSDV resistant variety. In this study, we generated three RNAi constructs to specifically target three RBSDV genes (*S1*, *S2* and *S6*), respectively. We confirmed that RNAi targeting RBSDV *S6* conferred rice with almost full immunity to RBSDV through phenotyping test in eight consecutive years in both artificial inoculation and field trials, while RNAi of S1 or S2 only lead to partially increased resistance. The *S6RNAi* was also found conferring strong resistance to southern rice black-streaked dwarf virus (SRBSDV), a novel species closely related to RBSDV that outbroke recently in Southern China. In particular, no adverse effects on agronomical and developmental traits were found in *S6RNAi* transgenic lines. The marker-free transgenic lines with *S6RNAi*, driven by either maize *ubiquitin-1* promoter or rice *rbcS* green-tissue expression promoter, in elite rice background should have great potential in breeding of resistant varieties to both RBSDV and SRBSDV and provide a basis for further safety evaluation and commercial application.

全文链接：https://doi.org/10.1111/pbi.13459