Normec
Groen Agro Control
Projecten

Inventory of Natural Biological Control Agents in Egypt

Collecting grapevine mealybugs (*Planococcus ficus*).

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Summary

The aim of this research was to identify potential local biological control agents against pest insects in citrus orchards, vineyards (table grapes) and arable fields in Egypt. Between April 19th and 21st of 2026 several farms were visited around Cairo, Egypt. During the survey several pest insects (insects that are making damage to a crop) as well as their natural enemies (such as ladybirds, predatory mites and parasitic wasps) were collected. In this report the findings are documented of the collected insects per farm and inspected crop. It can be concluded that beside pest insects also potential biological control agents were found at the farms. For future research the collected local predators/parasitic wasps will be evaluated on their potential as biological control agent. Also, their biology and possibility to locally mass rear these insects will be ascertained, so they can become available for the farmers. Next to this, the contribution of banker plants to transitioning from the current chemical pest control to a more biological way of pest control will be investigated. Besides a more biological way of pest control, an education program for fieldworkers and students on universities is needed to educate them on recognizing pest insects and biocontrol agents in the field.

Content

1. Introduction

1.1 The problem

In the Netherlands the use of more and more chemical crop protection products is reduced. This is caused partly by pressure from society to grow vegetables and ornamental crops (flowers/pot plants) as healthily as possible. As a result of this reduction growers are forced to increase the use of green solutions. The most commonly used green solution for pest control are biological control agents. Biological control agents are insects that eat pest insects (insects that are making damage to a crop like aphids, caterpillars and thrips), for example ladybirds that eat aphids or parasitic wasps that are laying eggs into a caterpillar and the wasp's larva are eating the caterpillar from inside out which will be killed when the larvae are full grown. In the Netherlands biological control agents are used in all greenhouse crops. Biological control agents can often completely control a pest. This is often achieved by using several species of biological control agents against the pest insect in question. The entomology department of Normec Groen Agro Control Projects (from here on indicated with Normec) has extensive experience on determining the presence of (new) pest insects and (new) biological control agents in greenhouse horticulture, orchards and arable fields. In addition, this department is experienced in researching the interactions between pest insects and control agents, both on commercially available control agents and potentially new biological control agents.

Next to pest insects, many species of biological control agents often occur in greenhouses, having flown in from outside. Without the growers' knowledge, these biological control agents already suppress some pest insects. Normec looks for these natural predators/parasitic wasps in and around the greenhouse, attempts to cultivate them, and assesses their potential as predators. When a predator shows potential, a decision is made in consultation with the client on how to proceed. The predator can be presented to bio producers who can turn it into a commercial product or, if it is too difficult to rear them on a large scale (e.g. long-life cycle), a solution is sought to enable the grower to maintain/rear the predator in the greenhouse themselves.

Due to the growing demand from the EU for organically grown vegetable and ornamental products and high cost of using pesticides, farmers in Egypt are more attracted to switch to organic farming. However, at this moment, there is still a lack of knowledge about which native biological control agents are already present at the farms and research into these local pest control agents in Egypt.

Biological control agents imported from Europe are often less effective in Egypt. For example, shown by Abd-Rabou (2006), the parasitic wasps *Diglyphus isaea* and *Dacnusa sibirica* have a very low parasitism rate against the American serpentine leafminer - *Liriomyza trifolii* in vegetable crops. The parasitic wasps were imported from the Netherlands. Both species of parasitic wasps are effective against *L. trifolii* in the Netherlands. This difference in effectiveness is most likely due to the fact that the temperatures in Egypt are higher than in the Netherlands. *Dacnusa sibirica* is known for thriving at temperatures below 20°C (https://www.koppert.nl/gewasbescherming/biologische-bestrijding/sluipwespen/dacnusa-sibirica/).

This phenomenon can be seen more often because biological control agents from Europe are often most effective at controlling pests at temperatures between 15 and 25°C. Higher temperatures cause them to be inactive and/or die. Therefore, it is better to use biological control agents against pest insects that are native to Egypt. These biological control agents are better adapted to the higher temperatures (>25°C) and climatic conditions in Egypt.
Normec has extensive experience in searching for potential biological control agents of pest insects, both in and around greenhouses, orchards and arable fields. By visiting several farmers and inspecting various crops and making an inventory of the pests and the biological control agents that occur naturally (native) in and around the agricultural fields a list of potential biological control agents for the pests in Egypt can be made.

1.2 Aim of the research

To identify local potential biological control agents against pest insects in citrus orchards, vineyards (table grapes) and arable fields in Egypt.

2. Material & methods

Farms were visited between April 19th and 21st of 2026 around Cairo, Egypt. At every farm several crops where inspected (Figure 1). During a crop inspection, plants were carefully inspected on the presence of pest insects and potential biological control agents. When a pest insect or biological control agent was found, it was caught with an aspirator or brush and put carefully in an Eppendorf tube with a 50% ethanol solution. Tubes were labelled and transported to the laboratory of Normec, the Netherlands. At the laboratory of Normec pictures ware taken of the collected insects and insects were morphologically identified. When morphological identification was not possible, identification through DNA was conducted. A list was made of all collected pest insects and biological control agents (Table 1). Also prey predator relationships have been indicated, if present.

Figure 1: Examples of crops that were inspected during the survey. A: table grapes, B: potato and C: citrus.

3. Results

In the table below (Table 1), the collected pest insects and potential biological control agents are listed. It is sorted by company and crop type.
Note: the collected pest insects are **very common** pests in Egypt and are **not** company specific. Because of time constrains not all crops of a company were inspected. Therefore, some pest insects were not found at some companies. Even though, it is expected that all pest insects can be found at every company.

Table 1: Collected pest insects and potential biological control agents per inspected crop per farm. When possible, the connection of a biological control agents (BCA) is mentioned to the related pest insect in the remarks.

Company	Crop	Pest insect scientific name	Pest insect common name	Biological control agent scientific name	BCA common name	Remarks
Farm Y	Table grapes	*Planococcus ficus*	Vine mealybug			Vine mealybugs can be found under the bark. The Vine mealybugs were protected by ants (Figure 2). Vine mealybugs are sucking plant juices.
				Platygastridae sp.	Unknown parasitic wasp species of the Vine mealybug	In the collected samples of Vine mealybugs, a parasitized Vine mealybug was found (Figure 3), which indicates that a local parasitic wasp species does parasitize Vine mealybugs. According to the DNA analysis a *Platygastridae* sp. wasp was found. The members of this family are known to parasitize mealybugs. The species name is unknown.
		Aphid, probably *Aphis illinoisensis*	Grapevine aphid			Aphids collected on young leaves and stems (Figure 4).
				Hymenoptera sp.	Unknown parasitic wasp species of the Grapevine aphid	Parasitized Grapevine aphids (so called 'mummies') were collected (Figure 5) on leaves and stems. Collected parasitic wasp species is unknown.

Company	Crop	Pest insect scientific name	Pest insect common name	Biological control agent scientific name	BCA common name	Remarks
Farm Y	Table grapes			Hymenoptera sp.	Unknown parasitic wasp species of the Grapevine aphid	On a leaf with Grapevine aphids an unknown parasitic wasp species was collected (Figure 6). The parasitic wasp was searching for a host on the leaf, which indicated that it could be searching for aphids.
				Hymenoptera sp.	Unknown parasitic wasp species of the Grapevine aphid	On a leaf with Grapevine aphids an unknown parasitic wasp species was collected (Figure 7). The parasitic wasp was searching for a host on the leaf, which indicated that it could be searching for aphids. This species differs from the species in Figure 6 by a different wing pattern and body shape, which indicates that it is a different species.
				Coccinella undecimpunctata	Eleven-spot ladybird	On a leaf with Grapevine aphids an adult Eleven-spot ladybird was collected. Adult and larvae ladybirds are aphid predators (Figure 8).
				Coccinellidae sp.	Unknown ladybird species	On a leaf with Grapevine aphids a larva of an unknown ladybird species was collected. Adult and larvae ladybirds are aphid predators.
				Coenosia sp.	Hunter fly	Adult flies are predators of flying insects and larvae are soil born predators. Several flies present. Not collected.
				Coenagrionidae sp.	Damselfly	Adults are predators of flying insects. Not collected
	Green peas	*Thrips tabaci*	Onion thrips			Thrips on leaves and beans (Figure 9). No potential biological control agent has been seen.
		Probably *Aphis fabae*	Black bean aphid			Aphids collected on leaves (Figure 10).
				Coenosia attenuata	Hunter fly	Adult flies are predators of flying insects and larvae are soil born predators. Several flies present (Figure 11).
		Liriomyza trifolii	American serpentine leafminer			Adult leafminers collected on leaves as well as larvae in leaves (Figure 12).

Company	Crop	Pest insect scientific name	Pest insect common name	Biological control agent scientific name	BCA common name	Remarks
Farm X	Potatoes	*Liriomyza trifolii*	American serpentine leafminer			Adult leafminers collected on leaves as well as larvae in leaves.
				Alysiinae sp.	Unknown parasitic wasp species of the American serpentine leafminer	The *Alysiinae* are a subfamily of braconid parasitic wasps. According to the DNA-analysis the nearest named relatives are*: Exotela* sp., *Idiasta* sp. and *Dinotrema* sp. which are all known to be parasitic wasps of *Liriomyza* sp. leafminers (Figure 13).
		Tuta absoluta	South American tomato pinworm			Caterpillars collected on potato leaves (Figure 14).
				Diadegma fenestrale	Parasitic wasp of the potato tuber moth and diamondback moth and probably of the South American tomato pinworm	Known from *Diadegma fenestrale* (Figure 15) is that it parasitizes caterpillars of the potato tuber moth - *Phthorimaea operculella* (potato) and the diamondback moth - *Plutella xylostella* (cabbage). Both are major pests in Egypt. From *Diadegma* sp. it is also known that they parasitize *T. absoluta*.
				Hymenoptera sp.	Unknown parasitic wasp species of the South American tomato pinworm or the potato tuber moth	Beside *Diadegma fenestrale*, another parasitic wasp species with a visible ovipositor was flying around by leaves damaged by caterpillars, which indicated that is could be parasitizing larvae of the South American tomato pinworm and/or the potato tuber moth. Several female wasps (only females have an ovipositor) have been seen. Because of the strong wind these wasps could not be collected.
				Coenosia attenuata	Hunter fly	Adult flies are predators of flying insects and larvae are soil born predators. Several flies present.
		Aphididae sp.	Aphid			Aphids present on leaves, species unknown.

Company	Crop	Pest insect scientific name	Pest insect common name	Biological control agent scientific name	BCA common name	Remarks
Farm X	Potatoes			*Coccinella undecimpunctata*	Eleven-spot ladybird	Two adult Eleven-spot ladybirds were collected. Adult and larvae ladybirds are aphid predators (Figure 16).
				Hippodamia tredecimpunctata	Thirteen-spotted ladybird	One adult Thirteen-spotted ladybird was collected. Adult and larvae ladybirds are aphid predators (Fig. 17).
				Coccinellidae sp.	Unknown ladybird species	Four ladybird larvae were collected. Species unknown. Adult and larvae ladybirds are aphid predators (Fig. 18).
		Lygus sp.	'Plant bug'			A nymph of *Lygus* sp. was collected. Some *Lygus* species are known to be a major pest in potatoes (Fig 19).
	Citrus	*Aphis spiraecola*	Green citrus aphid			Aphids were collected on leaves (Figure 20)
				Hymenoptera sp.	Unknown parasitic wasp of the Green citrus aphid	Parasitized Green citrus aphids (mummies) were collected (Figure 20) on leaves. Parasitic wasp species unknown.
				Coccinellidae sp.	Unknown ladybird species	Several adult ladybirds were seen, but not collected because of the strong wind during the survey.
				Diadegma fenestrale	Parasitic wasp	Several *Diadegma fenestrale* wasps have been seen drinking from the honeydew produced by the green citrus aphid, a potatoes field was close by.
		Tetranychidae sp.	Spider mite			Small plant-feeding mites (< 1mm), spin fine silk webs around leaves and stems and making a lot of damage. Not collected.
				Coenosia sp.	Hunter fly	Adult flies are predators of flying insects and larvae are soil born predators. Several flies present. Not collected.
		Spilostethus pandurus	'Seed bug'			This bug consumes seeds and plant juices, especially from milkweed and sunflower seeds, but can also feed on cotton, tomatoes and citrus (Figure 21).
Farm Z	Table grapes	*Planococcus ficus*	Vine mealybug			Vine mealybugs can be found under the bark. The Vine mealybugs were protected by ants.

Company	Crop	Pest insect scientific name	Pest insect common name	Biological control agent scientific name	BCA common name	Remarks
Farm Z	Table grapes	Aphid, probably *Aphis illinoisensis*	Grapevine aphid			Aphids on leaves and stems. Not collected.
Sekem	Marigold - *Calendula officinalis*		Aphid			Aphids present on leaves and stems, species unknown. Found in experimental garden, no crops were investigated during the inspection.
				Coccinella undecimpunctata	Eleven-spot ladybird	Two adults Eleven-spot ladybirds were collected. Adult and larvae ladybirds are aphid predators. Found in experimental garden, no crops were investigated during the inspection.
				Hippodamia variegata	Adonis ladybird	An adult Adonis ladybird was collected (Figure 22). Adult and larvae ladybirds are aphid predators. Found in experimental garden, no crops were investigated during the inspection.
El Taji Farm	White beans	*Tetranychidae* sp.	Spider mite			Small plant-feeding mites (< 1mm), spin fine silk webs around leaves and stems and making a lot of damage.
				Phytoseiulus sp.	Predatory mite	Red predatory mites, collected together on leaves with spider mites. *Phytoseilus* predatory mites are known to be very efficient predators of spider mites.
		Chrysodeixis chalcites	Tomato looper or golden twin-spot moth			Two caterpillars collected on bean leaves (Figure 23).
		Lygus sp.	'Plant bug'			An adult of *Lygus* sp. was collected. Some *Lygus* species are known to be a pest in beans (Figure 24).
		Empoasca decipiens	Green leafhopper			Four adult Green leafhoppers were collected. This species is known to be a pest in beans (Figure 25).
		Thysanoptera sp.	Thrips			Thrips on leaves and beans. Species unknown.

Company	Crop	Pest insect scientific name	Pest insect common name	Biological control agent scientific name	BCA common name	Remarks
El Taji Farm	White beans	*Aphis spiraecola*	Green citrus aphid			Aphids collected on leaves. Beside citrus this species is can also be a problem in beans.
		Whitefly, probably *Bemisia tabac*	Silverleaf whitefly			Several whiteflies collected on bean leaves.
		Leafminer, probably *Liriomyza trifolii*	American serpentine leafminer			Adult leafminers on leaves as well as larvae in leaves. Not collected.
				Coenosia attenuata	Hunter fly	Adult flies are predators of flying insects and larvae are soil born predators. Several flies present.
	Corn	*Spodoptera frugiperda*	Fall armyworm			Two caterpillars collected on corn leaves (Figure 26).
	Citrus	*Aphis spiraecola*	Green citrus aphid			Aphids collected on leaves.
				Hippodamia variegata	Adonis ladybird	An adult Adonis ladybird was collected. Adult and larvae ladybirds are aphid predators (Figure 27).
		Ceratitis capitata	Mediterranean fruit fly			Four adult Mediterranean fruit flies were collected. This species is a major pest in citrus in Egypt (Figure 28).
				Coenosia sp.	Hunter fly	Adult flies are predators of flying insects and larvae are soil born predators. Several flies present. Not collected.
Wael Maari	Pomegranate			*Coccinellidae* sp.	Ladybird	An adult unknown species of ladybird was collected. Adult and larvae ladybirds are aphid predators (Fig. 29).
				Chrysoperla carnea	Green lacewing	Larvae are aphid predators (Figure 30).
	Bean	Aphid, probably *Aphis spiraecola*	Green citrus aphid			Aphids on leaves. Beside citrus this species is can also be a problem in beans. Not collected.

Company	Crop	Pest insect scientific name	Pest insect common name	Biological control agent scientific name	BCA common name	Remarks
Wael Maari	Citrus	Aphid, probably *Aphis spiraecola*	Green citrus aphid			Aphids on leaves. Not collected.
				Coenosia sp.	Hunter fly	Adult flies are predators of flying insects and larvae are soil born predators. Several flies present. Not collected.

Insects that were not found or collected during the field study but are giving problems at the company and other information:

- At Farm Y they also have problems with leafhoppers in grape and with the Mediterranean fruit fly (*Ceratitis capitata*) in citrus.
- At Farm X they also have problems in citrus with the Mediterranean fruit fly - *Ceratitis capitata*.
- At Farm Z we were only able to inspect the vineyards (table grapes).
- At El Taji Farm they also have problems with scale insects in citrus.
- At Wael Maari the also have problems with scale insects in mango.

Figure 2: Vine mealybug - *Planococcus ficus*.

Figure 3: Parasitized Vine mealybug by an unknow *Platygastridae* parasitic wasp species.

Figure 4: Probably Grapevine aphid - *Aphis illinoisensis*.

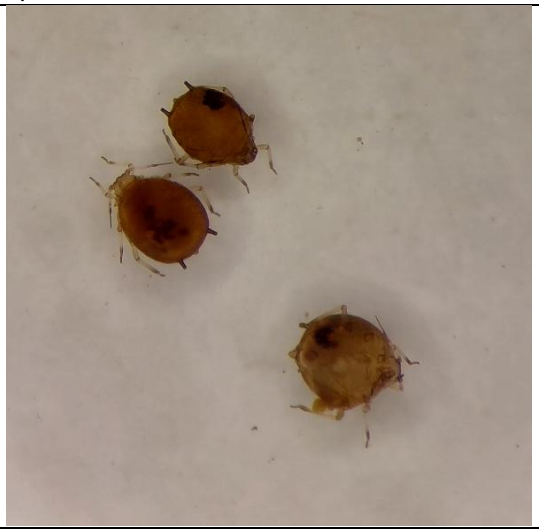

Figure 5: Parasitized Grapevine aphids (mummies), parasitic wasp species unknown.

Figures 6 and 7: Two unknown parasitic wasps (species) found on leaves with Grapevine aphids.

Figure 8: Eleven-spot ladybird - *Coccinella undecimpunctata* found on a leaf with Grapevine aphids.

Figure 9: Onion thrips - *Thrips tabaci*.

Figure 10: Probably Black bean aphid - *Aphis fabae*.

Figure 11: Hunter fly - *Coenosia attenuate*.

Figure 12: American serpentine leafminer – *Liriomyza trifolii*, damage by larva and adult fly.

Figure 13: *Alysiinae* sp.
Parasitic wasp of *Liriomyza* sp.

Figure 14: Larvae of South American tomato pinworm - *Tuta absoluta*.

Figure 15: *Diadegma fenestrale* parasitic wasps.

Figure 16: Eleven-spot ladybird – *Coccinella undecimpunctata*.

Figure 17: Thirteen-spotted ladybird - *Hippodamia tredecimpunctata*.

Figure 18: Ladybird larvae, species unknown.

Figure 19: A *Lygus* sp. nymph found in potato.

Figure 20: Green citrus aphid - *Aphis spiraecola*
and parasitized aphids (mummies), parasitic wasp species unknown.

Figure 21: The 'seed bug' *Spilostethus pandurus*.

Figure 22: Adonis ladybird - *Hippodamia variegata*.

Figure 23: Larvae of Tomato looper or golden twin-spot moth - *Chrysodeixis chalcites*.

Figure 24: A *Lygus* sp. adult found in bean.

Figure 25: Green leafhopper - *Empoasca decipiens*.

Figure 26: Larvae of Fall armyworm – *Spodoptera frugiperda*.

Figure 27: Adonis ladybird - *Hippodamia variegata*.

Figure 28: Mediterranean fruit fly – Ceratitis *capitata*.

Figure 29: Unknown ladybird species – *Coccinellidae* sp.

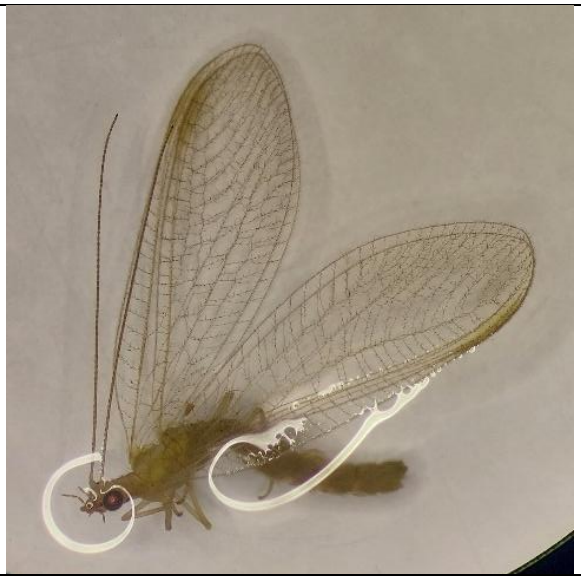

Figure 30: Green lacewing - *Chrysoperla carnea*.

To summarize the results:

- For the Vine mealybug (*Planococcus ficus*) one parasitic wasp species was collected.
- For aphids 4 different ladybird species were collected, as well as several larvae of ladybirds (unknown species); parasitic wasp mummies on two different aphid species indicating 2 different parasitic wasp species, as well as 2 different wasp species that were collected close by aphids; and the green lacewing (*Chrysoperla carnea*). Showing a total of at least 7 native potential biological control agents against aphids.
- For the American serpentine leafminer (*Liriomyza trifolii*) one parasitic wasp species was collected.
- For the South American tomato pinworm (*Tuta absoluta*) one parasitic wasp species was collected in very high numbers of individuals of *Diadegma fenestrale*.
- At all visited farms Coenosia sp hunter flies were seen. As not at all farms *Coenosia* flies were collected. Where they were collected, they were all from the same species *Coenosia attenuate*, indicating that this species is probably present at all visited farms.
- For thrips, bugs, the Tomato looper (*Chrysodeixis chalcites*), the Fall armyworm (*Spodoptera frugiperda*), the Green leafhopper (*Empoasca decipiens*) and the Mediterranean fruit fly (*Ceratitis capitata*) no potential biological control agents were collected during the survey. This does not exclude the presence of potential biological control agents against these pests. It only means that they were not collected during this short stay survey.

4. Discussion, conclusion and follow up

4.1 Discussion

At all farms that were inspected, pest insects were found. Mostly the same pest insect species were found in the same crop types throughout the visited farms. This shows that farmers around Cairo have problems with the same pest insects. Even though, almost every week the visited farmers use chemical pesticides to kill pest insects, several were found alive in the inspected crops. This suggests that several pest insects can have become resistant against the used pesticides. This finding is very concerning for the farmer, as pest insects can become more resistant in the future through the use of chemical pesticides and cannot be killed anymore and keep on causing damage to the crops, showing the importance of (start) using biological control agents to control the pest insects.

However, on the positive side, next to pest insects at almost all inspected crops biological control agents were found. At all visited farms *Coenosia* hunter flies were present in the crops. These flies eat all kinds of small flying insects, so they can prevent the spread of flying pest insects like flying aphids. On the down side they do not distinguish between pest insects and other flying biological control agents. As a result, they can also catch parasitic wasps, which is undesirable. Next to these hunter flies, other biological control agents against aphids were found. These include several ladybird species (larvae, pupae and adults), mummified aphids (aphids parasitized by parasitic wasps) and a green lacewing (larvae are aphid predators). These findings are looking very promising for controlling aphids by natural enemies in Egypt. For *Tuta absoluta* also hundreds (probably in the whole crop thousands) parasitic wasps were found. Unfortunately, they were all dead, located on bean leaves that were treated with pesticides. Most likely the parasitic wasps were migrating from a potato field that was ready for harvesting (so all the foliage was almost dead, so no hosts were available anymore) to a potato field on the other side of the bean field (the bean field was between both potato fields). The use of pesticides in this case shows that the biological control agents are killed, because they are not resistant against the pesticides. This will allow *T. absoluta* to become a major pest in the new potato field. Still, the finding of the dead parasitic wasps show big biological control opportunities in potato fields in the Cairo region. Close by both potato fields citrus trees were growing. In the citrus fields a lot of aphids were found, as well as ladybirds. The aphid species that was present (Green citrus aphid) in the citrus trees was producing a lot of honey dew. In both citrus fields the *T.* absoluta parasitic wasps were seen feeding on this honey dew. For adult parasitic wasps food, such as sugar/pollen, is necessary to stay alive. Therefore, the presence of honey dew might have been the reason why so many parasitic wasps of *T. absoluta* were found in this area. As farmers, of course, do not want to have aphids in citrus other ways to feed the adult parasitic wasps have to be explored. A way to do this, is by introducing plants that contain nectar and pollen, called banker plants.

Banker plants are plants perform one or more of the following functions:

1) Luring pest insects away from the crops. For these pest insects the banker plants are more attractive than the surrounding crops. Once the banker plants are filled with pest insects, these plants can then be treated with green pesticides or thrown away.
2) Being used by biological control agents like predatory bugs (*Orius* sp.) as egg laying plant. Not all crops are suitable for egg laying, via these plants biological control agents are still able to reproduce.

3) Being used as feeding station plant for adult biological control agents such as parasitic wasps and hoover flies. The selected plants are flowering for a long period and produce nectar and pollen.
4) Being used as feeding plant/reproduction plant for a standing army. This principle is based on the presence of an insect closely related to the pest insect where the biological control agent can feed on. For example, on the banker plant another aphid species is present than the pest aphid species damaging the crop. The aphid species on the banker plant cannot feed from the crop. However, the biological control agents can predate on both aphid species. This way the biological control agent always has something to feed on. These plants are normally used when the pest aphid is not present (yet), so the farmer can already rear/keep the biological control agents against aphids in the crop; called “standing army”.

The idea for banker plants was proposed by the people from the companies during the inspections. When banker plants are introduced in crops watered by a dripping system, a dripping system for the banker plants can easily be construct. For open field crops, the farmers can water the banker plants the same way as they water the crops.

Unfortunately, not for all pest insect species potential biological control agents were found. During the farm visits there was only a short time to inspect the crops. So, it is still possible that local biological control agents are present, and will be found when more time is available.

During our trip Sekem was visited as well. Sekem, and its related farmers, are already trying to grow their crops in a biological way. Sekem has its own biological control department. At this department they are growing several native biological control agents and applying them on their fields. This can be a good example for other large farms.

During the field inspections we met a lot of very enthusiastic people that were working in the field and they showed the willingness to learn about biological pest control. However, when larvae of ladybirds were shown to them, they were all believing that it was a pest insect and that they have to kill it. We suggest to come up with a biological control education program for fieldworkers, so they can recognize pest insects and biological control agents. During our stay we also had a meeting with Prof. Dr. Faouzy from the Ain Shams University in Cairo. We discussed about this education program and the professor is willing to help with setting up this education program. Also, besides making an education program for fieldworkers it is very important to educate students at agricultural schools about pest insects and biological control agents. The professor agreed with this and mentioned to educate students as well.

4.2 Conclusion

Beside pest insects, several potential biocontrol agents were found in several crops at the farms. Farmers are willing to use less pesticides and implement a more biological method, using biological control agents and exploring the use of banker plants. There is a lack of knowledge on recognizing pest insects and biological control agents in the field by fieldworkers. For this, an education program could help. This could be set up together with Normec and a local university in Cairo. The educational program can help current and future farmers and fieldworkers on schools/universities. Sekem has already started with rearing their own biological control agents and applying them in their fields. This could be used as a good example for other large companies to produce their own biological control agents locally or together with Sekem or Normec.

4.3 Follow up

- As there was only a short time to inspect the crops on the farms, probably not all pest insects and potential biological control agents were found. A longer field survey is needed to find for all pest insects potential native biological control agents. This can be done by Normec together with a local University/research institute in Cairo.

- Normec found already some potential biological control agents. However, nothing is known about the biology of most of them. Research has to be conducted on how effective they are in controlling a pest insect and getting insights about their life cycle (biology). This can be done together with a local University/research institute in Cairo. Normec has a lot of knowledge and practical experience with conducting experiments on several species of pest insects and (new) biological control agents.

- Local biological control agent mass rearings. As Normec already found some potential biological control agents, beside knowledge about their biology also knowledge about the possibility to rear them is needed (are they easy to rear?). Based on this knowledge, local (professional) mass rearings of the biological control agents can be established, so they become available for farmers. This can be done together with a local University/research institute in Cairo and together with Sekem, as they already have some experience with rearing some local native biological control agents. Normec has a lot of knowledge and practical experience with rearing several species of pest insects and biological control agents as well.

- Banker plants. The visited farmers asked about the possibility to explore the use of banker plants at their farms. As banker plants can be used in several ways, research is needed to find suitable banker plants per crop(system) and how to integrate them in the concerning crop. Research can be conducted together with Normec, a local University/research institute in Cairo, and farmers.

- Education program. As there is a need to educate both fieldworkers and students recognizing pest insect and biological control agents, an education program has to be set up. This can be done by Normec together with a local University/research institute in Cairo, as well as with Prof. Dr. Faouzy from the Ain Shams University in Cairo.

Acknowledged

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