

Potato tuber moth parasitoids imported 40 years ago, where are they today?

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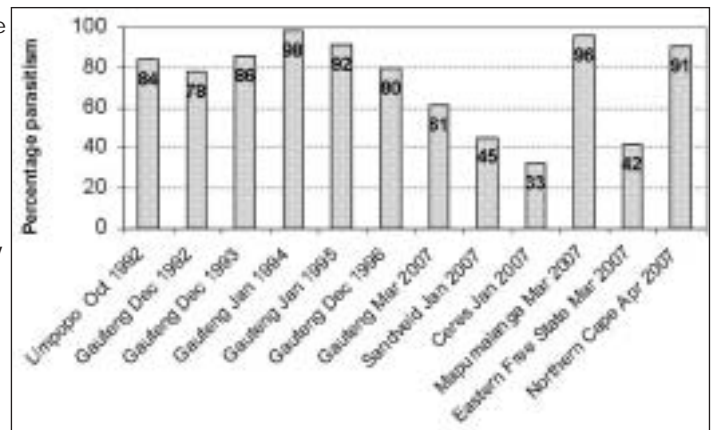
The potato tuber moth is one of the most important potato pests in South Africa. It was already established in the vicinity of Cape Town in 1895. Today it occurs in all eleven provinces and annual yield losses of up to 30% have been reported in certain years. Between 1965 and 1967 two exotic parasitoids were imported from South America for biological control of the tuber moth. In the 1970's the introduction of these two parasitoids, *Copidosoma koehleri* and *Apanteles subandinus*, was reported to be successful due to a high percentage of parasitism in areas where it had been released years before. But what is the situation today, 40 years later? To find out, several tuber moth populations (as larvae in leaf mines and tubers) were collected in various production areas and kept in an insectarium to determine the percentage parasitism. Data from previous collections were also included in order to obtain a complete picture of the presence of these two parasitoids in potato fields across the country from 1992 to 2007. The data is represented in figure 1.

The data indicates that the percentage parasitism (combined values of *C. koehleri* and *A. subandinus*) varied between 33 and 98% in unsprayed potato fields (Figure 1). The lower percentages are not indicative of a lower incidence of parasitism. Parasitoids are known to peak at certain times during the season, thus, timing of the collection will affect the percentage parasitism at that specific point in time. The percentage parasitism for some of the regions could, therefore, be much higher if the collections had been performed on a different date. An important conclusion that can be made from these results is that potato tuber moth parasitoids are still active and effective in all areas where it was monitored.

Can parasitoids effectively control tuber moth?

The answer is not straightforward. Many factors influence the effectiveness of potato tuber moth parasitoids.

From Figure 1 it may appear that the parasitoids are generally effective by producing parasitism levels of 80% and higher on several occasions. However, if the ecology of the parasitoids is taken into account, it becomes clear that these natural enemies will never control the tuber moth 100%. The increase in the number of parasitoids over time is always lower than that of their prey. If all of their prey is killed off, then their progeny will succumb to starvation. The 98% parasitism recorded in January 1994 in Gauteng is higher than the 80% to 90% usually recorded in the Gauteng (Roodeplaats) region in un-sprayed potato fields. The predicament is that in the



The potato tuber moth parasitoid, *Copidosoma koehleri*, kills the tuber moth by mummifying the larvae (left and below) just before the larvae pupate (healthy pupae on top right).

Figure 1. The percentage parasitism of potato tuber moth larvae collected in unsprayed potato fields in the different potato production areas between 1992 and 2007. The figure represents the combined values for the two parasitoids, *Copidosoma koehleri* and *Apanteles subandinus*.

case of severe tuber moth infestation, the remaining 10% to 20% not parasitized by the parasitoids is high enough for heavy yield losses to occur. There is, therefore, no guarantee that parasitoids will be as effective as insecticides. Most insecticides are still effective against the potato tuber moth (D. Visser, unpublished data). Most farmers rely on weekly spraying in those areas that are known to suffer severe tuber moth attacks. Spraying programs are usually designed to include insecticides against tuber moth, leafminers and aphids, as well as fungicides against plant diseases. Most fungicides have no effect on the parasitoids, while most insecticides will also kill the parasitoids.

Some of the newer insecticides are, however, safe as they have no effect on the natural enemies of the tuber moth. These insecticides are usually labelled so as to indicate that they can safely be used where natural enemies of the tuber moth are also relied upon.

Although most commercial potato farmers do not rely on natural enemies to control pests, there are some instances where natural enemies, such as parasitoids, can play a central role in pest management. Organic farming, where the usage of insecticides is severely limited, and small scale farmers, who do not have access to expensive insecticides, may utilize parasitoids to a great extent.

Both these farmer groups can tolerate yield losses to some degree. When parasitoids are present in their fields, yield

losses may be significantly reduced. The answer to the question of where the imported parasitoids are today is, therefore, apparent in that they are well established country-wide and at certain times are responsible for very high levels of parasitism.

The question of whether these parasitoids can be relied upon to control potato tuber moth effectively, however, is a different story.



Copidosoma koehleri laying its eggs inside potato tuber moth eggs (top right). The relatively small size of these parasitoids (black dots) can be seen inside the Petri dish.