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Influence of breeding strategy on genetic diversity of individuals

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The most widespread method of asexual reproduction in animals is parthenogenesis, which is also found among highly organized organisms [1]. Even in stable natural populations of multicellular organisms, the phenomenon of the formation of offspring due to asexual reproduction is quite often encountered, when there is no recombination and unification of the genetic material of different organisms. This process is most widespread among plants and primitive animals (annelids, coelenterates, etc.). Often, the appearance of a new generation in such populations occurs according to a mixed type, some individuals are formed as a result of sexual reproduction, and some – during asexual reproduction. There are situations when populations, depending on environmental conditions, can switch from sexual reproduction to asexual reproduction and vice versa [2, 3]. In such cases, violations of the patterns of genetic diversity should be expected.

In populations with a sexual process with neutral molecular evolution – fixation of new alleles due to gene drift is established by the Hardy - Weinberg principle.

Hardy-Weinberg's principle is the position of population genetics, which states that in a population of infinitely large size, in which natural selection does not work, there is no mutation process, there is no exchange of individuals with other populations, there is no gene drift, all crosses are random – the frequencies of genotypes for which -or a gene (if there are two alleles of this gene in the population) will be kept constant from generation to generation and will correspond to equation [4].

The formation of genetic diversity in populations with sexual reproduction occurs due to the recombination and independent segregation of genetic material in several generations. This leads to the formation of new combinations of alleles. Some of the new alleles that have arisen as a result of spontaneous mutations are fixed or eliminated from the population due to gene drift and/or natural selection. In vegetatively propagating populations, the process of recombination and segregation of alleles is absent. For this reason, during vegetative reproduction, the genotype is transferred from one individual to another completely. In this case, genetic diversity is formed only due to the mutational process [5, 6] and competition/drift of clones. The mutation appears independently in different alleys.

In populations with a sexual process with neutral molecular evolution, fixation of new alleles occurs due to gene drift, and the equilibrium of frequencies by the allele is maintained following the Hardy-Weinberg principle.

Violation of this ratio, as a rule, indicates the impact on the population of any processes that dramatically change genetic diversity. Such processes can be: natural selection, fixing new alleys, expansion or decline in numbers ("bottleneck"), as well as migration. The bottleneck effect is common in many invertebrates because their number is greatly reduced when the temperature regime changes (autumn-winter period). The sharp drop in numbers leads to significant difficulties in the analysis of various genetic markers. In highly organized animals, this effect can lead to the low viability of the species. Individuals also have to resort to inbreeding, and this, in turn, leads to inbred depressions within the species.

In our work, using a computer simulation model, we tried to investigate how the transition from sexual reproduction to vegetative reproduction will affect the population of diploid organisms with a neutral character of molecular evolution. At the same time, special attention was paid to the specificity of microsatellite markers. This specificity is a consequence of the multi-allele nature of microsatellite repeats and the high rate of their mutation.

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