

5.3 Natural Pesticides

Introduction

As explained in chapter 5.1, strengthening the plant is the best protection against pests and disease. Through adapted cultivation methods and with good management of the ecosystem (beneficial organisms), infestations can be prevented or reduced. In some cases, however, preventive measures are not sufficient and the damage by a pest or a disease may reach a level of considerable economic loss. That is when direct control measures with natural pesticides may become appropriate. Contrary to conventional farming practises, where it has become a widely held view that pesticides are the best and fastest means to reduce pest damage, organic farmers know that preventive methods are superior and that only if prevention is not sufficient, natural pesticides should be applied.

Lessons to be learnt

- What are botanical pesticides?
- How to prepare a botanical pesticide?
- Other natural pesticides

5.3.1 Botanical Pesticides

Some plants contain components that are toxic to insects. When extracted from the plants and applied on infested crops, these components are called botanical pesticides or botanicals. The use of plant extracts to control pests is not new. Rotenone (*Derris sp.*), nicotine (tobacco), and pyrethrins (*Chrysanthemum sp.*) have been used widely both in small-scale subsistence farming as well as in commercial agriculture. Most botanical pesticides are contact, respiratory, or stomach poisons. Therefore, they are not very selective, but target a broad range of insects. This means that even beneficial organisms can be affected. Yet the toxicity of botanical pesticides is usually not very high and their negative effects on beneficial organisms can be significantly reduced by selective application. Furthermore, botanical pesticides are generally highly bio-degradable, so that they become inactive within hours or a few days. This reduces again the negative impact on beneficial organisms and they are relatively environmentally safe.

B However, despite being «natural» and widely used in agricultural systems, some botanicals may be dangerous for humans and they can be very toxic to natural enemies. Nicotine for example, derived from the tobacco plant, is one of the most toxic organic poisons for humans and other warm-blooded animals! Before a new botanical pesticide is applied in a large scale, its effect on the ecosystem should be tested in a small field experiment. Do not just use botanical pesticides as a default option! First understand the ecosystem and how botanicals influence it!

Experience sharing: Plants for pest and disease control

Which locally available plants can be used to prepare a botanical pesticide? In many traditional farming communities, there is a broad knowledge on botanical preparations. You can also invite an experienced farmer or other expert in this field to handle the topic. To share and document the knowledge, write down the contributions in a table: Ask the participants to name plants they know with toxic effects on insects or fungi. List the name in the first column. Let them explain, which parts of the plant they use (Part used) and which pest or disease it acts against (Disease/Pest). Ask them how they prepare the plant before using it as a pesticide (Preparation) and whether or not big quantities of the material are needed (Effectiveness). Find out whether the botanical pesticide also has an effect on natural enemies and other non-targets, such as humans etc. (Specificity). Discuss other control/prevention methods for the pest/disease targeted.

Plant	Part used	Preparation	Effectiveness	Specificity	Disease/Pest
Chrysan-head	Flower head	Powdered to dust	++	Low	Insect pests

Illustration: Example for a set up of a table to collect the information.

5.3.2 Preparation and Use of Botanical Pesticides

The preparation and use of botanicals requires some know-how, but not much material and infrastructures. It's a common practice under many traditional agricultural systems.

Some commonly used botanicals are:

- Neem
- Pyrethrum
- Rotenon
- Quassia
- Chillipepper
- Mexican Marigold
- Garlic
- Ginger

Neem

Neem, derived from the neem tree (*Azadiracta indica*) of arid tropical regions, contains several insecticidal compounds. The main active ingredient is azadiractin, which both deters and kills many species of caterpillars, thrips and whitefly.

Both seeds and leaves can be used to prepare the neem solution. Neem seeds contain a higher amount of neem oil, but leaves are available all year.

A neem solution loses its effectiveness within about 8 hours after preparation, and when exposed to direct sunlight. It is most effective to apply neem in the evening, directly after preparation, under humid conditions or when the plants and insects are damp.

High neem concentrations can cause burning of plant leaves! Also, natural enemies can be affected by neem applications! This can be checked in insect zoos (see section 5.2).

There exist different recipes for the preparation of a neem solution. Find one in the box below and one on the transparency.

Neem seed kernel extract: the recipe

In Ghana, Africa, neem seed kernel extract was tested on cabbage in Farmer trainings and had a very good repelling effect on diamondback moth (*Plutella xylostella*). Here is their recipe:

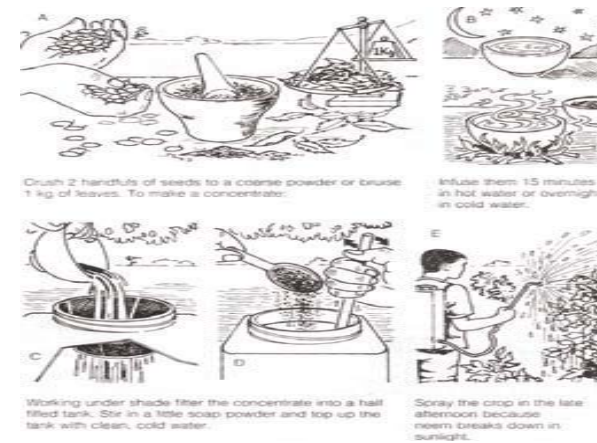
Pound 30 g neem kernels (that is the seed of which the seed coat has been removed) and mix it in 1 litre of water. Leave that overnight. The next morning, filter the solution through a fine cloth and use it immediately for spraying. It should not be further diluted.

Pyrethrum

Pyrethrum is a daisy-like Chrysanthemum. In the tropics, pyrethrum is grown in mountain areas because it needs cool temperatures to develop its flowers. Pyrethrins are insecticidal chemicals extracted from the dried pyrethrum flower. The flower heads are processed into a powder to make a dust. This dust can be used directly or infused into water to make a spray.

Pyrethrins cause immediate paralysis to most insects. Low doses do not kill but have a «knock down» effect. Stronger doses kill. Pyrethrins are not poisonous for humans and warm-blooded animals. However, human allergic reactions are common. It can cause rash, and breathing the dust can cause headaches and sickness.

Preparation of a Neem solution



Transparency 5.3.2.a: Preparation of a Neem solution

Pyrethrins break down very quickly in sunlight so they should be stored in darkness. Both highly alkaline and highly acid conditions speed up degradation so pyrethrins should not be mixed with lime or soap solutions. Liquid formulations are stable in storage but powders may lose up to 20 percent of their effectiveness in one year.

Attention: Pyrethroids are synthetic insecticides based on pyrethrins, but more toxic and longer lasting. They are not allowed in organic farming! They are marketed under various trade names, for example «Ambush» or «Decis». Some pyrethroids are extremely toxic to natural enemies! Pyrethroids are toxic to honey bees and fish. Sunlight does not break them down and they stick to leaf surfaces for weeks killing any insect that touches the leaves. This makes them less specific in action and more harmful to the environment than pyrethrin. In addition they irritate human skin. B

Chacals Baobab

Farmers in Eastern Senegal are involved in cotton production. Some years ago, some of them turned to organic farming. To fight cotton pests, they use a natural insecticide based on chacals baobab (*Adenium obesum*, French: baobab du chacal). It has been used basically against Cotton ballworm (*Heliothis sp.*), but also against the spiny ballworm (*Earias sp.*) and Sudan ballworm (*Diparopsis watersii*). Chacals baobab is one of the most toxic plants in Africa.

This preparation is efficient for fighting the larvae of the pests mentioned above.

Be very careful in manipulating this liquid; it is as toxic as latex. Avoid any eye contact. However, no negative effects have been observed as long as the concentration indicated above is respected.

Chacals Baobab as insecticide: a traditional recipe from Senegal



Adenium obesum

Preparation method:

- Cut small branches into pencil bits that are 10 to 15 cm long
- Put them into small groups of 7 bits
- Put 3 groups of 7 bits in a jar or any other container which is not metallic (The impair number is important according to local belief).
- Let them soak in 2 litres of water for 3 days.
- Add 8 litres of water and spray the solution on the plants

5.3.3 Other Natural Pesticides

Besides extractions of plants, there are some other natural pesticides, which are allowed in organic farming. Although some of these products have limited selectivity and are not fully biodegradable, there are situations, when their use is justified. However, in most cases, the desired effect is best reached in combination with preventive crop protection methods.

Below, some examples:

Disease control:

- Sulphur: against fungal disease
- Copper: against fungal disease (gets accumulated in the soil and harms soil organisms!)
- Sulphuric acidic argillaceous earth: against fungal disease
- Ashes: against soil-borne disease
- Slaked lime: against soil-borne diseases
- Clay: against fungal diseases
- Baking soda: against fungal diseases

Pest control:

- Soft soap solutions: against aphids and other sucking insects
- Light mineral oil: against various insect pests (harms natural enemies!)
- Sulphur: against spider mites (harms natural enemies!)
- Plant ashes: against ants, leaf miners, stem borers etc.

Recommended Readings

- «*Natural Crop protection in the tropics*», Gabriela Stoll, Agrecol, 2000.
- «*The Neem Tree*», HDRA.
- «*Neem in the Community*», DFID.
- «*Natural Pesticides*», HDRA.