Novel determinants of plant-pectobacteria interaction: identification and characteristicsGorshkov V.^{1,2}, Parfirova O.^{1,2}, Tsers I.^{1,2}, Petrova O.¹, Gogoleva N.^{1,2}, Ageeva M.¹, Islamov B.¹,
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Key message. There are “molecular switchers” that transform peaceful coexistence of plants with phytopathogenic pectobacteria to symptomatic infection. These switchers seem to be perspective “targets” for plant protection approaches.

Keywords: phytopathogens, latent infection, phytoimmunity, virulence, tolerance

Most if not all phytopathogenic microorganisms being able to cause plant diseases usually interact with their hosts as commensalists or even mutualists without manifesting their pathogenic potential. This knowledge forces one to think about the alternative ways of plant protection. The contemporary plant protection approaches are based on pathogen elimination either by using pesticides or by breeding resistant plant varieties. However, such kind of a “tough politics” in relation to a pathogen leads to its fast adaptation resulting in the emergence of new highly aggressive strains. Therefore, the plant protection methods that would not apply a selective pressure on a pathogen are of a great importance. From this position, agrotechnological strategy that would ensure obligatory mutualistic behavior of phytopathogens seems promising. The major obstacle for such a strategy is our poor knowledge in the physiology of asymptomatic infections.

Pectobacterium atrosepticum (*Pba*) belongs to one of the most devastating phytopathogens that causes plant rots. It is always regarded as a pathogen with brute force mode of action. Herewith, these bacteria often establish prolonged commensalistic interactions with plants without causing the disease. Our comprehensive study aims to understand what drives the peaceful coexistence of plants with pathogens in terms of the molecular physiology of both organisms and what disturbs the equilibrium within the pathosystem.

Different types of microscopy and NGS-transcriptomics constitute the basis of our systemic methodology providing information on 1) spatial organization of microbial population *in planta* and phenotypic diversity of *Pba* cells – both are the criteria of the infection type; and 2) plant and bacterial genes differentially expressed during latent and acute infection enabling us to assume the molecular players (including novel ones) that determine the type and outcome of plant-pathogen interaction. Then, specific test-systems (including those involving mutagenesis, cloning, chromatography, NMR-spectroscopy, phytohormone application, immunodetection, etc.) are developed to experimentally characterize these players.

The obtained results show that latent, disease-free infections are likely to be the physiological norm and reflect natural equilibrium between plants and pathogens, and the development of pathological processes is a result of the disturbance of this equilibrium due to the specific physiological reactions of both organisms. Different types of induced plant susceptible responses with different outcomes were characterized. Specific role in determination of the infection type was shown for phytohormonal status (which is actively modulated by the pathogen) and *Pba*-induced plant-mediated reorganization of the plant cell wall by plant cell wall proteins/enzymes and ROS. For the first time, we have revealed that a member of soft rot *Pectobacteriaceae* (SRP) is able to produce low molecular weight extracellular phosphonates that seem to contribute to plant-microbe interaction. The synthesis of these compounds is strongly induced by plant-derived metabolites. In addition, for the first time for *Pectobacterium* genus, we obtained and characterized the mutant defective in enterobactin-like siderophore production. Our results show that *Pba* siderophores act in a different manner compared to well-characterized *Dickeya* siderophores. We also identified and characterized the properties of *Pba* exopolysaccharides that made it possible to discuss their role in the pathosystem development. Thus, our data revealed novel molecular participants of plant-*Pba* interaction. The action of some of these metabolites determines the strategy of host-microbe interaction (latent, typical or atypical infection). Global comparative picture of the pathosystem at the equilibrated and disequilibrated states will be presented and maintenance of a pathosystem at the equilibrated state will be discussed as a perspective plant protection strategy.

The study is supported by RSF (No 19-14-00194).