

# Biopesticides Portal – an online tool that facilitates the identification, sourcing and application of biological control products

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Member Countries Regional Consultation: Americas and Caribbean  
12-14 September 2018, Ottawa, Canada

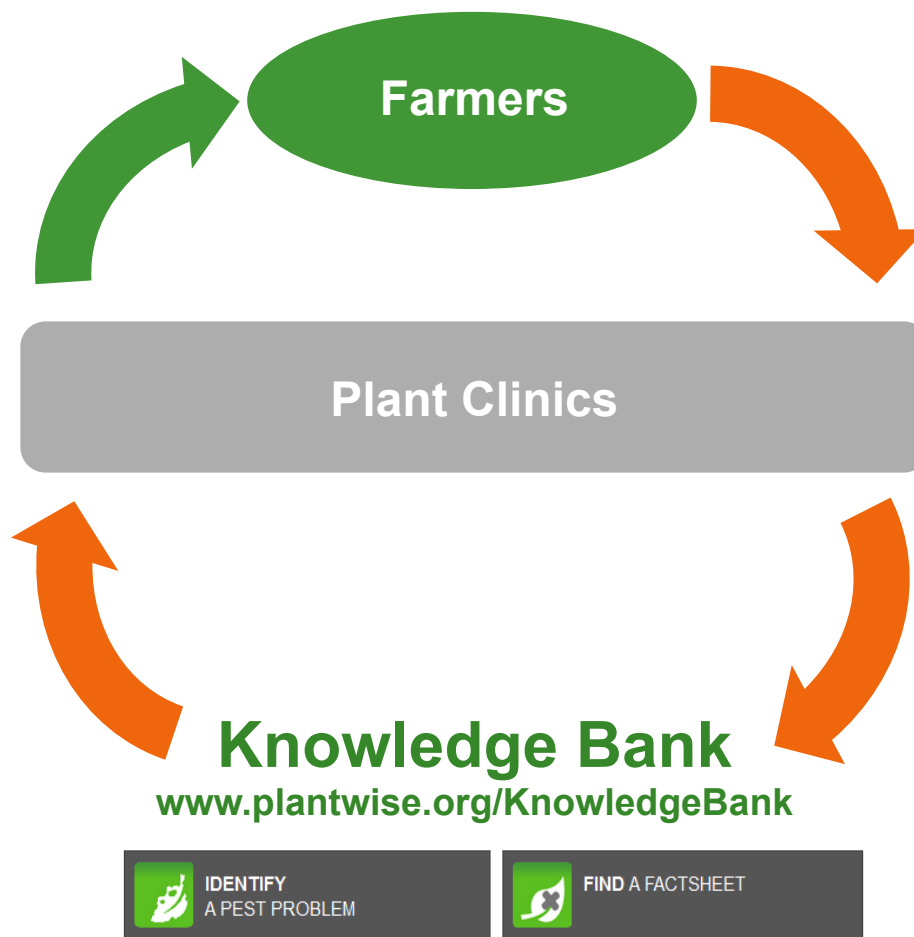
# Plantwise – CABI's flagship programme

*Plant clinics are channels for the 2-way flow of information to and from farmers*

Diagnosis and recommendation



Extension materials and other support tools



Farmer interviews and data collection



Intelligence on pests causing problems

# Reference materials for plant doctors



FACTSHEETS FOR FARMERS

Created in Tanzania, October 2014

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## Sprays against *Tuta* tomato leaf miner

**Recognize the problem**

Tomato leaf miner is a devastating pest of tomatoes. It is also known as *Tuta absoluta*. Tomato moth, or kidomoni wa nyanya in Kiswahili. Tomato leaf miner adults are small silver-grey moths with black spots on their inner wings. They are about ½ cm long and have wings of about 1 cm if spread. They hide under leaves in the daytime. Young larvae in the tunnels are creamy-greenish with a dark head but later turn pinkish-green. They are tiny and feed in tunnels (galleries) through young leaves and into young fruits. The larvae destroy leaves and fruits. Note that single ½ cm holes on upper part of tomato fruits are caused by bollworms not by *Tuta*.

**Background**

The life cycle of *Tuta* only takes about 1 month so they can multiply 10 to 12 times per year. The moth lays more than 200 eggs from which the damaging larvae hatch. The larvae must be controlled because they are so destructive. Foliar sprays of biological or synthetic pesticides might help. Sprays may only help against young larvae so act when you first see symptoms. Pupation of larvae happens in the soil below the plants so pupae are hidden from treatment.

**Management**

- Spray early in the morning when the larvae of leaf miners are not active and are still on the leaves
- Preferably, use biopesticides like the microbial sprays of *Bacillus thuringiensis* var. *kurstaki* over synthetic pesticides like Imidacloprid because they are less dangerous to you and to tomato consumers
  - There are several products based on *Bacillus thuringiensis* such as Bt WP, Ascopel WP and others. They are also called Bt products. Follow instructions on the product label for dosages.
  - If needed, spray twice per season but with at least 1 week interval between sprays. Do not enter the field for a day after spraying.
  - Do not spray the day before a harvest
- If you still experience infestation, then use products with the active ingredient Imidacloprid such as Hotshot 70WG and Inax 700WDG
  - They are often mixed at 10ml product per 20 litres water sprayed per acre but double-check with product labels, because products have different concentrations and formulations
  - Spray only once per season
  - Do not spray later than 3 days before harvest, and do not enter the field for 1 day after spraying, as the product is toxic
- Regardless of bio or synthetic pesticide, you must wear gloves, mask, goggles, overcoat, gumboots during mixing, spraying and cleaning

When using a pesticide, always wear protective clothing and follow the instructions on the product label, such as dosage, timing of application, and pre-harvest interval.

Scientific name(s) > *Tuta absoluta*

The recommendations in this factsheet are relevant to: Tanzania

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**Tunneling of Tuta larva.** (Photo by Virginia Tech ODA, via Flickr)

**Damage by Tuta larvae.** (Photo by Shahr Al-Zaid)

PEST MANAGEMENT DECISION GUIDE: GREEN AND YELLOW LIST

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### *Tuta absoluta* (tomato leaf miner) on Tomato

*Tuta absoluta*

Prevention	Monitoring	Direct Control	Direct Control	Restrictions
<ul style="list-style-type: none"> <li>• Rotate with non-host crops such as maize, beans and cabbages</li> <li>• Remove and destroy wild host plants around the farm such as Sodom apple</li> <li>• Remove from the farm and burn all infected crop residues</li> <li>• Plant clean seedlings free from all stages of the moth</li> <li>• Clean all equipment used in transportation of tomatoes such as boxes, crates and trucks using soap and water</li> </ul>	<ul style="list-style-type: none"> <li>• Look for: for insect pest damage on leaves, stems and fruits</li> <li>• Look out for burnt leaves with irregular mines that have black deposits (frass)</li> <li>• Look out for black frass on the stem and holes on the fruit surface leading to tunnels in the fruit</li> <li>• Scout for moths in the field/greenhouse walls.</li> <li>• Start control once you notice 1-3 moths or larvae per week</li> </ul>	<ul style="list-style-type: none"> <li>• Remove infested leaves</li> <li>• Mass trap using water traps with pheromones e.g (Pheroids at 4 packets per acre supplied by Koppert Biological Systems Kenya, Tutack found at Kenya Biologics)</li> <li>• Burying deep (50-100 cm) of infested fruits and foliage</li> <li>• Use black sticky traps (at 24 pcs/acre supplied by Koppert Biological Systems) placed at 15:00 cm above the ground to catch the adults</li> <li>• Use screen vents in roofs and on the sides of the greenhouse to reduce insect pest migration</li> </ul>	<ul style="list-style-type: none"> <li>• The pest is still new in the country and trials on pesticides are still ongoing</li> <li>• Drench with imidacloprid at the recommended rates</li> <li>• Neonicotinoid, IRAC 4A</li> <li>• Systemic insecticide with translaminar activity and with contact and stomach action</li> </ul>	<ul style="list-style-type: none"> <li>• Not classified by WHO. PH 7 days</li> <li>• WHO class II (Moderately hazardous), PH 3 days. MRL 0.2</li> </ul>

Kenya  
CREATED/UPDATED: August 2014  
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EDITED BY: Plantwise

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# Recent Plantwise study to assess the contribution of the extension service to the uptake of biological control

- Baseline study in six low- to lower-middle-income countries analysing extension material developed within the Plantwise programme and advice given by extension workers relating to the **management of insect pests using microbial and macrobial biocontrol products** (over a one year time period, 1 July 2015 – 30 June 2016)
- We focussed on the following research questions, among others:
  - Do nationally registered biocontrol products make it into the extension material available to the plant doctors?
  - Where extension material does include biocontrol products, how frequently are plant doctors recommending these products to farmers?

# What did we learn from this baseline study?

- Results revealed that nationally registered biocontrol products are not always included in the extension material compiled by national experts in the Plantwise programme; India and Nepal are better in this respect
- Even if biocontrol products are mentioned in the extension material used at the plant clinics, they are only sometimes (or never – in Ghana and Zambia) recommended to farmers by extension workers
- Extension officers have a lack of knowledge / awareness about biocontrol products and their use



- Dougoud, J., Cock, M. J., Edgington, S., & Kuhlmann, U. (2018). A baseline study using Plantwise information to assess the contribution of extension services to the uptake of augmentative biological control in selected low- to lower-middle-income countries. *BioControl*, 63(1), 117-132.



# Why is the uptake of biocontrol products rather limited in the study countries?

## **Knowledge**

Extension officers have a lack of knowledge / awareness about biocontrol products and their use

## **Registration**

Some registration pathways make the registration of biocontrol products lengthy and complicated

## **Availability / local production**

Agro-input suppliers in rural areas often do not have biocontrol products available; local production is rather limited although major efforts are being made in Kenya and India

## **Affordability**

Price of biocontrol products is sometimes high and only affordable for business-oriented farmers. One exception is India (support of local production and subsidy schemes)



# How can Plantwise/CABI facilitate improved uptake of biological control products by extension and farmers?

- Create a database to **facilitate the identification, sourcing and application of macrobial and microbial products** for particular crop pest problems in a given country
- Develop a **free to use mobile app and/or website** for use on smartphones, tablets and desktop computers to put information about biological control products at the fingertips of farmers and extension workers, both within and outside of the Plantwise programme

# Your one-stop information shop for identifying and sourcing biopesticides

Kenya ▼

Crop\*

Pest

Manufacturer ▼

Search ►





Kenya

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The following **3** products were found  
Select a product to see more information or modify above:

Filter by:

Active ingredient

Manufacturer

User rating

4th filter option



**Bb-Plus**

Active ingredient: *Beauveria bassiana*  
ManufacturerX



**Mycotal**

Active ingredient: : *Lecanicillium muscarium*  
ManufacturerY



**Neemazal**

Active ingredient: *Azadirachtin*  
ManufacturerZ



Description

Related documents (3)

Customer Reviews (346)

Product Q&A (125)

## Mycotal



[Go to store](#)

[Back to product list](#)

Active ingredient	<i>Lecanicillium muscarium</i>
Manufacturer	<a href="#">Koppert</a>
Crops	French beans, maize, roses
Target pests	Thrips, Aphids
Mode of action	Stomach poison
Application info	Apply every 7 days
PPE requirements	Gloves, face shield (icons)
Precautions	Do not apply if crop is in flower
Approved for use in	EU Organic

Rate this product: ☆☆☆☆☆

Comment on this product:



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**MYCOTAL**  
KOPPERT 10101

**CONTAINS**  
1 x 100 ml (3.37 fl. oz.) Lactariaform macromer Ve-6  
Water (Deionized Grade) (DW)

**IMPORTANT INFORMATION**  
FOR USE ONLY AS A MICROBIOLOGICAL INSECTICIDE

**USE:** Professional  
For control of adult fly on protected crops of tomato, cucumber, pepper and chili, ornamental plant production, seedling, ornamental trees, broad beans, French beans, lettuce, squash, aubergine, melon, cucumber and courgette. Qualified recommendation for Mass Use for the moderate control of glasshouse whitefly in protected strawberry.

Maximum individual dose: 2 kg product per hectare  
Maximum number of applications: 8 per crop

- Other specific restrictions:**
1. Maximum concentration must not exceed 1 g product per litre of water.
  2. A minimum interval of 7 days must be observed between applications.
  3. Treatment must only be made under "permanent protection" situations which provide full enclosure (including continuous top and side barriers down to below ground level) and which are present and have been maintained over a number of years.
  4. Reasonable precautions must be taken to prevent access of birds, wild mammals and honey bees to treated crops.
  5. To maintain safe for environmental organisms, weeds, rivers and other openings must be closed during and after application until the applied product has fully settled.

**READ ALL OTHER SAFETY PRECAUTIONS AND INSTRUCTIONS FOR USE BEFORE USE**

**BATCH NO**

see top

**USE BY**

see top

**NET CONTENT**

100 g

**PRODUCT NUMBER**

10101

**STORAGE**  
Keep/Store opened at 2-8°C. Do not keep in domestic refrigerators. Do not freeze.

**EXTENSION OF AUTHORITY:** Protected crops of Edamware, black current, blueberry, strawberry, gooseberry, raspberry, blackberry, cherry, apple, pear, plum, apricot, cherry, raspberry, raspberry, blackberry and blueberry.  
This extension of the authorized use provides for the use of Mycotal® in open air crops and situations other than those indicated on the product label (above). Further the efficacy (or the phytoxicity) of the product for which this extension of authorization has been granted has been determined, as such, the user bears the risk involved of adverse reactions to efficacy and phytotoxicity.

**SAFETY PRECAUTIONS**  
Contains Lactariaform macromer Ve-6: Micro-organisms may have the potential for genetic modification.

**OPERATOR PROTECTION**  
WASH HANDS AND EXPOSED SKIN before meals and after work.  
**DO NOT BE NEAR DUST**  
WEAR SUITABLE PROTECTIVE CLOTHING (OVERALLS), SUITABLE PROTECTIVE GLOVES AND SUITABLE RESPIRATORY PROTECTIVE EQUIPMENT when handling the product or applying the product.  
\*Disposable filtering facepiece respirator to at least EN949 FFP or equivalent.

**ENVIRONMENTAL PROTECTION**  
Do not contaminate water with the product or its container. Do not drain application equipment near surface water. Avoid contamination via drains from farmyards and roads.

**STORAGE AND DISPOSAL**  
KEEP OUT OF THE REACH OF CHILDREN  
KEEP IN ORIGINAL CONTAINER tightly closed, in a safe place. DO NOT REUSE OR BURN. WASH UNDER RUNNING WATER. EMPTY CONTAINER COMPLETELY and dispose of safely.

To avoid risks to man and environment, comply with the instructions for use.  
MYCOTAL® is a registered trademark of Koppert BV.

**DIRECTIONS FOR USE**

**IMPORTANT:** This information is approved as part of the Product Label. All instructions within this section must be read carefully in order to obtain safe and successful use of the product.

Mycotal® contains the spores of a specific strain of the entomopathogenic fungus Lactariaform macromer which is highly active to whitefly. The use of the adjacent Adabi (Approved Adjuvant Ve-6, Adabi) is recommended with Mycotal®.

**MODE OF ACTION**  
Mycotal® is effective by direct contact, and under the right environmental conditions, kills glasshouse whitefly after 7-10 days. Applications should target larvae and pupae, as there is no activity against eggs. Repeat applications can be made at intervals of 10-14 days. To avoid more larvae as they emerge, and break the population. Other options, like green glasshouse and grow, providing light that penetrates the body cavity, where they proliferate, disrupting the tissues. The fungus then grows through that inner cavity and produces spores on the outside of the cadaver, which may reach the insect to other whitefly.

**ENVIRONMENTAL CONDITIONS**  
The successful performance of Mycotal® is dependent on the suitability of the temperature, relative humidity conditions within the crop cover, and timing of application, and requires the following minimum conditions:  
Relative humidity: 70% (when used with Adabi)  
Temperature: 18°C (minimum temperature 8°C)

**APPLICATION**  
Use 1-2 g/L (1-2 Mils required amount of Mycotal®) with enough water (at 15-20°C) to fill a 500 L capacity 500-gallon tank with required amount of water. Empty spray into spray tank and agitate well. Add a concentration of 0.25% Adabi (0.25% for disinfection) to the spray solution and mix thoroughly. Apply immediately after preparation with high volume spraying equipment, to provide more water for penetration and growth of the spores as well as increasing leaf humidity. Spray during the late afternoon and early evening, allowing the spray onto the underside of the leaves and to the growing points. Good coverage is essential for the best results. Use 100 L for spray suspension for each acre of canopy height. Keep the spray liquid well agitated.



# MYCOTAL



**TIMING AND NUMBER OF APPLICATIONS**

Mycotal® must be used early in the crop when pest numbers are low. For effective control, up to 8 applications per whitefly outbreak may be made, at 7-10 day intervals, with a maximum of 8 applications per crop.

**RESISTANCE MANAGEMENT**

Resistance to Lactariaform macromer is not currently known to occur. To minimize the risk of resistance developing, it is good practice to use a range of IPM techniques as part of a planned programme. Blocks of treatments should be alternated with products and techniques with different modes of activity. No more than 4 consecutive applications of Mycotal® should be made. It is not advisable to use Mycotal® continuously to successive crops within a structure.

**COMPATIBILITY - CHEMICAL CONTROL AGENTS**

The effects of other pesticides on Mycotal® when used on the same crop, have not been fully determined. However, caution the use of chemical control agents with Mycotal® may be possible provided that products are not tank mixed with Mycotal®, and that fungicides are only used up to three days before, or more than three days after, an application of Mycotal®.

Do not use any product containing the following active ingredients in conjunction with Mycotal®: captan, chlorobutol, fenaxol, diazinon, malathion, mevinphos, permethrin, acetamethiazole or thiazin.

**COMPATIBILITY**  
Lactariaform macromer suggests that Mycotal® has negligible effects on commercially available natural enemies (predators and parasitoids) and may be used in conjunction with them with some margin of safety. Before using Mycotal® with a particular biological control agent for the first time, growers should consult Koppert UK Ltd.

When using a product on a crop for the first time, always test a small area for compatibility prior to treating the whole crop.

The EU Directive Control of Substances Hazardous to Health Regulations may apply to the use of this product at work.

**APPROVAL HOLDER AND MARKETING COMPANY**  
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2300 AB Beuslandse Roodweg  
The Netherlands  
www.koppert.com

**MANUFACTURED FOR**  
Koppert UK Ltd  
8 Fisher Road Court  
15 Yorkland Road  
Haverhill, Suffolk CB9 9PF  
UK (Great Britain)

KOPPERT BV guarantees that Mycotal® is fit for the purpose and conforms to the specifications stated on this label. KOPPERT BV gives no warranty, express or implied, including the use of any commercially available quality and/or fitness for any particular purpose covering the material, other than those which are stated on this label, and will not be liable for any direct or indirect damage which results from the use of the product or non-compliance with the directions of its label.



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## Pests

Aphids

Beetles

Butterflies and moths

- Cutworm

- Tuta absoluta

Flies

- Leatherjackets

- Sciarid flies

- Stable fly

Leaf miners

Mealybugs

Spider mites

Thrips

True bugs (capsids)

- Sycamore lace bug

Whiteflies

Diseases

Pest control

Pollination

Resilient cultivation

Seed treatment

Products

Side effects

Search

## MYCOTAL

*Lecanicillium muscarium*

(formerly *Lecanicillium lecanii*)



### Unit of packaging

*Lecanicillium muscarium* (entomopathogenic fungus)

Pack size: 500 gram bag in a box

Contains: 500 grams of wettable powder with 10E+10 spores/gram

[Material Safety Datasheet \(pdf\)](#)

### Preparation of solution

- Mix the required amount of MYCOTAL with water (15-20°C/59-68°F), stir into a slurry in a bucket, use 3-4 litres water per 500 grams of MYCOTAL
- Fill the spray tank with the required amount of water
- Empty the slurry into the spray tank and agitate well
- Add the correct amount of ADDIT to the MYCOTAL spray solution and mix thoroughly
- Spray immediately after preparation

### Target

Whitefly larvae, with significant side effect on thrips larvae and spidermite.

Rates					
MYCOTAL	rate	m <sup>2</sup> /unit	interval (days)	frequency	remark
preventive	-	-	-	-	-
curative light	0.1%	2,000	7	2-3x	-
curative heavy	0.1%	2,000	7	3-4x	-

### Application and dose

- With high volume spraying equipment
- Late afternoon or early evening

[Side effects MYCOTAL](#)

[More information?](#)

[Distribution addresses](#)

### Product against thrips

ENTOMITE-M

*Stratiolaelaps scimitus*

ENTONEM

*Steinernema feltiae*

LIMONICA

*Amblydromalus limonicus*

MACRO-MITE

*Macrocheles robustulus*

SWIRSKI-MITE

*Amblyseius swirskii*

SWIRSKI-MITE LD

*Amblyseius swirskii*

SWIRSKI-MITE PLUS

*Amblyseius swirskii*

THRIPEX

*Neoseiulus cucumeris*

THRIPEX-PLUS

*Neoseiulus cucumeris*

THRIPEX-V

*Neoseiulus cucumeris*

THRIPOR-I

*Orius insidiosus*

THRIPOR-L

*Orius laevigatus*

ULTI-MITE SWIRSKI

*Amblyseius swirskii*



# Potential users

- Farmers and extension workers
- Governmental regulators (pesticide registrars)
- Private sector decision-makers: out-grower schemes, cooperatives, organisations operating voluntary certification schemes
- Biological control manufacturers

Your one-stop  
information shop for  
identifying and  
sourcing biopesticides



Login

## In partnership with the biocontrol manufacturers

- The Biopesticides Portal concept was presented at the Annual Biocontrol Industry Meeting in Switzerland in 2017
- Concept was very well received
- Manufacturers are keen to sponsor such an information portal so that farmers and extension workers can access it for free
- This partnership would also enable users to access factsheets to facilitate correct application as well as local distributor information to facilitate sourcing of products

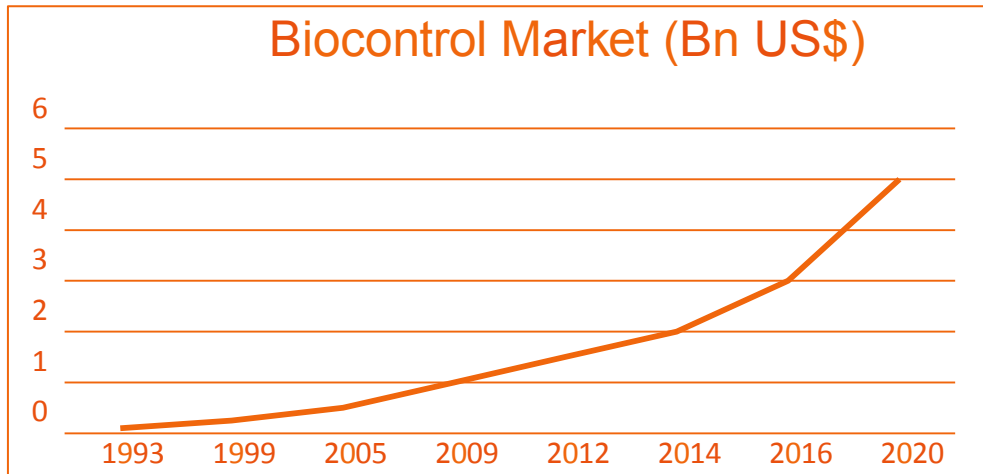
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# Market development



Source: Dunham Trimmer LLC

- Market anticipated to reach US\$ 8.8 billion by 2022 and US\$ 11 billion by 2025
- Through the improved knowledge and awareness of extension agents, the uptake of biological control products could be significantly enhanced, which in turn could contribute to an increase in the global biocontrol market







## Next steps to reach prototype launch at Annual Biocontrol Industry Meeting 2018

- Quality assurance activities
- Construction of full version of the portal with full functionality and features for 2-3 selected countries (including Kenya)
- User-testing in Kenya
- Final decision on the name of portal
- Development of sponsorship mechanism with the biocontrol manufacturers to ensure sustainability



Contact us to find out more: Ulrich Kuhlmann, Executive Director Global Operations [u.kuhlmann.cabi.org](http://u.kuhlmann.cabi.org)

CABI is an international intergovernmental organisation, and we gratefully acknowledge the core financial support from our member countries (and lead agencies) including:



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People's Republic of China



Agriculture and  
Agri-Food Canada



Ministry of Foreign Affairs of the  
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