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Agricultural Landscape Biodiversity and the Control of Pest Ecology

An important feature of modern agriculture is that the extent and rate of mankind's disturbance of the rural ecology has been increasing, seriously affection the structure of agricultural landscape and biodiversity. The changes of agricultural landscape structure and the loss of biodiversity inevitably leads to the weakening of ecosystem services, which is detrimental to the implementation of pest ecology control which aims to protect natural enemies. The intensification method of agricultural management led to the fragmentation of natural habitat, and has reduced the complicated nature of agricultural landscapes, causing crops and non-crops to form a relatively discrete habitat and entrenched landscape. Not only will these fragmented habitats lose the abundance of certain species, they will also affect the relationship between species as well as the diversity and stability of biological communities.

The landscape pattern, process and scale affect the richness, abundance and diversity of agricultural biological communities, as well as the interaction between pests and natural enemies. Working from the perspective of regional agricultural landscape systems, applying the theory and method of landscape ecology to study the transfer process and patterns of change of crops, pests and natural enemies, and revealing the disaster mechanism of pests in larger-scale and heterogeneous spaces can provide new research paths and methods for the use of agricultural landscape biodiversity to protect natural enemies in agricultural land and for the implementation of local ecological control of pests.

1 The landscape ecology theory and practice of pest ecology control

To sum up, these theories include: species-land relationship and island biogeography, metapopulation theory, patch-corridor-matrix model, landscape connectivity, percolation theory and the neutral model, etc.

2 The impact of habitat fragmentation on insect populations and communities

The intensive operation and management of modern agriculture has led to the fragmentation of natural habitats, reducing the complicated nature of agricultural landscapes, causing crops and non-crops to form a relatively discrete habitat type and a mosaic landscape. The fragmentation of habitats not only affects the individual density of certain species, but it could also speed up the rate of local extinction, eventually leading to a decrease in biodiversity; even though the fragmentation of habitats can support certain designated species within a short period of time, these species still face the possibility of local extinction due to spatial segregation.

3 The role of crop and non-crop habitats on natural enemies

On the scale of agricultural landscapes, the distributed situation of crop and non-crop habitats has determined the importance of the movement of natural enemies as well as their role in the composition of

species in crop habitats. The process of species with high diffusion force moving from a non-crop habitat to a crop habitat usually does not have any side effects. However, it is still affected by the landscape background to a large extent. Many parasites have smaller host ranges and have limited dispersing ability. They also do not have substitute hosts in surrounding non-crop habitats. To these species, although non-crop habitats can provide nectar and refuge, they could also be an obstacle to their dispersal.

4 Landscape pattern-process-scale and pest ecology control

In order to have a better understanding of the impact of landscape composition, scale of landscape and the process on the interaction between crop, plant eaters and natural enemies, we need to apply an integrated approach to investigate if the optimisation of landscape structure is beneficial to the following: (1) the establishment of natural enemies of crop; (2) the settlement of natural enemies in fields; (3) the lowering of density of pests; (4) the lowering of damage levels; (5) the increase of crop yield; and (6) the increase of production efficiency.

In summary, the optimisation of landscape pattern and dynamic management is important to the improvement of biological communities' structure, function, diversity and stability, and
the control of population dynamics of pests and natural enemies as well as the space, time, nutrients and quantity involved in their mutual interaction. The study of the structure, scale and processes of local agricultural landscape systems helps to fully utilise the agricultural landscape system's diversity to protect the sustainable control of pests by natural enemies, to avoid or reduce the use of chemical pesticides, reduce agricultural production capital, as well as to increase the health standards of the land ecology system and quality of agricultural products.