On microbes, biofactories and sovereignties (Part 1)

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This publication is the first part of an article in which the authors reflect on the relationships between microbial life, culture, knowledge development, food and agriculture. In this first part, they review conceptual aspects and peoples' experiences' proposals for soil, seed and food management linked to the management and understanding of microbial life, while reflecting on the attempts of agribusiness corporations to appropriate knowledge and biodiversity in order to add them to their control and business systems.
We invite you to read the second part in our next issue!

Over thousands of years, agricultural societies have built up very diverse identity profiles that have to do with the characteristics of the environment in which they develop. In this way, languages, foods, infrastructure, the way they form links, artistic expressions, medicine and rituals (which give new meaning to the above on a spiritual level) are a reflection of their actions linked to the land, natural cycles and landscapes.

Going further back in time to the eras in which these landscapes acquired their form and functions, we see that it was the micro-organisms that acted as a link between the mineral origin and its subsequent organic expression. In other words, they were the architects of bringing life to an inanimate world. In that silent and slow task they built a web of relationships that allowed them to capture solar energy, give a dynamic to the presence of nutrients in an incessant exchange and make the most of the capacity to store and use water; thus allowing an enormous diversity of species to develop there, including plants, fungi and animals, among which is the species Homo sapiens.

Our species was not the first to cultivate. Sebastiao Pinheiro, in the course "Peasant Biopower" [1] clearly states: "agriculture is not a human invention. Agriculture began 135 million years ago on our planet" and mentions termites, army ants, bees and moles as ultrasocial beings.

Therefore, it is not difficult to fathom that there is a continuity in the microbiological genetic profile of each site that cuts across all functional groups and communities; whether it is - for example - a photosynthetic soil bacterium, a wood-decomposing fungus or a protozoan inhabiting the rumen of a cow. In scientific parlance, this is known as metagenomics or environmental genomics. This continuity in the genetic profile - which is intimately related to the characteristics and genesis of each soil - finds its highest and most refined expression in the set of linkages that occur in ultra-social species, including humans. For all these reasons, and in a very simple way, we propose that there is a strong connection between soil microbes and the expressions of those ultra-social species; that is, with their culture. These connections are strong, although hegemonic academia has not worked on them in depth. Understanding the importance of complex biological processes in food production is fundamental. We consider it important to understand that much of what happens in soils, crops and animals is beyond our current understanding. The hegemonic sciences have considered that what is not known does not exist, and even in the agronomy and food industry fields they have taken an even more dangerous step: they consider that what does not have economic value does not deserve to be understood in depth. This conception has led to the destruction of diversity (both macro and micro) through monocultures, deforestation, pollution and the simplification of ecosystems. Mass extinctions lead to the disappearance of species that humanity has observed and described, as well as others that have not even been named. To retrace these paths of disaster requires intense efforts of study, observation, experimentation and debate. With its complexity of sciences, practices and movements, agroecology has much to contribute to these debates.

Hegemonic thought[1] has played a strong role in agronomy and in the shaping of the food industry. In the resistance, in the ancestral cultural practices that have antagonised the destructive advances of concentrated capital and hegemonic thought, there are concrete answers to each of the challenges of the current situation. Many cultures have had a deep respect for the unknown, and today we have much to learn from them. We believe that knowledge of religions, arts and spiritualities are important in addition to scientific

[1] “Pensamiento único” in the Spanish original (TN).

knowledge, regarding the historical and political construction of sovereignty and autonomy.

Spaces for knowledge exchange on soil microbial life management with local farmers.

Food and micro-organisms

The products of the soil and the food obtained from them are one of the most notorious and relevant cultural expressions of any ethnic group. The way of cultivating or raising, harvesting, fishing, preserving, cooking and even sharing food is part of their most primal and original identity. Humans developed them and these cultures, over the course of history, became body and nature: cooking, omnivorism, agriculture, social organisation for cultivating, cooking and eating are a constituent part of what we call human beings today. So much so that there are foods that can identify an area or region and that this identification is also translated into songs, poems, paintings and other artistic expressions.

Dairy products, for example, are one of the examples where fermentation processes allow the stabilisation and nutritional improvement of a naturally perishable food such as milk. The need to conserve and even improve this resource led to the development of diverse strategies that were in accordance

with the social context, the way of life, the available technology and infrastructure, and the environmental characteristics of each site. This gave rise to multiple varieties of foods such as cheeses, yoghurts and curds.

The history of fermented beverages follows the same path. Wine, mead and beer, for example, are mentioned in the earliest literature, accompanying the Norse gods or being made from water in the jars of Jesus. In America, *chicha* accompanies rituals and celebrations, born from the fermentation of corn inoculated with bacteria from saliva.

Meat and vegetables are also processed through the metabolism of micro-organisms, along with other strategies such as brine or direct cooking. In the field, the quality of the process is assessed by the colour of the sausage meat, regardless of whether the recipe is the fine mince of the Piedmontese traditions, adding paprika powder in the Spanish style or with fennel or *kummel* as the Volga German descendants like it.

The fermentation of grains, which gives rise to baked goods, allows naturally indigestible substances such as starch chains or certain cereal proteins to be assimilated in the human intestines. This technological innovation based on natural yeasts may have been one of the milestones that led to the *domestication* of cereals and the formation of the first civilisations in the so-called Neolithic Revolution.

What does not exist are traditional stories, grandmothers' tales or songs that mention characters such as Lactococcus, Enterococcus, Sacharomyces, Pediococcus or Penicillium. These almost invisible beings are responsible for transforming the raw materials of food into stable and nutritious substances and whose work can be perceived by our senses when the procedure has been carried out correctly. Thus, we can recognise their work - and even that of other less desirable species - by the aromas, textures, colour and flavour that foods take on in the alchemical moment we call fermentation.

Foods produced by fermentation are classified into those that contain live microbes at the moment of consumption (yoghurt, kefir, sauerkraut, kimchi, etc.) and those that do not (bread, cheese, wine, beer, etc.). In Pia Sorensen's introduction to a public lecture by Sandor Katz [2], the researcher raises three

points in which cooking with heat (boiling, frying, roasting, etc.) resembles cooking with microbes: both are ancient practices (at least 9000 years in the case of fermented fish and beer, demonstrated by archaeological records), simple recipes and the processing of macromolecules as a way of producing flavour diversity, improved digestibility and better preservation of food.

Similar things happen in soils. Every farming people everywhere on Earth developed a series of practices that aimed (and still do) at keeping the system at a high degree of energy uptake, maximising water use, giving dynamism to nutrient supply, and taking advantage of the role that biodiversity plays in this. These issues are expressed in the way organic matter is managed, in fertilisation strategies, in the use of diverse systems of water capture and use, and in the development of production integrated with the forest and animal components, among other ways. This is how the *milpas* of Central America with their polycultures, the Mexican *chinampas* producing on islands of organic matter, the *waru waru* of the altiplano and their cultivation ridges keeping the water below, the Inca terraces, the system of tomb, slash and burn of the Amazon and so many other examples scattered throughout the world came about. [3]

All of them accumulated years of experience and sustained the development of numerous civilisations without knowing of the existence of micro-organisms, only observing the manifestation of their work. It was only in the middle of the 19th century that microbiology began to gain momentum as a branch of science, finding the role of bacteria, fungi, protozoa and viruses in the generation of diseases, the maturation of compost, the stabilisation of food and many other processes.

Beyond this recent discovery, for a long time the scientific focus was aimed at describing the link between microbes and human health; and it did so from a linear and reductionist perspective that did not take into account many variables that help to understand systems (human bodies, soils, ecosystems, the world) in their entirety. In this way, theories were discarded and others were created under the protection of the new scientific and industrial paradigms of the time, replacing parts and functions of the natural environment with industrial synthesis engineering. Both agronomy and hegemonic medicine are heirs to reductionism, as well as to the so-called

techno-science, whereby technical, scientific and technological developments were used for mega-projects that were functional to capitalist expansion and concentration. [4]

Today we are witnessing a time when soil microbiology seems to occupy a central role in agribusiness. Following the postulates of the Green Revolution - which began with synthetic fertilisers and heavy machinery, then moved on to biotechnology - agro-industrial production brings the proposal of soil microorganisms and laboratory bio-inputs as a strategy for reinventing itself. With a large propaganda apparatus and support from state research centres, biological solutions are proposed based on this linear and reductionist logic. Every time a microbiological species is isolated and put in a can for commercialisation, the value of biodiversity and the functioning of a balanced ecosystem continues to be ignored; monoculture continues to be reproduced and the effects of attempting to control nature from a laboratory are exacerbated, since little is known about the microbiota of the soil and the enormous web of relationships and functions that are established in the environment of the roots. A very similar process is taking place in the food industry: the hegemonic line of intervention concerns monocultures of specific strains for the production of industrial probiotics and other products. Instead of promoting the cultural revitalisation of ancestral cuisine with micro-organisms, the proposal is to sell us a commodity with advertising languages identical to those used to sell medicines.

In addition to selling us their products, corporations are imposing other forms of control: patents. We are close to a scenario where in order to reproduce a micro-organism in our kitchen, or in our bakery, winery or brewery, we have to pay royalties to a company that owns a patent. And, as happened to Percy Schmeiser with a canola seed containing genes owned by Monsanto, if we unintentionally multiply an organism, or use a certain patented process, we can be sued by the company that owns the patent. [5]

In this way, we believe, the chains of dependency of farmers around the world are deepened and refined into a production system in which their participation as decision-makers is reduced to which product to buy in order to keep producing. Just as it is important to be able to decide and manage within the framework of communities which seed is best suited to each place and

situation, self-management of soil health is key to the development of an agriculture that is based on the valuation of biodiversity and respect for the cultural patterns of the territories.

In this framework, along with the knowledge to be built or recovered on ways to improve and conserve local genetic resources, it is essential to learn to act on the dynamics of the 3M of soils (organic matter, minerals and micro-organisms). For this, the local production of biofertilisers is a matter of technological and political relevance that needs to be taken care of and strengthened.

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4. For more information on the concept of Technoscience, we suggest the following work: Echeverría, J. (2003). La revolución tecnocientífica. Madrid: Fondo de Cultura Económica.

5. For more information on this case, we suggest the following link: https://www.biodiversidadla.org/Noticias/MONSANTO-contra-PERCY-SCHMEISER-Irresponsabilidad-corporativa-sexo-inseguro-y-bioesclavitud-RAFI