Biological Robustness and Fragility

We have known that all the organism is always in a changing environment and they adjust to changing environments in order to survive better. To evaluate an organism's ability to adapt to the environment, scientists define biological robustness and fragility.

The definition of 'robust' in the Oxford Dictionary is strong and healthy. When it comes to the definition of robustness in biological field, it means when a biological system is disturbed by some uncertain such as the external disturbance or internal emergency, the system can keep its structure and function stable[1]. I think the biological robustness is also the anti-jamming ability. For example, when the forest suffers from persistent drought, trees tend to control their growth rate and expand their root space to ensure they can access adequate water. The opposite of biological robustness is biological fragility. Biological fragility is the state that a system is vulnerable when facing external damage and internal change. The most typical example of biological fragility is when alien species invade, often doing great harm to the local biological system and destroying local biodiversity. For instance, water hyacinth is a famous invasive alien species, widely distributed with China's Yangtze River, Yellow River and South China provinces. Although water hyacinth can absorb a large amount of nitrogen, phosphorus, lead, mercury and other heavy metals in water during its growth, water hyacinth's strong ability to reproduce and adapt makes it block waterways and affect traffic. What's more, after it decaying, water quality is

polluted twice, resulting in serious ecological harm. The cost of national artificial fishing is up to hundreds of millions of yuan every year[2].

Biological robustness enables organisms to maintain a relatively stable internal environment, enabling them to survive in a variety of environments. Both biochemical reactions in living organisms and biological interactions between biological systems require certain preconditions to proceed. And these conditions are often based on a stable environment to proceed smoothly. When organisms need to carry out activities necessary for survival, biological robustness can keep organisms in a stable environment to ensure the continuation of survival activities, so biological robustness is an indispensable part of biological survival. Take animals as an example, I once learned that all animals have homeostasis, which means that under normal physiological conditions, both various components and physical and chemical properties of the internal environment only change within a small range. Homeostasis reflects the biological robustness of animals. The normal biochemical reactions of all cells are based on the homeostasis of the internal environment, such as the temperature of the normal reaction of enzymes and the water of cells. Without homeostasis of the internal environment, the biochemical reactions of cells will be affected, which will affect the normal life activities of animals.

The consequence of biological fragility is that when the external environment changes, the organisms cannot adjust themselves to adapt to the environment, so they are very easy to be damaged, and then affect the

biodiversity of the ecosystem where the organisms live. Due to the interaction between organisms and the environment, they will eventually react to the environment. One example is the vegetation in the desert. Ecosystems in deserts are relatively fragile. In extreme climates, vegetation in deserts is easily damaged or even killed due to its fragility. Animals will suffer as a result of the degradation of vegetation, which will result in the loss of food sources and habitats for them. The death of animals and plants will lead to the reduction of ecological diversity of the ecosystem and the instability of the ecosystem. Destroyed vegetation causes decreased transpiration and evaporation as well as less precipitation, which exacerbates the arid climate. Although biological fragility cannot be eliminated, we can take measures to avoid the consequences of biological vulnerability. For single organisms, biological gene banks can be established. With information from the gene banks, it is possible to reprogram not only the organism but also its close relatives. At the same time, the consequences of biological fragility can also be avoided by maintaining the relative stability of the environment, such as ecological reserves for endangered species. As for the ecosystem, advanced technology can be used to predict the factors that may cause the collapse of the ecosystem in advance and adjust them through human involvement in time, for example, the whole world is united to fight global warming and nuclear pollution.

Reference:

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