

BIOLOGICAL ASSOCIATION OF INSECTS: PARASITE AND HOST POPULATIONS

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PROBLEMS IN ENTOMOLOGY pertaining to studies of ecology, life history, population trends, and control are numerous and varied. In the Orthoptera, a group of insects which includes grasshoppers, roaches, and a few others familiar to us, it is estimated that more than 12,000 species have been named. In the order Coleoptera, which includes the beetles, there are an estimated 100,000 species described. Insects are distributed from the equator to the arctic. Some are adapted to live in fresh water, others in salt water. They can thrive on many different kinds of food media, some of which are wood, leather, stored grains, dung, carrion, and growing plant and animal tissue. Many insects are detrimental to our interests, whereas others are beneficial.

Economic entomologists are concerned with the control of the insects that are detrimental to our well being. The methods employed may be grossly classified in the following groups: chemical, mechanical, cultural, and biological. As its title suggests, the Division of Biological Control of the University of California is engaged in research on biological control methods. We endeavor to utilize insect parasites, predators, and diseases to reduce and maintain populations of insect pests below a level at which they become a problem of economic importance. Many of the insect pests of agriculture in this country have been brought in from foreign countries. Under such conditions the natural enemies of the pest are seldom introduced at the same time. It then becomes necessary to search for the natural enemies so that they can be imported. Before importation actually begins, however, a detailed study is made of the world-wide distribution of the host and its parasites and predators. From this information a program is arranged, and an explorer is sent to collect, classify, and ship to this country entomophagous insects. The parasites and predators are reared here under quarantine conditions. After the necessary preliminary observations are completed, the entomophagous insects are liberated in the hope that they will become established and bring about an effective control. Methods must then be devised to study the pests and their natural enemies in order to evaluate the results obtained.

The first problem for discussion is one in which an attempt was made to study the influence of fungus diseases on populations of purple scale (*Lepidosaphes Beckii* Newm.) in Florida. Many species of scale insects in Florida show evidences of entomogenous fungi. Frequent showers during the rainy season aid in disseminating the fungus spores, and the warm, humid weather in this season is ideal for the germination and growth of fungi. They develop during all seasons of the year but the greatest activity occurs in the summer, which is the rainy season in Florida. The most frequently encountered fungus asso-