Aim of the study

Viruses that replicate efficiently in a plant and/or in a shorter period of time cause systemic infection, are more likely to succeed evolutionary. Both processes can be significantly impacted by resistance level of plants and the ability of viruses to break it down. Therefore, the aim of the project is to determine whether strains of *potato virus Y* (PVY^{NTN}, PVY^{N-Wi} and PVY^{O}) vary in rates of movement and efficiency of multiplication in infected plants as well as whether and how the resistance of potato varieties affects both phenomenons. In addition, the process of multiplication of the virus strains will be studied at the molecular level. Replication of viral particles depends on transcription of the viral RNA and on the translation of viral proteins. Both of these processes will be examined separately in cellular and extra-cellular model systems. Accurate knowledge of the mechanisms of movement and replication of PVY strains in plants with different levels of resistance can answer the question about the reasons for replacing the "old" strains of PVY by new ones. Knowledge about the speed of the movement, distribution and concentration of viruses during different growth stages of plants may also have important practical meaning.

Basic research planned to be implemented in the project

During the initial stage of the study pure preparations of PVY strains will be isolated from infected plants by organic extraction, differential centrifugation and sucrose gradient ultracentrifugation. The genomes of the purified strains will be sequenced and compared the genomes of PVY deposited in the NCBI on-line gene bank by researchers from around the world. This will allow for a defining genetic structure of investigated PVY isolates. The remaining part of the research will be divided into 3 stages. The first will investigate movement rate of PVY strains and the effectiveness of their replication in primarily infected potato plants that differ in their degree of resistance to PVY. In the second stage, the same processes will be studied in plants infected secondarily, where the source of infection are sick from mini-tubers. The aim of the third step is to analyze the efficiency of replication PVY strains at the molecular level using the cellular *in vivo* system – cell suspension cultures and extracellular *in vitro* system for protein translation.

Reasons for research on movement and replication of PVY strains in plants

Biological causes of the rapid spread of new strains of PVY are unknown. New strains may overcome the resistance of plants and displace older variants due to genetic changes leading to increased rates of viral replication and its faster and more efficient movement of infected plant. Hence investigation of these phenomena in primary and secondary infection caused by the major strains of PVY in varieties with different resistance can bring important knowledge about the biology of these important pathogens. Knowledge of the concentration and distribution of the virus in all stages of plant development will facilitate the correct collection of leaves samples for virus detection. In addition, the project will produce detailed knowledge about the molecular mechanisms of transport and replication PVY strains, which may be further in the future important for breeding new, more resistant varieties.