INTEGRATED CONTROL OF SPIDER MITES ON COTTON PLANTS

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C O N T E N T S

I. INTRODUCTION

The disruptive effects to arthropod ecosystems due to the use of the new broad spectrum synthetic insecticides included pest flarebacks, secondary pest outbreaks and pollinator mortality.

These results along with the development of resistance of pests to insecticides have stimulated interest in pesticides programs designed to work harmoniously with biological restrains on pest increase. By combining the advantageous features of both chemical and biological control methods, i.e., reducing the pests while causing a minimum disruption of the natural enemy activity, a greater permanence of pest suppression may be obtained.

Although most chemical treatments produce some unfavourable change in the subsequent natural-enemy-pest ratio, certain pesticide manipulations have been shown to reduce this adverse effect with corresponding gains in the future pest restrain.

The aim of the present study was to test the effect of large number of pesticides now recommended for use against cotton pests in Sakha area, on the spider mite and its natural enemies, in order to pick up the most selective insecticides. Selectivity is the measure of the capacity of a pesticide to spare natural enemies while destroying pests. Selectivity in pesticide treatment may be physical which depends on differential exposure of pests and natural enemies to the pesticide and physiological selectivity which originates from physiological difference in susceptibility of hosts and natural enemies to a toxicant.

II. REVIEW OF LITERATURE

A. Integrated control concept :

The call for the integrated control approach started recently few years ago.

Van den Bosch and Stern (1962) defined integrated control as "pest control" which combines and integrates biological and chemical control. In this approach chemical control is used as may be necessary and in a manner which is least disruptive to biological control.

Biological control and chemical control are in no way similar phenomena. Biological control is a part of the natural control which governs the population density of a pest species. On the other hand, chemical control involves only immediate and temporary decimation of localized population and do not contribute to permanent density regulation.

Obviously, if biological control was perfect there would be no pests and chemical control would be unnecessary. Thus, chemical control is needed and should be used to reduce numbers of pest species which rise to dangerous level when or where the suppressive environmental pressures are inadequate.

In an integrated program, applied biological control is supplemented by appropriate chemical control procedures. The latter are thus reduced in frequency and intensity because the average level of pest abundance in first reduced by the former. The two control methods complement each other, biological control lacks the positive disadvantages of chemical control, such as destruction of beneficial insects, accumulation of toxic residues, more frequent development of pest resistance and the negative disadvantages of biological control, notably results that are slow in developing and are frequently only partly effective, are counteracted by corresponding positive advantages of chemical control. Suitable integration, based on knowledge, minimizes harmful effects of each method.

The rate of development of effective integrated control is limited mainly by the rate of development of effective biological control, as the latter must occupy a basic position in the former.

Integration of biological and chemical control is possible if:(a) a suitable low-density natural enemy is available,(b) a selective insecticide exists which controls the pest but not the low density-dependent natural enemies, and (c) the maximum population density of the pest which does not produce economically significant damage to the crop is not lower than the population density of the pest needed to the low-density natural enemy.

The relative stability of the ecosystem is an important factor in the development of an integrated control program. The possibilities of directly utilizing biological control agents are generally much better in orchards, forests, rangelands, and perennial field and forage crops than they are in short-term plantings such as vegetable crops, cut flower plantings, and the like, where stable host-natural enemy relationships hardly have time to develop before the crop matures.

Smith (1962 a & b) laid down the principal points of integrated control. Integrated control is based on the use of fundamental ecological principles to control and manipulate pest insects and mites. It has as a prime goal the combination and integration of biological and chemical control. The integrated control programs emphasize the utilization of both chemical and biological measures because these two techniques are our main standbys in the struggle against insect and mite pests.

Integrated control is applied pest control which combines and integrates biological and chemical measures into a single unified pest control program. Chemical control is used only where and when necessary and in a manner which is least disruptive to beneficial regulating factors of the environment. There is three basic principles of integrated control.

1- Emphasizes the ecosystem concept and may be stated as follows : The complete complex of organisms, the culture of the crop and the conditioning environment. This ecosystem includes all the pest insects and mites, the plant diseases, the natural enemies of the pests, their competitors, the plant and its culture, the weeds, the soil and its management, the conditioning environment.

2- Stresses economic levels and may be stated as follows: The population levels at which the pest species causes harm or damage. The low economic levels create special difficulties especially so for biological control and integrated control. The higher the economic level, the greater will be the possibility that biological control agents can come into play and the hence the greater the opportunity for integrated control.

3- Underlines the importance of avoiding disruptive actions. It may be stated as follows : Necessary control measures should be designed to give adequate control but in a manner which does not upset some other part of the eco-system.

Beirne (1962) discussed also the concept of integrated control. Biotic and chemical control agents have one desirable attribute in common : they kill harmful insects. One of these kinds of agents used alone will not normally give optimum control : it will not provide the best combination of efficiency in destroying noxious insects with ease and economy of application and the minimum of harmful side-effects. Biotic agents have a major positive advantage over chemical agents : they are living organisms and thus can seek, find, and attack the pests, and can be self-perpetuating and can multiply and spread.

Other main desirable attributes of biotic agents are primarily the absence of the main undesirable attributes of chemical agents. Chemical agents affect most insects with which they come in contact, including beneficial organisms, but biotic agents are specific to the insects against which they are applied.

To use biological control alone because of the desirable attributes of biotic agents means not taking advantage of the desirable attributes of chemical agents. Chemical agents can be obtained, stored, handled and applied more easily, they tend to be more immediately effective in destroying pests, and there is greater certainty of pest mortality from their use. The obvious solution is integrated control programs that combine both chemical and biological controls to exploit the desirable attributes of each kind of agent while minimizing effects of the undesirable.

Reynolds (1962) explained the need for integrated control by developing selective insecticides. It has become evident that there is need for an integrated approach to chemical control in which insecticides are used for the alleviation of some particular pest problem but the biological control populations in the environment are left virtually intact.

It seems there are two major specifications for the successful development of integrated control programs. First, fundamental biological information is mandatory concerning the intricate and delicate interrelationships of the biotic complex in the field.

When the individual impact of the various parasite and predator species upon pest population regulation are understood, the second major specification can be undertaken with greater assurance. It does not seem necessary to discuss the obvious values of elimination of unnecessary treatments, use of minimum insecticide dosages compatible with effective control, improvement of application timing and the like. Ideally, an insecticide application would not eliminate as many individuals as possible in the field but rather lower the pest population below the economic level and leave intact, or virtually so, the important beneficial species to reduce possibility of pest flare-back.

In order to approach this portion of the goal of integrated control, it is necessary to develop selective insecticides.

There are several obvious ways in which insecticide selectivity may be discovered. The first involves use of insecticides at dosages sufficiently low that at least partial selectivity results. Some insecticides are extremely effective on certain pests. Systemic insecticides may be the most promising for development in this realm of selectivity.

Messenger (1965) reviewed the integrated control concept stressing the need for selective insecticides. The concept of integrated control concerned primarily the joint use of both chemical control and biological measures. The biological control included not only the action of introduced predators and parasites, but also the effects of native natural enemies. More recent definitions of the term "integrated control" refer to the joint use of a variety of pest control measures to reduce the abundance of target species. However analysis of such integrated control programs as have been developed so far suggests that what most commonly is "integrated" is some form of chemical control with some one or more elements of biological control.

Another requirement is the development of integrated controls around the existing natural enemy fauna lies in the need for chemical controls that will not render these biotic agents even less effective. Pesticides and natural enemies must be made compatible. This compatibility may be procured by use of physiologically selective pesticides (ones to which natural enemies are tolerant or resistant.

The native cyclamen mite, _Steneotarsonemus pallidus_ (Banks), on strawberry in California is controlled by native, predatory phytoseiid mite supplemented periodically with applications of the selective acaricide thiodan.

B. _Effect of pesticides on mites and their predators_ :

Clancy and Pollard (1952) stated that DDT failed to stimulate outbreaks of the European red mite more than did lead arsenate in the well-cared for commercial orchards, possibly because of the depressing effect in both DDT and lead arsenate plots of sulphur fungicides on the dominant early-season predators. However late, summer populations of the spider mites _Tetranychus bimaculatus_ Harvey and _T. schoenei_ McGregor definitely increased to higher levels in plots sprayed with DDT.

In unsprayed orchards, mite populations were maintained at extremely low levels by the predators. When DDT was applied to several of these trees the predators were killed and infestations increased rapidly. _Iphidulus_ sp.,