In situ protection of microbiodiversity is under consideration

It is estimated that at least 99% of the microorganisms on earth are not cultivable using current technologies, and only four of the 36 major divisions of the domain Eubacteria seem to be correctly represented in ex situ collections (1). Paradoxically enough, this tremendous uncontrolled microbiodiversity could be the reason for the lack of interest in the endangered bacteria hypothesis.

In a recent symposium that focused on genetic resources, it was clearly demonstrated that, while plant and animal preservation are approached both in situ (preservation of the organisms in their natural environment) and ex situ (preservation of the organisms under artificial conditions such as freezing), preservation of microorganisms seems to be managed only ex situ (2).

Research in our laboratory is focused on dairy micro-organisms. Recent work on the distribution of subspecies within the species Lactococcus lactis, which is a long-standing lactic acid bacterium currently used as a starter in the dairy industry, has shown the recent difficulty of isolating the cremoris subspecies from the dairy environment in some geographic areas in accord with Salama et al. (3). Consequently, we have searched for Lactococcus lactis subsp. cremoris in collections of micro-organisms and have shown that this prokaryote is rarely present. Thus searches 20 international culture collections of bacteria using the internet showed that less than 10 collections possess about 100 strains corresponding to 78 original ones (4). At least 24 of them are isolated from industrial starters and most of the others are of unknown origin.

While studies are still necessary to discover the original natural habitat of the subspecies, numerous hypothetical intrinsic and extrinsic causes can be proposed to analyse this subspecies rarefication. (i) Intrinsic reasons. The previous bacterium is known for its inability to metabolize numerous substrates; furthermore, Lactococcus lactis subsp. cremoris has a weak ability to respond to environmental stress by phenotypic adaptation (5). (ii) Extrinsic reasons. Over the last few decades, the environment of Lactococcus lactis subsp. cremoris has been drastically modified by human activity, giving rise firstly to human-borne stress (disinfectant stress and stress by cold storage of milk) and secondly to biodiversity reduction (plant varieties in pasture and breeds of cow).

To sum up, Lactococcus lactis subsp. cremoris (i) is poorly represented ex situ; (ii) is growing scarce in raw milk from some geographic areas for indeterminate reasons; and (iii) has an unidentified original habitat. The above considerations lead to a global reflection about scarcity and preservation of micro-organisms. It seems important to expand and improve collections by adding not only new pure strains, but also microbial consortia.

Besides this approach, we plan in situ preservation of micro-organisms. The conservation in situ can be considered by adapting to micro-organisms the notion of nature reserve that is usually limited to animal and plant preservation. However, these future reserves can be realized only as far as the modification of the environment by human activity is controlled. This perspective requires scientific investigations for the selection of geographic zones with the support of national, regional and local authorities and an awareness of the agricultural world.

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