RNA SILENCING AS A AN ANTIVIRAL DEFENSE MECHANISM

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In eukaryotes, ARGONAUTE proteins (AGOs) associate with microRNAs (miRNAs), short interfering RNAs (siRNAs), and other classes of small RNAs to regulate target RNA or target loci. Viral infection in plants induces a potent and highly specific antiviral RNA silencing response characterized by the formation of virus-derived siRNAs. *Arabidopsis thaliana* has ten *AGO* genes of which *AGO1, AGO2,* and *AGO7* have been shown to play roles in antiviral defense. A genetic analysis was used to identify and characterize the roles of AGO proteins in antiviral defense against *Turnip mosaic virus* (TuMV) in Arabidopsis. AGO1, AGO2 and AGO10 promoted anti-TuMV defense in a modular way in various organs, with AGO2 providing a prominent antiviral role in leaves. AGO5, AGO7 and AGO10 had minor effects in leaves. AGO1 and AGO10 had overlapping antiviral functions in inflorescence tissues after systemic movement of the virus, although the roles of AGO1 and AGO10 accounted for only a minor amount of the overall antiviral activity. By combining AGO protein immunoprecipitation with high-throughput sequencing of associated small RNAs, AGO2, AGO10, and to a lesser extent AGO1 were shown to associate with siRNAs derived from silencing suppressor (HC-Pro)-deficient TuMV-AS9, but not with siRNAs derived from wild- type TuMV. Co-immunoprecipitation and small RNA sequencing revealed that viral siRNAs broadly associated with wild-type HC-Pro during TuMV infection. These results support the hypothesis that suppression of antiviral silencing during TuMV infection, at least in part, occurs through sequestration of virus-derived siRNAs away from antiviral AGO proteins by HC-Pro. These findings indicate that distinct AGO proteins function as antiviral modules, and provide a molecular explanation for the silencing suppressor activity of HC-Pro.

Reference

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