A guide for biological control against vegetable pests

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Introduction

This manual is written for Abalimi Bezekhaya. It targets current and future gardeners who are linked to the Abalimi Bezekhaya's gardening program. This manual provides information of potential biological control strategies. This guideline provides a simplified step-by-step approach for the sustainable management of common pests of vegetables in the Cape Peninsula region.

Table of contents

Control of snail and slugs

Snails and slugs

Snails (fig. 2) and slugs (fig. 1) are slimy animals that belong to the *Mollusca* family. There are different species of snails and slugs. Land snails eat different species of vegetables in the garden and have a high preference for leaves (Beemsterboer, 2017).

Figure 1. Slug.

Figure 2. Snail.

Control

Natural enemies are mainly birds, for example the *Turdus philomelos* (fig. 3), which is part of the *Turdidae* family. Other natural enemies are snakes, lizards, tusks, frogs, toads and hedges. However, because these animals are not always present in the garden, other mechanical options such as handpicking of snails and slugs are often used (Beemsterboer, 2017).

Figure 3. Turdus philomelos.

Also, small beer containers with holes on the side can be used to collect the snails. The snails and slugs will crawl through the holes and will fall into the layer of beer at the bottom of the container. The snails could be killed or transferred to a safe place (Beemsterboer, 2017).

In Kholomtwana snails are cooked in a bucket, left for 3 days and the liquid spread over the garden. Snails do not like the mucus, so it protects the plants against other snails (Beemsterboer, 2017).

Control of aphids

Aphids

It has a distinct waxy coating covering of the body of the aphids and the most common species that infests cabbage species is *Brevicoryne brassicae* (fig. 4). Aphids prefer to eat cabbage species in small-scale gardens (Beemsterboer, 2017).

Figure 4. Aphids.

Control

To control the aphids, natural enemies like, beetles could be used. The beetles that are most effective are the ladybug (fig 6) species. Another predator of aphids is the mantids (fig. 5). Another control option is to hand-pick the leaves with the aphids or use the soap, garlic and chili pepper in water method explained in chapter “Generals biological controls” (Beemsterboer, 2017).

Figure 5. Themantids.

Figure 6. Ladybug.

Control of Mole Cricket

Mole Cricket

The crickets (fig. 8) are light brown and furry. It has two massively developed legs, which are used for burrowing. This species can feed on potatoes (fig. 7) and strawberries and they live in gardens nearby rivers or other water streams. The *Gryllotalpa africana* is widespread in the region (Beemsterboer, 2017).

Figure 7. Sweet potato

Figure 8. Mole Cricket.

Control

To control these insects the entomopathogic nematode, *Steinernema scapterisci* (fig. 9) can be used. Suspension containing this nematode is sprayed over the soil. This nematode cultivated and distributed by specialized bio-control companies. Another control option is to hand-pick the leaves with the mole crickets (Beemsterboer, 2017).

Figure 9. Nematode Steinernema scapterisci

Control of moths

Moth

Figure 10. Trichoplusia orichalcea moth.

The moth has complete metamorphosis and have the following life stages after hatching from the egg; larvae, caterpillar and pupa and adult. In the picture is adult moth known as *Trichoplusia orichalcea (fig. 10)* and *Lymantriidae (fig. 16 and 17)*, also known as Golden Plusia and Gypsy moths, respectively. They are common in small-scale gardens and lives on different vegetable species. The Golden Plusia eggs look like little white balls, the caterpillar is green coloured and is a looper, but the larvae are still yellow coloured. The pupae's are black coloured and smooth and the moth has brown wings with a metallic-gold triangle on it (Beemsterboer, 2017).

Figure 11. Golden Plusia eggs.

Figure 12. Golden Plusia lifecycle.

The Gypsy moths abdomen and thorax are densely covered in barbed hair (fig. 15), the eggs (fig. 13) are laid in clusters and often have hair at the end of the female's abdomen. The caterpillar (fig. 14) is hairy and has a colourful skin. An adult caterpillar can produce a toxic white foam, which can cause skin irritation. The pupal have and larval hairs are black coloured and the moth has

two types of appearances. A female (fig. 16) looks white and the male (fig. 17) looks brown (Beemsterboer, 2017).

Figure 13. Gypsy moth eggs.

Figure 14. Gypsy caterpillar.

Figure 15. Gypsy pupal.

Figure 16. Lymantriidae female adult.

Figure 17. Lymantriidae male adult.

Control

The pest can be used controlled by natural enemies in the form of a *Bacillus thuringiensis (fig. 18)*. The culture could be sprayed once a week over the soil after the first larvae appear. This solution is not harmful for animals or humans and is the mostly used biological insecticide in the Netherlands. After spraying, the larvae will be contaminated as they eat the leaves and the bacterium will be ingested and transported into the

Figure 18. Bacillus thuringiensis.

intestines where it will make toxins. The toxins paralyzed the larvae, the larvae cannot eat anymore and will die. Another control option is to hand-pick the caterpillars and larvae (Beemsterboer, 2017).

Control of butterflies

Butterflies

Figure 19. Pieris brassecae

Before the butterfly have complete metamorphosis and the life cycle includes egg, larvae, pupa adult shown in the picture. This butterfly is *Pieris brassecae* (fig. 19), also known as Cabbage White. Cabbage White is common in small-scale gardens and infest cabbage species. The eggs (fig. 21) are yellow and has the form of an oval. The caterpillar (fig. 20) is yellow coloured with black spots at the side. The old pupae's (fig. 22) are mostly at the downside of the leaves are mostly anfractuous by a white web. The butterfly (fig. 19) has white wings with black tip to fore wings and some black at base of wings (Beemsterboer, 2017).

Figure 20. Pieris brassecae caterpillar.

Figure 21. Pieris brassecae eggs.

Figure 22. Pieris brassecae pupae's.

Control

Figure 23. Pteromalus puparum.

The caterpillars are kept in check by the indigenous parasitic wasp *Pteromalus puparum* (fig. 23). This only works if the wasps are present. The wasp is metallic bluish-black, with short, elbowed black antennae. It could control Cabbage White by laying eggs in final instar larvae, the insects develop and pupate within the butterfly and the pupae emerge through small exit holes. Also, *Bacillus thuringiensis* can be used to control the moths (Beemsterboer, 2017).

Control of thrips

Thrips

Figure 24. Thrip

It has become a key pest of cabbage and onion. Thrips (fig. 24) belongs to the family *Thripidae*, are small insects, which cannot be easily seen with the naked eye. The adults are dark brown and the nymphs are yellow and they feed by rasping the foliage and sucking the plant sap released from the damaged tissue. They are most damaging when the plants are still young. Normally, thrips prefer onion plants, but they can also live at other vegetables like cabbage species (Beemsterboer, 2017).

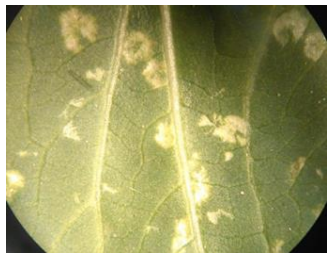

Figure 25. Damaging on cabbage leave due to thrips.

Figure 26. Damaging on spring onion due to thrips.

Thrips could be controlled by parasitic mites and wasps. For example, green lacewing larvae (fig. 27) are important predators of Cuban laurel thrips. Euseius species mites (fig. 28) are important predators of citrus thrips. There many predators against different species of thrips. Before knowing which control approach to use, the species identity of thrips have to be determined (Beemsterboer, 2017).

Figure 27. green lacewing larvae.

Figure 28. Euseius mites.

General biological control

General controls which are already used

Culturally, control against insects is achieved by mixing water, garlic, chili pepper and 2 spoons of soap. This is left for 2 nights and is spread over the vegetable garden. Insects do not like garlic, chili, soap or even mucus, so it protects the plants against the damaging pests. This method of control is used in these gardens: Asande, Sinako, Mayo we Khaya, Sinoxolo and Kholomtwana (Beemsterboer, 2017).

Crop isolation

Crops are planted some distance from the same species, but more mature crop, may prevent pests from moving to young plants in large numbers. It may be less of a problem if the crops are kept at a distance of at least 100 m apart from each other (Visser, 2011).

Crop rotation

Crop rotation is only effective against pests that meet certain criteria. These include soil-inhabiting pests, pests

that do not migrate, pests that only attack certain plants and pests that are unable to survive for long periods without a suitable host plant. Crop rotation aims at reducing the planting crops from different plant families in succession on the same piece of land. It has been used effectively against certain nematodes, soil-dwelling insects like white grubs and certain soil-borne pathogens (Visser, 2011).

Intercropping

Intercropping involves growing more than one crop in a field at the same time. That could be done to grow the plants in small randomized plots. Under certain situation intercropping may lead to lower levels of damage, especially with pests like mites. In an intercropping system it is advisable to plant at least one crop with sustainable flowers that can supply nectar and pollen to parasitoids. It also ensures that at least one or two crops remain healthy when a severe disease or pest destroys the others (Visser, 2011).

Companion planting

This concept is comparable to intercropping. Certain plants are planted near or around other plants to repel pests. In this system, crops are grow together (Visser, 2011).

Trap and border crops

Certain crops are planted near or adjacent to the primary crop to deliberately attract key pests. When pest numbers increase in the trap crop, the pests are destroyed. This technique only works with pests that are highly attracted to the trap crop. Border crops are also planted around the primary crop to trap migrating pests and virus vectors like aphids (Visser, 2011).

Push-pull technology

This technique combines companion planting and trap cropping. Attracting plants are planted around or near the primary crop while repelling plants are planted within the primary crop. The pest is then repelled out of the field and trapped by the attracting plants on the edges of the field (Visser, 2011).

Mechanical barrier

For example, the best mechanical barrier is the greenhouse. It protects from adverse weather conditions and flying pests. Other mechanical barriers used in pest control strategies include vertical copper strips around crops to prevent snails and slugs from crossing into the crop. Also, vertical plastic barriers around small plots can prevent crawling pests from entering the plots (Visser, 2011).

Sanitation

Sanitation simply means to keep the crop and the surrounding areas free of any material that may harbour pests and diseases. The most common technique is to destroy and remove all nearby hosts of important pests. These are mostly weeds that grow in the wild next to a field, but may also be discarded plant material from a previous season. One of the most common and notorious origins of various pests is dumping sites. Such refuse or dumping areas usually have deep holes in the ground, which only get covered once the hole is nearly filled with waste. Pests reproduce during this time and re-infest other discarded produce and in the process may build up to huge numbers. However, this practice is only successful if it is implemented on a regular basis, like every two weeks (Visser, 2011).

Time of planting/harvest

Some of the crops could planted earlier to reduce infestations dramatically. Sometimes a crop is harvested earlier than planned when it is known that a pest will do more harm if the harvest is postponed. For every crop it will be different (Visser, 2011).

Tillage

The main aim of tillage is to prepare the soil for the new season and for weed control. The soil has to be ripped, then ploughed, disked and sometimes also rotated to loosen the soil for improved air, root and water penetration. The most soil pests overwinter in the soil less than 20 cm below the surface. Some of them could be killed in the tillage process (Visser, 2011).

Organic pest control

Organic pesticides contains natural enemies and organic pesticides. This control can be defined as any control method that does not utilize synthetic pesticides. Pesticides are allowed, but only those derived from plant extracts or naturally occurring organisms. Several organic pesticides are as toxic as, or even more toxic than many synthetic chemical pesticides (Visser, 2011).

References

Beemsterboer, C. M. (2017). *Common pests of vegetables in the Cape Peninsula.* Cape Peninsula University of Technology, Bellville. Retrieved June 2017

Visser, D. (2011). *A complete guide to vegetable pests in South Africa.* Pretoria: ARC-roodeplaat. Retrieved April 2017