
Discovery Learning: A Manual to Promote Better Pest Management in Tree Crops

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Background

In Vietnam, weaver ants have been traditionally used by citrus farmers to increase the quality of their fruit and to protect their trees from harmful insects. With an increased pressure from pesticide companies, this traditional practice is under threat. Especially younger farmers, who shifted from rice to fruit crop cultivation, are tempted to reside to toxic pesticides as they do not know how to take care of the ants. An easy solution at first sight, but with dramatic consequences for their health, this of consumers and the environment.

Learning how to work with natural resources such as these ants requires that farmers are trained in ecological principles, that they learn to improve their observation skills, and their decision-making based on social learning processes with their colleagues. Current day farmer training approaches move away from the top-down delivery of blanket recommendations and put more emphasis on the farmers themselves and their learning environment.

To support these farmer learning sessions, which can take place in farmer clubs, farmer associations or farmer field schools, a curriculum needs to be developed that comprises discovery learning exercises addressing biodiversity monitoring, weaver ant ecology, etc.

In what follows, an overview is given of those exercises developed and tested in Vietnam in collaboration with Cantho University, the Southern Regional Plant Protection Centre and the National Farmers' Association VACVINA. They can be used by anybody engaged in farmer training and education. We believe that the exercises can be adapted and applied to other countries and regions, and hope it will be disseminated as widely as possible.

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Exercise 1: Monitoring citrus orchards

Objective :To understand the importance of field monitoring

Materials:

- Polythene sheets
- Vials
- Polythene bags
- Hand lens
- Citrus orchards
- Flip charts
- Colour pens
- Mosquito spray can

Procedure:

In small groups, visit different citrus orchards (preferably those which have been not recently treated by chemicals) and make observations on insects, diseased leaves, branches, fruits etc that are known or can be recognised by the participants. In each field, each group selects and tags one or more citrus trees. Each tagged citrus tree should be observed systematically through detailed observations of main and side branches (at the height people can reach). After that, spread a polythene sheet on the ground below the tree. Beat or shake the tree stems so that the insects and leaves fall down on the sheet. Take the polythene sheet carefully away and observe its' content: how many different types of insects are found, which of these are known as pests, how many fruits and leaves are found and why did they drop off the tree? To record the results, draw a large picture of the citrus tree with the correct colours and draw the major pests and other phenomena's that were observed. Present the results per group. During the discussions, mention the local names of the observed insects and diseases and any differences between the different fields. Differentiate as much as possible the various insect pests from the natural enemies. Try to arrive at a consensus on why observations of citrus orchards must be done.

Guiding questions for group discussion:

1. Which insects were found and what are their local names ?
2. Can you differentiate those insects that are pest insects and those that are natural enemies ('friends of the farmers')?
3. When is the appearance peak of this pest/natural enemy?
4. What cause affectes on the population augmentation of the pest/natural enemy?
5. Was there a difference in results between the various fields? Why (/why not) and what can we learn from this observations?
6. Is there a need to observe citrus orchards regularly? Why (/why not)?

Exercise 2: Biodiversity and the weaver ant in the citrus orchard

Objectives: To show the difference in biodiversity between orchards with ant and those without ants where a lot of pesticides are used

Materials :

- Vials
- Polythene bags
- Hand lens
- Citrus orchards (one orchard with lot of ants and one orchard without ant + use insecticides)
- Shelter trap (10 pieces)
- Pitfall Trap (100 pieces)
- Malaise trap (2 sets)
- Sweep net (2 pieces)
- Cyanide bottles (2 pieces)
- Small bottle for insect keeping (10 pieces)
- Plastic bags and small containers to collect various insects
- Small soft brush *Tissue paper
- 4 Transparent buckets
- 4 Pieces of Muslin or mosquito screen cloth with rubber bands, to cover the buckets
- Labels and marker, note book, pen
- 4 Small hand-sprayers ((0.5 l), shared between groups)
- Water *Small amounts of different
- Gloves and masks

Procedure:

1. In each orchard, use 5 shelter traps - 5 pitfall Traps (100)- 1 Malaise trap (1) to capture insects and other arthropods - Note the quantity of species or group of arthropods after 3 days using the traps)
2. In each orchard, use insect net to collect insects and other arthropods (5 crossing points) - In small groups, visit two citrus orchards Note the quantity of species or group of arthropods after 3 days using traps.
3. Present the results per group. During the discussions, mention the local names of arthropods observed and any differences between the different orchards.

Exercise 3 : The weaver ant and parasitoids of the leafminers

Objectives:To show the difference in prevalence of leafminer parasitoids between orchards with ant and those without ants where a lot of pesticides are used

Materials:

- Vials
- Polythene bags
- Hand lens
- Citrus orchards (one orchard with a lot of ant and one orchard without ant and insecticide sprays)
- Petri dishes (different size)
- Insect net (2 pieces)
- Young leaves with the symptoms caused by leafminers

Procedure:

In each orchard:

1. Use insect net to capture parasitoids of leafminer (5 crossing points) - In small groups, visit two citrus orchards Note the parasitoid quantity of leafminer.
2. Each farmer observes 3 plants and 10 randomized flushes/plant. Note the % of flush infested by leafminer.
3. Each farmer observe and cut 5 infested flushes, keep these flushes in 5 petri dishes betted with humid paper. Observe during 3-5 days (every day) and note the % of leafminer attacked by parasitoids (by the presence of parasitoids or by the presence of the adult of leafminer). Note the % of leafminers parasited by parasitoids
4. Present the results per group. During the discussions, compare the difference concerning the degree of parasitoid infested flush between orchards with ant and orchards without ants where a lot of pesticides are used.

Exercise 4: Impact of insecticides on the weaver ant

Objectives: To evaluate the effect of insecticides on the survival of the weaver ant

Materials:

- A citrus orchard, preferably unsprayed
- Sweep net
- Plastic bags and small containers to collect various insects
- Small soft brush
- Tissue paper
- 4 Transparent earlen meyers
- Labels and marker, note book, pen
- 4 Small hand-sprayers ((0.5 l), shared between groups)
- Water
- Small amounts of different insecticides [incl. broad spectrum and selective, if possible a bio-pesticide (e.g. B.t.) and botanical (e.g. neem)]
- Gloves and masks

Procedure:

1. Prepare 4 hand sprayers before the practical.. Fill 1 hand sprayer with pure water (control). Prepare and fill 3 hand sprayers with commonly used insecticides, at field rate concentrations, for example: monocrotophos (organophosphate), cypermethrin (pyrethroid), *Bacillus thuringiensis* (biological insecticide) (**use gloves**). Label the hand sprayers to avoid confusion!
2. Collect : one young shoot treatment. Spray young shoot with a selected spray solution and let the leaves dry (**use gloves and masks**).
3. Transfer the dried young shoot per treatment to the transparent buckets (full of water) (one young shoot per per bucket) (**use gloves**). Label the jars. Put the buck into the deep jar (already fill with water until the top of the beaker to avoid the escape of the ants). Each group should have 3 beakers with 3 treatments in the jar
4. Put the jar under the ant and use a stick tape on the nest, ant will fall down on the young shoot
5. Check and record the condition of the insects hourly for 4 hours, after 8 hours and after 24 hours. Count the number of dead insects. It may be necessary to touch the insect with a pen or pencil to determine if it is dead. If it does not walk off in a normal manner, then record it as dead.

Guiding questions for group discussion:

1. What happened to the ant in the different jars? Why?
2. Did you observe any differences in the behaviour of the ants?
3. What happens in the field when a farmer sprays against a certain pest?

Exercise 5: The risk of insecticide drift on farmers' health

Objective

To create awareness of the direct exposure of farmers to pesticides when spraying
To demonstrate drift to non-target organisms
To initiate discussion on wastage during spraying

Materials:

- knapsack sprayers of the farmers
- Buckets, measuring can and water
- Non-toxic dye, e.g. food colorant (preferably red)
- White flip charts, paper kitchen towel, toilet paper
- Masking tape
- Citrus orchard
- A few volunteers!

Procedure:

1. Prepare 5 litres of dye solution for each sprayer
2. Wrap up the volunteers completely (apart from the eyes!) in white flip chart paper and/or paper kitchen towels or toilet paper, secured with masking tape.
3. Ask the volunteer to fill his sprayer with the dye solution and subsequently spray for 10 minutes as though using a pesticide for an agreed pest problem.
4. Ask the other participants to watch and make notes.
5. After spraying, remove the sprayer and observe how much dye is on each part of the body (none, a little, a lot).
6. Measure back the remaining amount of dye solution in each of the sprayers

Guiding questions for group discussion:

1. How much of the spray solution ended up on the operator?
2. What are the hazards that pesticide contamination might pose to the health of the people spraying?
3. What kind of protective clothing could sprayers use? (Discuss use of hats, shoes, boots, long-sleeved shirts, etc.)
4. How far did the spray drift? Under what conditions would the drift be greater? Under what conditions would it be less?

Exercise 6: Reduce harm from ant bites by scattering ashes on branchers near nest

Objective: to show that ash can reduce the bites of weaver ant by preventing its circulation

Materials:

- kitchen ash (2 kg)
- Wooden ask (2 kg)
- One citrus orchard with the weaver ant at the harvest time

Procedure

1. Mark the position that farmer will stand for harvesting on citrus plant
2. To scatter on the branchers near the nest
3. To rub the branch near the nest with ask
4. (The same procedure for two king of ash)
5. Observe the behavior the ant befor and after using ask to prevent the circulation of the ant and compare the efficacy of two king of ash.

Exercise 7: Reduce harm from ant bites by rubbing ashes on arm and hand

Objective: to show that by rubbing ashes on arm and hand, people can reduce the bites of the weaver ant

Materials:

- Kitchen ashes (1 kg)
- Wooden ashes (1 kg)
- One citrus orchard with the weaver ant at the harvest time
- Two groups pf farmer (2 -3 farmer per group)

Procedure

1. Put the hand (without ashes) on the way that ant circulate
2. Rub carefully the ashes on the arm and hand before putting the hand and arm on the way that ant circulate
3. (The same procedure for two king of ash)
4. Observe the behavior the ant ant the bites of ant in two situation (a and b) and discussion the efficacy of using ashes to reduce the bites of the weaver ant

Exercise 8: Reduce harm from ant bites by rubbing oils on arm and hand

Objective: to show that by rubbing oil on arm and hand, people can reduce the bites of the weaver ant

Materials:

- Vegetative kitchen oil (100 cc)
- Petroleum oil (100 cc)
- Citronella oil
- One citrus orchard with weaver ants
- Two groups of farmer (2 -3 farmer per group)

Procedure:

The same as the test 5

Exercise 9: Reduce harm from ant bites by spraying water on trees

Objective: to show that application of water spraying on trees before harvest can reduce bites of the weaver ant during harvest

Materials:

- Water pump (strong pressure)
- 4 citrus orchards (with the weaver ants)

Procedure:

1. In 2 citrus orchards, use pump to spray water on the canopy of 5 plants
2. In other two citrus orchards, select 5 plant (with ant), but don't spray.
3. In each orchard, before water spray and 4 hours after spray, observe on water spray plant and non water spray plant (10 plant in total):
 - a- Behavior of the weaver ant
 - b- The number of ant
 - c- The difference of ant number on plant already sprayed with water and those don't have water sprays.
4. Group discussion

Exercise 10: Removing ant nests before the harvest

Objective: to show that by removing ant-nest before harvesting, people can avoid the bites of the weaver ant

Materials:

- Citrus orchard with ant nest in harvest time
- 2 scissors
- % big plastic bags

Procedure

1. Select on place in the orchard where there are nests, count (average) the number of ant on the phant with nest and the plants nearby (count in 3-5 minutes)
2. To remove the nest outside the orchard: Put the opent plastic bage under the nest (on tree), cut the nests, the nests will fall down into the bage, cloe the bag(with nest), and bring the bag outside the orchard
3. One day after removing the nests,count (average) the number of ant on the phant with nest and the plants nearby (count in 3-5 minutes)
4. Discuss in group

Exercise 11: Reducing ant circulation before harvest

Objective : To show that by removing the means of ant circulation before harvesting, people can avoid the bites of the weaver ant

Materiels

- 2 citrus orchards with ant in harvest time (orchard A and orchard A)
- two groups of farmers

Procedure:

1. In orchard A, remove all means of circulation of the weaver ant on tree (cut the contacted part of plant between different plants, remove all the bamboo sticks or string to make contact different plant for the circulation of the ant...) out off the harvest place
2. In the orchard B, nothing to remove
3. One day after, discusion the difference concerning the bites during the harvest between two orcharchs

Exercise 12: The predatory role of the weaver ant

Objective: To show the capacity of the weaver ant in attacking different insect and arthropods of the weaver ant

Materials:

- Different insects (caterpillar, locust, ...)
- One citrus orchard with the weaver ant

Procedure:

1. Put the prey near the nest
2. Put the prey on the circled way of the weaver ant
3. Observe the behavior of the ant in attacking the prey and discuss the efficacy of the weaver ant in reducing pest in the citrus orchard (why and how)

Exercise 13: Competition and fighting between different colonies of weaver ant and between weaver ant and smelly ant *Dolichodoris thoracicus*

Objective

To show the necessity of removing the smelly ant and the old weaver ant colony before to introduce the new weaver ant in the citrus orchard

Materials:

- Two orchards (A) having the smelly ants (don't have weaver ants)
- Two orchards (B) having the weaver ant (don't have smelly ants)
- Nests of the weaver ant

Procedure:

1. In orchard A, select one plant with a lot of smelly ant, introduce the nest of weaver on this plant
2. In orchard B, select one plant that already has weaver ant, introduce the nest (from other orchard) on this plant
3. Observe:
 - a. The antagonism between the weaver ant and the smelly ant (fighting)
 - b. The antagonism between the weaver ant (old one) and the newly introduced one (fighting)
 - c. The capacity of the new weaver ant to establish in the orchard
4. Discussion

Exercise 14: The weaver ant society

Objective: Observe different ant casts present in the nests

Materials:

- Two ant rearing citrus orchards
- Plastic bags
- Scissors
- Kitchen ashes
- Group of farmers (2-3 persons)

Procedure:

1. Note the number of nests in the orchard all year round (every 3 months)
2. Open the nests, note the presence and number of different castes (queen, male, small worker and big worker) inside the nests. Open 10 nest in each orchard

Guiding questions for group discussion:

1. Fluctuation of the number of ant nests during the year
2. Density of ants at the different time of the year (+, ++, +++)
3. Different castes of ant present in the nest at different time of the year
4. What time of the year can people find a lot of queens and males in the nests?

Exercise 15: Symbiose between weaver ants and honeydew producing insects

Objective: to prove that the weaver ant even like the honey dew produced by scale, mealy bugs and aphids but they don't cause the outbreak of these honey dew producing insects

Materials:

- Citrus orchards (1 with weaver ant and 1 without weaver ant)
- Sugar
- Group of farmers (2-3 persons)

Procedure:

1. Monitoring (as exercise 1) the citrus orchard and record the presence and degree of damage cause by scale, mealy bugs and aphids (on leaves, fruits and branches...) (during the year, every 3 months)
2. Put a few of sugar (dissolve in small water) in a bowl or on a leave nearby the nest. Observe the behavior of the weaver ant.
3. Discussion

Exercise 16: How to feed weaver ants

Objective: to show that weaver ants need a lot of protein to survive during the dry season or the time when the food may be scarce.

Materials:

- Citrus orchard with nests
- Chicken

Procedure

1. Put the chicken on the branche near ant-nests
2. Observe the behavior of ant one hour after putting the food
3. Discussion

Exercise 17: Spatial and temporal distribution of ant nests in orchards

Objective: to know the spatial and temporal distribution of ant-nest in the orchards

Materials:

- Citrus orchard with nests
- Some food for feeding the ant (every three months)
- Flip charts
- Colour pens

Procedure:

1. Observe the number and the distribution of the nest in the orchard all year round (every 3 months).
2. To record the results, draw a large picture of the citrus orchard with the distribution of plant in the correct way and the position of nests on plants. Present the results per group (every 3 months)
3. During the discussions (every 3 months) establish any differences between the different orchards and at different times of the year. Arrive at a consensus as to what time of the year there a lot of new nests and the way that the ants distribute nests in the citrus orchards.