A HANDBOOK ON

BIOLOGICAL CONTROL

NATIONAL AGRICULTURAL RESEARCH ORGANIZATION

1994

A HANDBOOK ON BIOLOGICAL CONTROL

Introduction

Biological control is the use of living organisms to control pests and weeds. It is therefore a form of population management. The organisms controlled are noxious in that they consume useful plants or plant products, attack livestock, interfere with man's pleasure or affect man's health. In nature, lions feed on zebras or antelopes and yet both the eater and the eaten seldom decline in number. Clearly, a form of biological control exists in nature to reduce competition because if the population of the zebras and antelopes were to explode, there would be scarcity of grass. Biological control therefore is nature's secret of check and balance of population growth of living things.

The Basis of Biological Control

Most weeds or insect pests that appear suddenly originate from other countries. These being their native home, they normally have natural enemies that evolve with them and help to keep those plants or insects to a very low population level. Once such a plant or insect, free from competition with its native neighbours and without its native natural enemies, appears in virgin land, the population density increases very rapidly. Such an insect or weed is referred to as EXOTIC. Examples of exotic weeds are *Lantana camara* and water hyacinth while exotic insect pests in Uganda include, the cassava mealybug and cassava green mite.

Advantages and Disadvantages of Biological Control

Advantages

- It is the cheapest method of pest control
- It is environmentally safe
- Few if any, develop resistance to biocontrol agents
- It is a good tool for the poor since no sophisticated technology is required for its application.
- Once established, there may be no need to constantly reintroduce the agent

Disadvantages

- Biocontrol agents act slowly
- Biocontrol is not applicable in control of storage pests
- Biocontrol cannot be used in abrupt pest invasion e.g the locust which requires quick knock down.
- Inconclusive research may lead to introduction of an agent which may become a pest of non target crops.

Biological control aims at reducing a pest or weed to an insignificant level. Complete eradication of a pest or weed is ambitious and seldom achieved. Besides, any natural enemy that eliminates its host completely will itself perish.

It is cheaper and more environmentally friendly than chemical control, more efficient than mechanical control and faster than breeding for resistance.

Biocontrol Activities

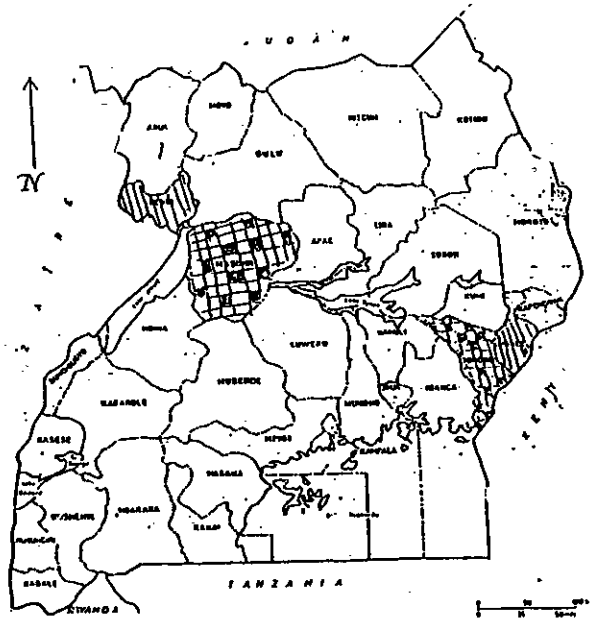
The table below shows pests and the natural enemies used for their control:

Commodity	Pest/Weed	Natural Enemies in Use
Cassava	Cassava mealybug (*Phenacoccus manihoti*)	Wasp (*Epidinocarsis lopezi*)
	Cassava green mite (*Mononychellus tanajoa*)	Phytoseiids (*local and exotic predatory mites*)
	Water hyacinth (*Eicchorniae crassipes*)	Beetles (*Neochetina bruchi and Neochetina eicchorniae*)
Conifers	Cypress aphids	Predatory beetles

Control of the Cassava Mealybug, *Phenaccocus manihoti*

The cassava mealybug, *Phenaccocus manihoti* is an exotic pest which was first observed in Congo. It has spread to all the cassava growing belt of Africa. It was first observed in Uganda in Busia near the Kenya border in 1992. This causes stunted growth and results in very poor yield. It can cause up to 80% crop loss.

The pest in adult stage is pinkish but covered with white waxy coating. This coating is protective and explains why spraying with contact insecticide would not control the mealybug. The youngest stage (first instar) commonly called crawlers is a very active stage. Because of its size, it can be transported with cutting materials thus aiding spread. This early stage can also be blown by wind to new areas to cause an outbreak. Presently the cassava mealybug has been reported in certain areas of Uganda (see Map 1).

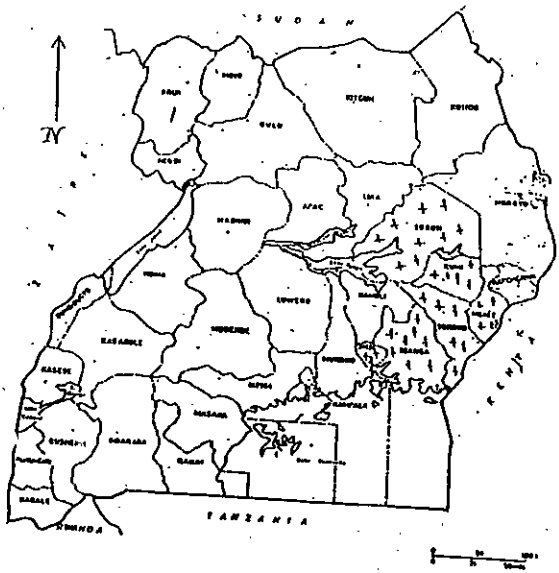


Map 1. Map of Uganda showing Districts invaded by the Cassava mealybug (October, 1992) and areas where natural enemies have been released

There are a number of natural enemies of the cassava mealybug, some are locally available in Uganda. The International Institute of Tropical Agriculture (IITA) has carried extensive research on the natural enemy of the cassava mealybug, a wasp, (*Epidinocarsis lopezi*) and two beetles *Hypersaspis notata* and Diomus sp have been found to be most effective. The wasp lays eggs in adult mealybug and as the young wasps develop, the mealybug is killed. The beetles feed on the live mealybugs. The wasps and beetles when released in an infested area exert a lot of pressure which results in the control of the mealybug. This is a very effective and cheap method of control though it does not act fast. These beneficial insects are reared and distributed free in areas of outbreak of cassava mealybug.

Control of the Cassava Green Mite, *Mononychellus tamajoa*

The cassava green mite is another exotic pest in Africa. It was first noticed in Uganda in 1971. Infestation now occurs in all cassava growing areas of Uganda (Map 2). The mite is a close relative of the spider and feeds by sucking sap from young plants leaving yellow dots on the leaves giving symptoms similar to that caused by the African cassava mosaic virus disease. It can reduce yield by up to 60%.



Map 2. Map of Uganda showing Districts where Phytoseiid mites have been released to control CGM

nap 2

The green mite is small and mainly found on the underside of cassava leaves. It is particularly serious in dry season and poor soils. Rain washes most of the mite and gives the cassava plant enough moisture thus promoting vigorous growth. Clearly, maintenance such as mulching may help in promoting plant health which indirectly helps in controlling the green mite.

Cassava green mite is controlled by use of predatory mites. These are specialized types of mites that feed on the green mite. The predatory mites were identified by the International Institute of Tropical Agriculture. When released in infested areas, the predatory mites multiply and spread naturally.

Control of the Water Hyacinth,

Water hyacinth is a water weed that originated from the Amazon Basin in South America. The weed has spread to most countries of the world. In Uganda, it was first seen in Lake Kyoga about ten years ago. It now covers most lakes and rivers of the country. It is a free floating weed which can grow to a height of 45 cm above water surface. It has attractive bluish flowers, oval thick leaves with long petioles and a mass of hairy-fibrous roots. The weed grows very fast and in Uganda, because of the favourable equatorial climate, it is estimated that if not checked, an area of water as big as Lake Kyoga may get blocked in 15-30 years.

The weed is a problem for the following reasons:

- Water hyacinth in dense mats can block water bodies thus prevents water transport and fishing.
- Floating mats of water hyacinth is an ideal place for breeding of vectors of malaria and bilharzia.
- It can interfere with hydro-electric power generation.
- It deprives oxygen supply to fish, thereby resulting in their death.

There are two types of weevils that feed on and can control the weed. These weevils, *Neochetina bruchi* and *Neochetina eichhorniae* feed, breed and live exclusively on water hyacinth.

Recently, the National Biological Control Programme carried host specificity tests on bananas, rice, onions, egg plants and irish potato and results confirm that the weevils cannot survive nor breed on these plants.

Besides, the weevils do not eradicate water hyacinth rather it reduces the abundance of weed to a level where it is no longer a problem. There is therefore no possibility of the weevil running out of food and turning on non target plants.

The disadvantage of using the weevils is that it is extremely slow acting. The weevils are reared at Namulonge and have already been released in Lake Kyoga.

Control of the Cypress (Conifer) Aphids

The aphids feed and cause the infested trees to dry. It is a very destructive pest which is spreading rapidly in Uganda. There are three species of conifer aphids, *Cinara cupressi*,

Eulachnus releyi and *Pineus sp*. These pests which originated from Europe and/or North America have spread rapidly throughout the East Africa region causing extensive damage to conifer trees. Cinara cupressi is the most serious of the three aphids whose attack has left hundreds of acreages of cypress trees in the region brown and dry.

It is estimated that $10,000,000 worth of tree is lost per year in the region. The International Institute of Biological Control (IIBC) is spearheading research to evaluate natural enemies of the aphids. IIBC, Forestry Research Institute and National Biological Control Programme are collaborating in research on the control of cypress aphids in Uganda.

It is likely that the control will be through the use of predatory beetles.

Printed by:
Agricultural Communication Centre, Entebbe