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Dynamics and Diversity of Insect Populations: Approaches for Sustainable Land Use in Lychee Orchards of Northern Thailand

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Abstract

In lychee growing systems in northern Thailand, pesticides are frequently used by local farmers to prevent negative impacts of pest arthropods on fruit production. Considering the health and environmental hazards of synthetical pesticides, their constant and unreflected applications precludes attempts to establish a sustainable management of the lychee growing systems. Therefore, a substitution of pesticide application is required. However, it is well-known that the massive use of broad-spectrum insecticides leads to shifts in the composition of the arthropod community, i.e. not only numbers of pest insects are reduced, but also beneficial arthropods such as pollinators, predators and parasitoids. As a component of the agrobiocoenosis, beneficial arthropods provide a wide range of advantageous biological services including the suppression of pest insect populations. Conducting an intrinsic system approach, the present study focuses on the evaluation of the habitat requirements of beneficial insects and pests, which includes field scale and landscape scale approaches.

On the field scale, the objective is to improve the habitat conditions for beneficials with the specific focus on the role of additional resources provided by plants of the ground cover vegetation. By this, an increase in abundance and effectiveness of the beneficial species is expected, which in turn results in reduced pest populations. In a lychee orchard, four different combinations of two pesticide (with vs. without) and mowing (monthly vs. once per year) treatments of the attendant ground cover vegetation were studied. Effects of the four different combinations on the presence, density and diversity of beneficial insects are obtained.

On the landscape scale, the influence of the functional landscape coherence on the constitution of pest and beneficial insect populations in the litchi orchard is evaluated in addition. Since adjacent landscape elements are potential colonisation sources and places for refuge, lychee orchards represent open systems. Due to migrating individuals, the condition of pest and beneficial insect populations is affected. Hence, the spatial movement patterns of major pest and beneficial insects between an adjacent forest habitat and the lychee orchard were recorded on the landscape scale. Complementary, the seasonal dynamics of the insect antagonist-complex is documented facilitating alternative pest control measures.

Keywords: Beneficial insects, lychee, migration, pests, sustainable land use

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