Ecological basis of evolution

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Using flowing microorganism systems as model objects it is possible to formulate and define the applicability limits of the Gause‘s competitive exclusion principle and to define the mechanisms and reasons of competition results. The results of competition are of great interest, as they reveal the mechanisms of natural selection. Chemostat with microorganism growth limitation, if several populations develop within, is apparently a suitable model object for qualitative study of properties of dynamics and associated biological populations evolution. For mathematical analysis of the associated microbial populations development in the chemostat usually the equations describing the species population dynamics and resource concentration are used (consideration of the latter set these equations apart from known Lotka-Volterra equations). The applicability of this standard model approach is limited, unfortunately. It does not allow the formulation of a sufficiently general criterion, which would help to predict the result of competition of several microorganism populations in the chemostat on replaceable substrates mixture. There is such a criterion for development on a single resource – the reduction of it’s residual concentration. In case of using the replaceable substrate mixture the acceptable are still unknown. So, calculation of the above noted model, where $\mu(S_j)$are the sums of Monod dependencies on various substrates, shows that the sum of substrate residual concentrations for the winner populations or for the species stably co-existing in the chemostat is not always minimal. However, we cannot agree with the conclusion that there is no criterion at all. This only indicates the narrowness of this model approach. Sequential application of the functional approach is, in our opinion, the way out of this situation. Firstly, the analysis of level dynamics of one or more key factors limiting the population development is required. On the whole, it is necessary to study the function of the system acting as a single whole, which would obey the integrated criteria.