Universität Basel

Research Project

IDP BRIDGES: ESR3 siRomics for universal diagnostics of plant viral disease and virus diversity studies

Third-party funded project

Project title IDP BRIDGES: ESR3 siRomics for universal diagnostics of plant viral disease and virus diversity studies
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Traditional methods of viral diagnostics using specific antibodies and PCR often fail to identify a pathogen. We propose an alternative novel approach which we call siRomics. The main plant antiviral defense system is based on RNA silencing and generates 21-24 nucleotide short interfering RNAs (siRNAs). In plants infected with DNA and RNA viruses, Dicer enzymes generate viral siRNAs that restrict virus replication and systemic spread. Growing evidence indicates that viral siRNAs are derived from the entire genome sequence of RNA and DNA viruses and accumulate at high levels. Hence it appears feasible to reconstruct a complete viral genome simply from viral siRNA species. Current bioinformatics algorithms enable *de novo* assembly of genomes and transcriptomes from short sequencing reads. In a proof-of-concept experiment, we could reconstruct the genomes of known RNA and DNA viruses by deep-sequencing and *de novo* assembly of viral siRNA population (siRome) from virus-infected model plants as well as from crop plants iffected with unknown viruses (Seguin et al. 2014 PLoS One). Thus, our siRomics approach has the potential for universal diagnostics of plant virus disease. The main advantage of this approach is that it allows fast and reliable identification of the genome sequence of an unknown virus or new viral strain that causes a given disease. Here we want to apply this novel approach for a survey of viral pathogens on local field crops, grapevines, vegetables, fruits and ornamentals, all known to suffer from known as well as unknown RNA or DNA viruses. Owing to the global climate changes we expect to detect new viruses that normally occur far away from Switzerland. This study will also be informative for further understanding the mechanisms of RNA silencing-based antiviral defense and for developing novel strategies of virus control such as siRNA-based vaccination. This project combines multi-disciplinary approaches ranging from advanced molecular methods such as next generation sequencing to sophisticated bioinformatics algorithms for virus genome reconstruction and diversity studies. It is crucial for modern agriculture, horticulture and (bio-)farming to assess the risk of emerging plant infections and to control the spread of plant viral diseases.

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