



© J.P. Deguine

Agroecological management of populations of phloem-feeding insects in cotton farming systems

In cotton culture (*Gossypium hirsutum*) in the last two decades, two Homopterans, the aphid *Aphis gossypii* Glover and the whitefly *Bemisia tabaci* (Gennadius), have become major pests in various areas of the world. Their proliferation is now regularly observed and is stimulating research aimed at their control. A theory has been advanced that the change in status of these phloem-feeding insects is the consequence of a rupture of the balance initially established between these insects, their plant environment, and their diverse natural enemies (predators, parasitoids, entomopathogenic fungi).

Aphis gossypii and *B. tabaci* are distributed in most of the cotton-producing areas of the world; they are very polyphagous, which enables them to pass rather easily from one field to another or from one host to another, according to the conditions. These insects also share common characteristics, including high rate of reproduction, rapid development of resistance to insecticides, remarkable morphological diversity, and high genetic variability.

How to explain the change in status of these insects?

- 1) by the evolution of the abiotic factors of the environment, in particular the rainfall deficits observed in many tropical areas since the 70's;
- 2) by the changes in prevalence of certain crops, in particular an increase in cotton and market-gardening surfaces; evolution of technology, cultivation methods, and phytosanitary protection methods having ruptured a pre-existing balance in the entomofauna (e.g. increased amounts of mineral fertilizer, in particular nitrogenous fertilizers);
- 3) by the techniques of low-volume pesticide treatment;
- 4) by the active compounds used such as the pyrethroids;
- 5) by the modern cultivated varieties, with strong vegetative development at the expense of pest-resistance traits;
- 6) by the massive use of insecticidal products in market gardens.

This diagnosis, which is difficult because of the number of variables, paradoxically makes it possible to inventory the principal parameters to be taken into account in the long term to develop durable

strategies for management of insect pest populations. The objective is, on the one hand, to break with past practices or usages in order to avoid an aggravation of the situation and, on the other hand, to adopt new procedures and practices, allowing a return to a situation of balance.

From the observations, experiments, and reflection, the foundation for this agroecological process is proposed. It is based on the concept of integrated protection in the context of sustainable agriculture, which endeavors to reconcile the advantages of two different strategies: one, regarded as a priority, favoring an ecological approach to the regulation of pest populations and thus considering the agroecosystem at the level of preventive organization and intervention; the other relies on curative employment, on the plot level, of various techniques, among which synthetic pesticides should be avoided.

It is clear that the success of such an approach cannot be assured solely through strict respect to an integrated protocol. The initial phase of this integrated strategy aims to reduce the phytosanitary risks as much as possible and support the action of natural enemies.

The second phase aims at the diagnosis of the state of the plot and its environment, or even of the whole of the concerned plantation(s) within the same farming system (concept of territory). The last phase is of a curative nature, aiming at implementation of pest control methods that are the least detrimental to the environment (including human health and biological diversity). These are true terms of reference for ensuring the profitability and thus the sustainability of the cropping system, conservation of the agronomic potential of the soil, and the safeguarding of indigenous biological systems, according to the concept of sustainable development, in particular by enhancing biodiversity in cotton farming systems.

Contact: Jean-Philippe Deguine,
Jean-Philippe.deguine@cirad.fr