# Insects, farmers & farm-management

Insects can be seen as one of the many components of an agro-ecosystem. Yet farming has a strong influence on the population balance between different insect species: it helps some multiply exponentially by increasing the quantities of a species' preferred host, or reduces their presence with the use of pesticides. Alternative agricultural approaches show that farmers can also manage a farm in a way that combines a stable diversity of species with high yields and production levels. Insects do not just "combine well" with high yields: a larger insect population can actually help achieve these objectives.

Text: Luis L. Vázquez Moreno

Insects are closely related to many different human activities. Among these, agricultural production is probably the one that gets most attention, as insects can cause significant losses. Millions of dollars are spent every year in order to minimise the presence of insects in the field and avoid such losses. However, farmers are usually unaware of the huge diversity of insect species to be found on their farm, and their functions within the agro-ecosystem. Most farmers react to insects by looking for ways to eliminate them. This simplistic behaviour has contributed to the ever-growing use of pesticides, with all their attendant side-effects. The need to "control" the presence of insects is also one of the main arguments used by those promoting GMOs. Insects play many different roles within an ecosystem: some are phytophagous species, others pollinate crops, other species feed on detritus. Farmers are most familiar with the phytophagous species. Yet only a small part of all phytophagous insects (less than 3%) occur as pests; the rest are regulated naturally by entomophagous species and entomopathogens and other natural factors. All species are linked to each other as part of a complex food chain, and have different relationships with each other, acting as parasitoids, predators and hyperparasites. As a result, in a natural ecosystem, the population of the insects we think of as pests is generally kept in balance, and remains stable. In contrast, in agricultural systems involving a high degree of human modification, this natural balance is disturbed and lost, with some phytophagous insects coming to predominate.

## From insects to pests – and back

The intensification of agricultural production has been the main reason why some insect species have become pests. This occurs through a co-evolutionary process, driven by two main factors. First, the reduction of a farm's biodiversity, with one crop (or only a few species) being grown over large areas, often year after year. This provides the perfect environment for one or a few species of insects to thrive. Second, conventional agricultural production helps drive the evolutionary selection of new populations of phytophagous species, as the use of pesticides, fertilizers or the soil preparation system,

gives rise to populations that are tolerant and resistant to these external factors.

The increasing difficulties that farmers face in "controlling" insects could be the best argument for a drastic change in the world's agricultural production systems. An alternative approach, however, should not just seek to minimise the damage caused by pests, but rather to enhance all ecosystem services in order to achieve higher and more sustainable yields. Thus, there is a need to "unlearn" the old approach of "protecting" or "defending" crops by focusing on pest control, and to adopt an approach that looks at the system, the interactions that take place within it – and the benefits that farmers do, and can, get from insects.

Insects play a very important role in every farm system. Bees and apiculture are perhaps the best known example. Honey is produced and consumed throughout the world, and this contributes to the income of millions of farmers and the diets of millions of people. Bees also are important pollinators. As Sanagorsky (p. 10) shows, bees (and other insects) play a crucial role in the sexual reproduction of plants – something we only seem to acknowledge when it is not happening. Sam Adams (p. 18) describes another role of insects which is generally overlooked: their contribution to improving the soil. Again, this may be difficult to quantify, even if there is no doubt that better soils directly contribute to higher yields. As predators and parasites, insects also play a key role in controlling the populations of other insects.

## Helping those who help us

Acknowledging the many benefits that insects bring is the first step. But farmers, together with many other professionals, can help ensure – and increase – these benefits. One widely used strategy is biological control: the selective breeding and release of species that regulate the populations of phytophagous insects. This is widely practiced in Cuba, where there are more than 200 *Centros de Reproducción de Entomófagos y Entomopatógenos* run by the Ministry of Agriculture. These centres produce 9,000 million Trichogramma wasps every year, which are then released (in doses of 30-50,000 individuals per hectare) in order to regulate the presence of pests in pastures, rice, sugarcane, vegetables and other crops. On a smaller scale, there are also production units that breed specific types of parasitoids (Braconidae, Chalcididae, or Eulophidae) and predators (Coccinellidae, Anthocoridae or Reduviidae) that can be released to control various insect pests. Some farms have "on-farm reservoirs", a source where insects can be collected and taken to other fields. For example, the remains of banana plants are used to encourage the multiplication of colonies of a predatory ant (*Pheidole megacephala*), which are then taken to sweet potato or banana fields. A recent survey found that such reservoirs are used to protect some 16,000 hectares of these crops, reducing the presence of two of the main pests that attack these two crops.

It can be equally beneficial to simply encourage the presence of a wide variety of insect species within a farm by paying attention to factors such as the presence of weeds. Often maligned, weeds can play a positive role on a farm by regulating a farm's microclimate and reducing soil erosion. They can sustain large populations of phytophagous insects, but also their natural regulators, another important role in the cycle. Farmers in the western region of Cuba tolerate the presence of the weed known as "sour broom" (*Partenium hysterophorus*) in their fields, and even encourage it in the borders and other areas, as these plants provide an important habitat for predators of the Coccinellidae family (like parakeets or ladybirds) which feed on several species of aphids. The shrub known as "piñón florido" (*Gliricidia sepium*) serves as a host to seven species of phytophagous insects (of which only one, the bean aphid or *Aphis craccivora*, is a pest) but also hosts 21 species of entomophagous insects, of which 19 are known to regulate populations of phytophagous pests in vegetables and grains. The Ministry of Agriculture's *Programa de Agricultura Suburbana* is thus promoting the wider use of *piñón* as live fences in all urban and peri-urban agricultural plots. These different approaches are further described by Holland (p. 38).

The evidence shows that insects provide many benefits. Isn't it only logical to change the way we look at agriculture and encourage their presence?

Luis L. Vázquez Moreno works as a researcher at Cuba's *Instituto de Investigaciones de Sanidad Vegetal* (INISAV), in Havana. E-mail: lvazquez@inisav.cu ; llvazquezmoreno@yahoo.es

**Not minimising the damage, but rather enhancing all ecosystem services.** Photo: Luis Vázquez.