whitefly species *Dialeurodes citri* (Ashmead), are under trial in the U.S.S.R. for development of biological control against this hazardous pest.

These studies demonstrate that both biotic agents can successfully suppress greenhouse whitefly population increases. The effectiveness of *E. formosa* under temperatures lower than 23–24° C is, however, insufficient; the fecundity of the host under 18° C is ten times as high as that of the parasite. The fact that the night temperatures fall to 13° C and lower in the glasshouses where *E. formosa* is used has therefore a negative effect. For the present, this parasite is used only experimentally on comparatively small areas.

As to *Aschersonia*, a further increase in the application of fungi of this genus is restrained in view of the fact that the mass-rearing technique has not yet been adequately perfected; the technology is still somewhat amateurish, but it is nevertheless used by commercial biological control laboratories. Because of this and other reasons, the effectiveness of *Aschersonia* is not stable, though it reaches 65–85%. Best results have been obtained by first thinning pest populations by means of pesticides and then treatments of fungal suspension repeated at five- to seven-day intervals.

Results obtained to date indicate that the most practical way to successfully suppress the harmful activity of the greenhouse whitefly is an integrated system based on our knowledge of economic thresholds of its populations and a rational combination of biological and chemical controls. To establish such a system, further studies are required: in the first place an improved technology of the *Encarsia* mass-rearing technique; secondly, the development of a commercial technology for *Aschersonia* production aimed at obtaining a standard preparation; and finally, screening for the safest pesticides and determining rational methods for their application.

Having no currently satisfactory system of integrated plant protection in the glasshouse, growers of our country, influenced by phytosanitary considerations, still successfully apply biological control for certain pest species. In addition, the scale of *Aschersonia* application against the whitefly is being increased annually. Thus, in 1978 this biological agent was used on a total area of over 1,000,000 square meters.

Biological control of mice and similar rodents in hotbeds, storehouses and outdoors, has been developed and used in the U.S.S.R. for several years. The use of bacteria of the genus *Salmonella*, causal agents of typhus in rodents, is the basis for this method. Bactorodencide, formulated on this basis, was used on a total area of over 5,500,000 square meters in 1978.

By the present time, substantial data have been gathered on the elucidation of possibilities and development of methods for applying microbial antagonists and antibiotics to control plant pathogens under glass. The antibiotic trichotecin, a product of the vital activity of the fungus *Trichothecium roseum* Lk. ex S. F. Gray, and the plant antibiotics arenarin and imanin, are recommended to control powdery mildew of cucumbers, bacterial diseases of tomatoes and tobacco mosaic virus, respectively. Techniques for production and application of the antagonist *Trichoderma lignorum* Harz against the root rots (*Fusarium, Verticillium* and others) and *Sclerotinia libertiana* Fckl. of cucumbers, the vaccination of tomatoes with low pathogenic strains of tobacco mosaic virus to control this disease, and some other biological means to control plant pathogens are being successfully tested now at the commercial level.

The availability of quite a large set of biological methods to control the main glasshouse pests has made it possible to start establishing a biological control system to protect cultivated vegetables from a complex of injurious organisms. At present, the first version of a cucumber protection system has been developed and is under trial; it is based on the use of all available agents for biological control, combined with use of selective pesticides only in cases of emergency.

Development of Biological Control Systems for Greenhouse Crop Production in the U.S.A.

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In practice, the development of biological control systems for greenhouse crops can be as complex as it is for any other type of agricultural crop. Furthermore, agronomic practices vary so much in greenhouse crop production that it is difficult to make broad generalizations, particularly with regard to the way in which these practices affect biological control. There are potted crops, cut crops, flowers, vegetables and bedding plants. There are plastic houses, glass houses and lathe houses. However, in greenhouse crop production, as with most other agricultural systems, we deal most often with monocultures. And the types of pests we experience in greenhouse crop production are similar to those of other agricultural crop systems (e.g., whiteflies, mites, aphids, etc.). What is unique about the greenhouse system is that we have virtually total control of most of the physical environment.

What we would like to do in this address is very briefly introduce you to some of the U.S. programs that deal with the biological control of insect pests in this unique environment. Then, in an analytical approach, we would like to make some generalizations about the overall development of these programs as they interface with commercial agriculture. Finally, we would like to leave you with a few conclusions and recommendations in this regard.

Current Biological Control Programs in Greenhouses in the U.S.A.

In the United States the greenhouse industry can be divided conveniently into two major areas: flower production and vegetable production. Production of roses, carnations, chrysanthemums and various potted plants, such as poinsettia, virtually characterize the flower industry. The production of tomatoes, cucumbers and lettuce characterize the greenhouse vegetable industry.

In 1974, total U.S. greenhouse production was about $855,000,000. Of this total, flower production represents $825,000,000 and vegetable production about $30,000,000 (USDA, 1979). Thus, in the United States, when we consider the

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