Adaptation via natural selection is a process which can explain evolution of staking diversity of organisms populating our planet. Adaptations occur because genetic variants (alleles) producing phenotypes which survive or reproduce better in a given environment are found in more copies in following generation. Thus, adaptation could not proceed without genetic variation within populations. Yet, by increasing frequency of favorable alleles, natural selection should deplete genetic variation in populations. The variation can be restored by mutations, but these are often deleterious and occur on too small a rate (except for microorganisms) to explain the amount of genetic variation observed within populations or the ability of most populations to readily evolve in the face of environmental change. There must be other mechanisms maintaining genetic variation, and one possible mechanism relies on evolutionary trade-offs. For example, alleles associated with better survival may have negative effect on reproductive success or vice versa, preventing fixation of alleles associated with high value of either trait.

Trade-offs between reproduction and survival (or other aspects of organismal life histories contributing to evolutionary success) are especially likely for traits helping males to win competition for females. Selection arising from reproductive completion was named sexual selection by Darwin. He used this concept to explain evolution of elaborated traits, such as peacock tail or deer antlers, which appeared to counter the theory of natural selection by being detrimental to survival. As Darwin noted, the survival cost are compensated by increased reproduction: sexually selected traits help to attract mates (peackock tail and alike) or combat reproductive competitors (deer antlers and alike). Thus, the trade-off between reproduction and survival was at the heart of Darwin's theory of sexual selection, and yet the idea that these trade-offs may help to maintain genetic diversity in populations has received attention from evolutionary biology theorists only recently. The prediction that evolution of elaborated sexual traits results in increased genetic variation within population has not, as yet, been empirically verified.

The purpose of the project will be to fill this important gap in our understanding of the process of evolution by checking if evolution of elaborated, sexually selected traits does indeed help to maintain genetic variation within populations. The project will use experimental evolution approach, and the subject of evolution in laboratory will be a mite with very short generation time, in which males vary in expression of elaborated sexually selected trait: thickened legs which are costly to produce and hinder movement but are useful in intersexual combats. Populations will be forced to evolve towards low or high proportion of males with thickened legs, and after 20 generations (about 1 year in laboratory) their genomes will be sequenced to check whether amount of genetic variation is higher in evolutionary lines in which thickened legs are common.

Results of the study will have important consequences for our understanding of the process of evolution. Genetic variation is a fuel of evolution, therefore assessing the role of sexual selection in maintaining this variation is fundamental to our understanding of evolutionary processes, such as adaptation, speciation and extinction, occurring in sexual species,