Because of its taste and significant nutritional values the tomato (*Solanum lycopersicum* L) is popular vegetable in consumers` diet. Raw tomatoes provide essential vitamins, minerals and nutrients that can deliver a number of profound health benefits. The tomato is also an important source of lycopene – a antioxidant that acts as an anticarcinogen. According to the Polish Central Statistical Office in 2015 tomato was produced on over 10 000 hectares and overall production of the vegetablein Poland ranged over 236 000 tons. Just like the other crops and vegetables, the tomato is affected by pests (for instance whiteflies) or diseases (caused by microbes, such as viruses). The insect pests as well as commonly known disease agents (bacteria, viruses) can significantly reduce quantity of crop and quality values ofproduced tomatoes. One of the serious disease agents infecting *S. lycopersicum* is tomato torrado virus (ToTV). ToTV infects tomatoes causing severe disease symptoms in the plants: burn-like necrosis within basal parts of leaflets and tomato leaves. Under favourable conditions the ToTV infection, in extreme cases, might lead to plant`s death. This points on high aggressiveness of the virus. Moreover, ToTV can efficiently spread within field or greenhouse from infected plants to healthy ones. This is because the ToTV is transmitted by insects: the whiteflies. Importantly, experimental data showed that not all tomato cultivars are ToTV-susceptible. Still, little is know about tomato susceptibility to ToTV as well as molecular mechanisms associated with ToTV infection on the host. Therefore, taking into consideration high ToTV aggressiveness, we decided to look into molecular mechanisms standing behind necrosis in tomato caused by the virus.

The main goal in this project is assessment of molecular mechanisms standing behind disease symptoms (systemic necrosis) induction of in tomato infected with ToTV.

Genetic variability and biological characteristics of Polish ToTV isolates were characterized in the Interdepartmental Laboratory of Molecular Biology of Institute of Plant Protection – National Research Institute. This allowed us designing and optimizing innovative and highly sensitive methods for detection of ToTV in infected plants. Moreover, for the first time we indicated those ToTV genes that are involved in virus infectivity. By using infectious clones of ToTV (synthetic infectious viral RNAs) it was possible to indicate other ToTV genes possibly involved in mechanisms of disease induction. Interestingly, we pointed on the viral Vp26 to be pathogenicity determinant inducing necrosis in tomato. Additionally, with contrast to this, we showed that other ToTV protein: Vp23, affects necrosis development in *S. lycopersicum*. However, there are no information about precise host factors associated with disease symptoms induced by ToTV in tomato. Therefore, in the following project, supported by novel analytical methods and experimental approaches, we will look inside the ToTV-tomato relationship acting at molecular level and leading to induction of systemic necrosis in plants. We are going to indicate necrosis-specific genes in tomato. First of all, we will check if disease symptoms triggered by ToTV are related to virus accumulation level, and if those symptoms are modulated by virus titer. Then we will compare global gene expression in ToTV-infected *S. lycopersicum* to indicate those differentially regulated transcripts (mRNAs) that may be associated with ToTV infection. Next, we will launch a proteome map of tomato to indicate proteins (products of gene expression) accumulating in association with ToTV-induced necrosis. Finally, we will perform silencing of indicated genes to switch-off their activity. The *S. lycopersicum* with silenced (switched-off) genes will be subsequently inoculated with ToTV. In a result two scenarios can happen: ToTV will infect tomatoes with silenced “necrotic” genes not causing disease symptoms, or ToTV will not be able to infect *S. lycopersicum*. Moreover, with indicated „necrotic” genes in tomato, we will check their expression in a presence of the ToTV Vp26 (necrosis inducer) or the Vp23 (necrosis suppressor). This would indicate specific functional relationship between viral necrosis inducer and tomato proteins responding to presence of viral proteins.

The results delivered from the proposed project will considerably widen our knowledge about ToTV infectivity as well as about plant molecular mechanisms associated with necrosis induction under virus infection. Molecular patterns, especially necrosis-related genes, will be described in tomato infected by highly aggressive virus. This would give basics for developing alternative and innovative methods of virus control in *S. lycopersicum*, especially important in integrated pest management with limited use of chemicals in plant protection.