Abstract

The topic of this thesis has been built on previous work of our group, especially Rieger et al. 2008 and Čepl et al. 2010. We examined and described the regularity of morphogenesis of *S. marcescens,* morphotype F colonies (from "the fountain", because of a shape it resembles). Typical colony consists of elevated red navel, low non-pigmented ring and again elevated red rim. Structured profile of the colony together with changes in pigmentation of structures during development without need of artificial dying, provides considerable advantage in observation of the morphogenesis.

Aims of this thesis were (i) to find other factors that affect the morphogenesis, (ii) to characterize interactions of *S. marcescens* colonies with other bacterial strains (*S. rubidaea* and *E .coli*) and finally (iii) to study the phenomenon of induced resistance to the antibiotics described in (Heal and Parsons, 2002; Lu 2004; Bernier et al. 2011) in our model organisms.

(i) Mutual interactions of colonies on the plate indicates that morphogenesis is affected by autocrine signals, which diffuse into the medium and the atmosphere and affect the development of surrounding colonies. We have detected changes of pH of the medium during the development of colonies in their vicinity. At first, we detected acidification of neighborhood (pH 7.2 -> pH 6) to a distance of several millimetres from the edge of the colony. Later, we saw alkalization of environment (pH 8.6) of the entire dish. Time course of these three phases (neutral, acidic and alkaline) correlated with changes in the morphogenesis of colonies (navel, interstitial ring and rim). Acidification of the medium is probably caused by products of glucose metabolism. Factor that influences the interstitial ring – rim transition together with acidic – alkaline transition was identified as ammonia. Limited growth is probably caused by local depletion of nutrients from the medium.

(ii) We extended our observations of colony morphogenesis by “gnotobiological” interactions of interactions of *S. marcescens* with S*. rubidaea* and *E. coli*. Other bacterial clones bring new types of interactions: wrapping of *S. marcescens* colonies by colonies of *S. rubidaea*, the repulsion of growth of *E. coli* by factor produced by *S. marcesens* colonies or overgrowth of *S. rubidaea* colonies by *E. coli* colonies. We described these relationships as heterarchy like game rock, paper, scissors. We investigated how these competitive interactions would appear at different settings: neighborhood of colonies on the solid medium, mixed growth in suspensions or formation of chimeric colonies. To monitor population dynamics in mixed growth of two clones, we attempted to develop a method for non-invasive detection of ratios of individual clones in mixed growth by gaseous fingerprints.

(iii) Ammonia has been described as a factor inducing physiological changes leading to induction of resistance to antibiotic ampicillin and tetracycline in bacteria. We tested this phenomenon in our model bacteria. Ammonia produced by growth of bacteria *S. rubidaea* and *S. marcescens* or released from the ammonia solution increases the number of colonies grown on medium with antibiotics in a neighboring compartment of segmented Petri dish. We found, however, that such resistance is caused by an increase of pH in general followed by the degradation of antibiotic molecule.