Biological Control & Management of Invasive Species

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what is CABI?

CABI is a not-for-profit science-based development and information organization

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what does CABI do?

CABI addresses issues of global concern such as food security, through science, information and communication

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CABI

CAB International (CABI) – 50 Member Countries


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Cyprus


DPR Korea


Gambia


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Malaysia


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Solomon Islands


South Africa


Sri Lanka


St Helena


Switzerland

Tanzania

Trinidad & Tobago

Uganda

United Kingdom

Vietnam

Zambia

Zimbabwe

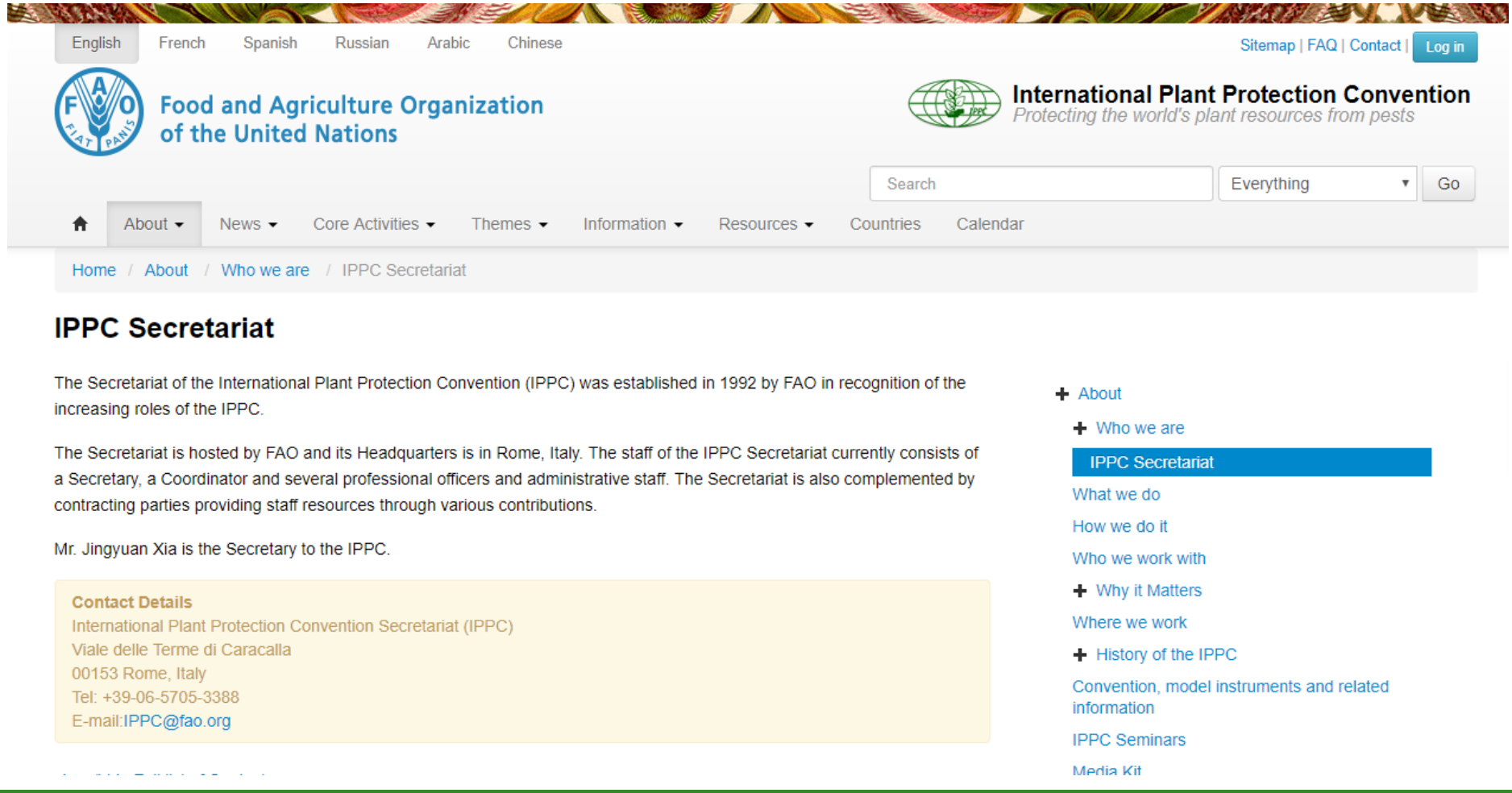
ORGANIZACIÓN INTERNACIONAL
PARA EL CONTROL BIOLÓGICO (IOBC)
SECCIÓN REGIONAL NEOTROPICAL
(NTRS)

International Organization of Biological Control

Neotropical Sub Regional Section

IOBC - NTRS

Coordinated work with Ministries of Agriculture - NPPOs - RPPOs

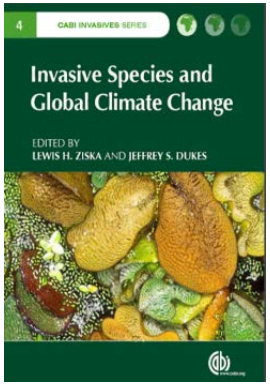


What factors affect food security worldwide?

Which one Do you think would be more significant?

Population growth

Reduction of arable land



Climate change

Latin America & Caribbean

- High Biodiversity
- Intense trade
- Movement of people and products
- New species introduced

What factors affect food security worldwide?

Invasive Species

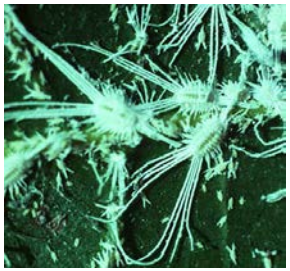
Helicoverpa armigera

Citrus leafminer

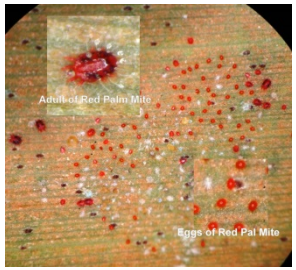
Anastrepha obliqua

Bactrocera carambolae

Rhynchoporus ferrugineus



Rastrococcus invandens

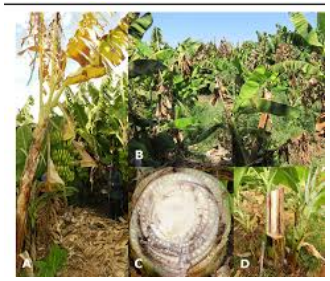


Red Palm Mite

Lethal Yellowing

Papayae mealybug

Scirtothrips dorsalis



Tropical Race 4

Sago Palm Scale

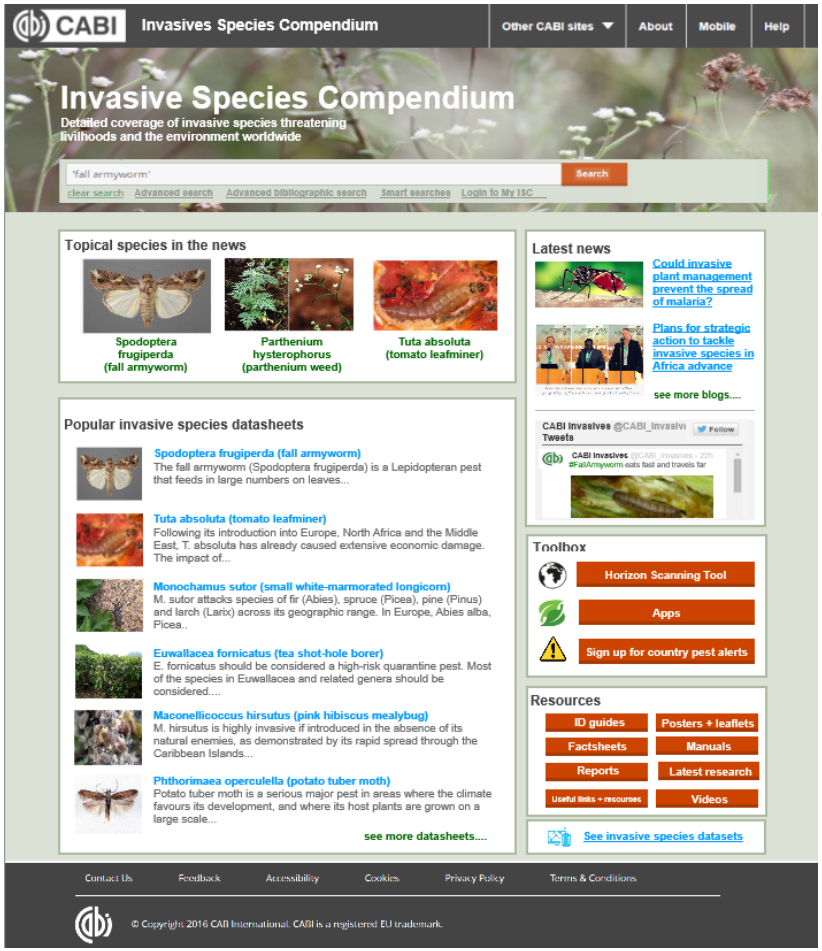
Neoleucinodes elegantalis

Drosophila Suzukii

Table: The number of species encountered reported exotic, or exotic naturalised / invasive in the Caribbean, presented by country. Exotic = known to be present in the Caribbean in cultivation, captivity or in the wild. Naturalised = known to be established in the wild in at least one Caribbean country. Invasive = established in the wild and reported to be spreading, and / or regarded as a threat to a native species, ecosystem or causing a socio-economic impact. **Kairo, et al., 2003 (CAB International).**

Country	Exotic In	Naturalized or Naturalized and Invasive In
Antigua-Barbuda	45	18
Anguilla	9	9
Aves I.	0	0
British Virgin I.	9	5
Guadeloupe	31	5
Montserrat	26	3
Netherlands Leeward I.	0	0
St. Kitts-Nevis	5	2
St. Martin	2	2
US Virgin I.	42	11
Barbados	60	30
Dominica	34	7
Grenada	37	5
Martinique	37	7
St. Lucia	37	4
St. Vincent	32	2
Haiti	63	18
Navassa	0	0
Bonaire	4	2
Curacao	41	31
Aruba	5	3
Bahamas	159	93
Bermuda	73	68
Cayman I.	7	2
Cuba	60	8
Dominican Republic	186	147
Jamaica	102	52
Puerto Rico	182	157
Turks-Caicos I.	8	6
Trinidad-Tobago	61	23

Enhanced Invasive Species Compendium



www.cabi.org/isc

Enhancements

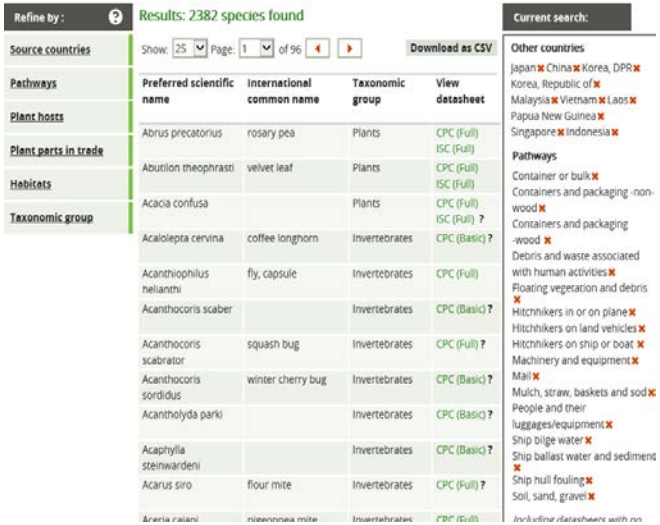
- Species “portals”
- Improved mapping
- Toolbox
  - Horizon scanning
  - Pest risk analysis (PRA)
- Resources
  - Diagnostics
  - Communication materials
  - Data
- Abstracts
- News

Horizon Scanning Tool (beta)

Prioritizing invasive species threats

The Horizon Scanning Tool is a decision support aid that helps you identify and categorize species that might enter a particular country from another country.

Using the Horizon Scanning Tool



Targeted users: risk assessors, plant protection officers, quarantine officers, protected area managers and researchers

Potential threats can be prioritized by:

- habitats
- pathways
- plant hosts
- plant parts in trade
- taxonomic group

Results output as a list with links to datasheets in the ISC and CPC. Exportable as .csv for analysis

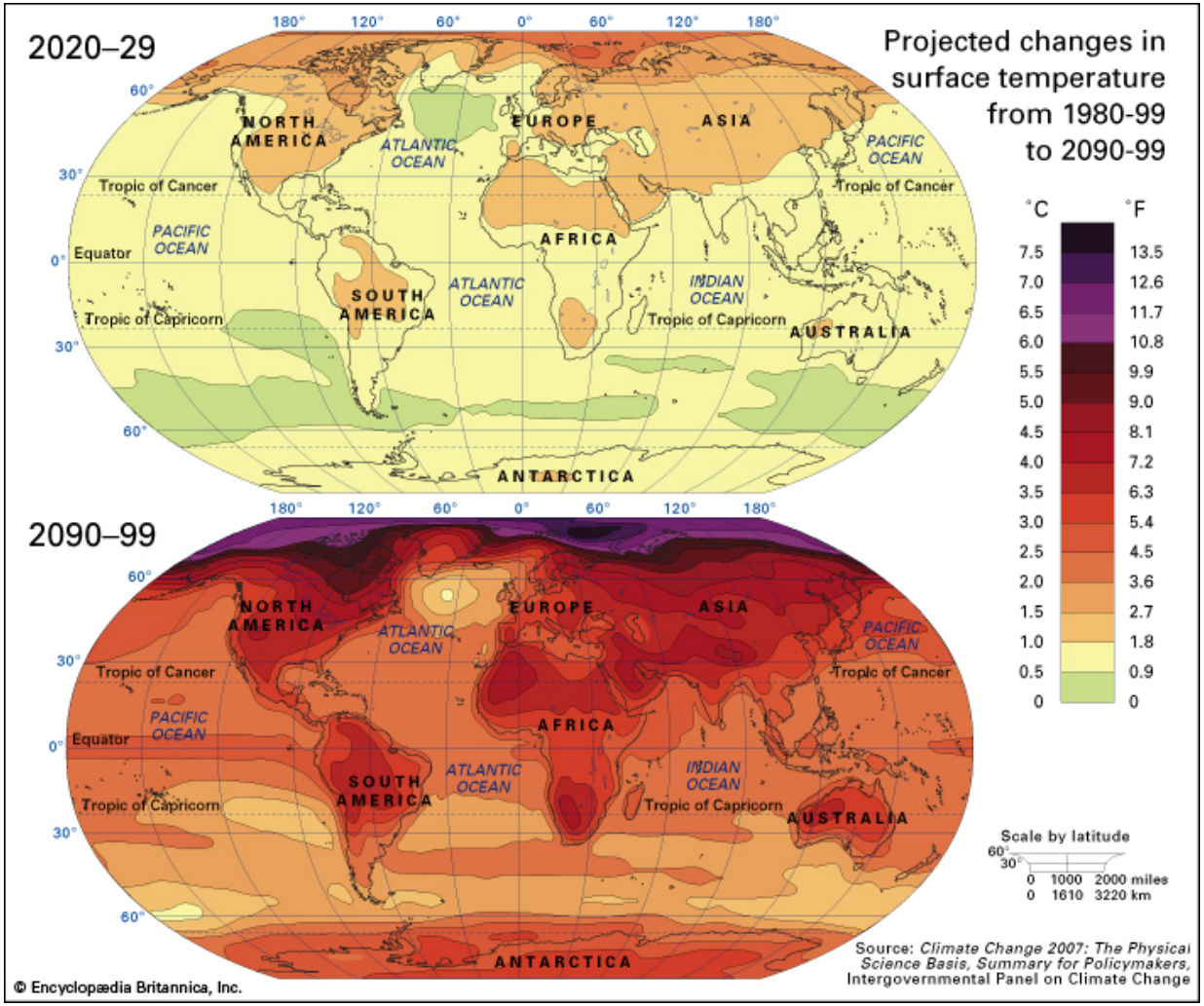
https://www.cabi.org/horizonscanningtool

Supported by USDA

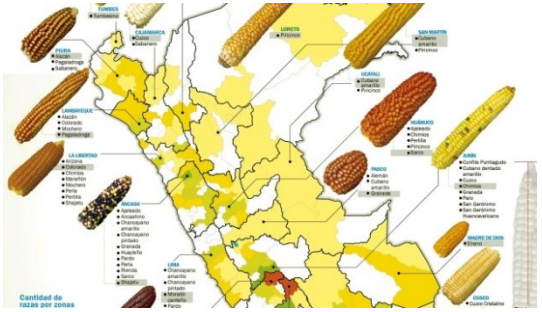
Prioritization of pests and diseases

1. **Bactrocera carambolae (Diptera: Tephritidae)**
2. **Mal de Panamá-** ***Fusarium oxysporum f. sp. cubense*** **(race 4)** en Banana –- Hongo
3. ***Prodiplosis longifila*** **(Gagne)** (Diptera: Cecidomyiidae)
4. **Banana bunchy top virus** - (BBTV) – Virus
5. **Coffee berry disease -***Colletotrichum kahawae* - Fungus
6. ***Haematobia irritans*** (Diptera: Muscidae)
7. **Zebra Chip** –Candidatus Liberibacter solanacearum – Bacteria – Transm. *Bactericera cockerelli*
8. **Lethal Yellowing** - Phytoplasma
9. **Phytophthora pod rot :** *Phytophthora megakarya* - Fungus
10. **African cassava mosaic virus** - (ACMV) - Virus
11. **Banana: Xanthomonas wilt-** *Xanthomonas campestris* pv. *Musacearum* - Bacteria
12. **European Canker of apples** - *Neonectria galligena* - Bacteria
13. **Frosty pod rot:** *Moniliophthora roreri* - Fungus
14. **Tomato ringspot vírus** - Virus
15. ***Pantoea stewartii*** **subsp.** ***stewartii*** **en Maíz** - Bacteria
16. **Vascular-streak dieback (VSD) in Cocoa:** *Oncobasidium theobromae* - Fungus
17. ***Pseudomonas savastanoi*** **pv. Phaseolicola** en frijol - Bacteria
18. **Bacteriosis Vascular del arroz -** *Xanthomonas oryzae* pv. *Oryzae* - Bacteria
19. **Swollen shoot virus (CSSV) in Cocoa:** transmitted by *Planococcoides njalensis* – Virus
20. **Plum box vírus en Durazno** - Virus
21. **Sudden oak death -** *Phytophthora ramorum* - Fungus
22. **Chancro Resinoso del Pino - Pitch canker disease in Pine** - *Fusarium circinatum* - Fungus

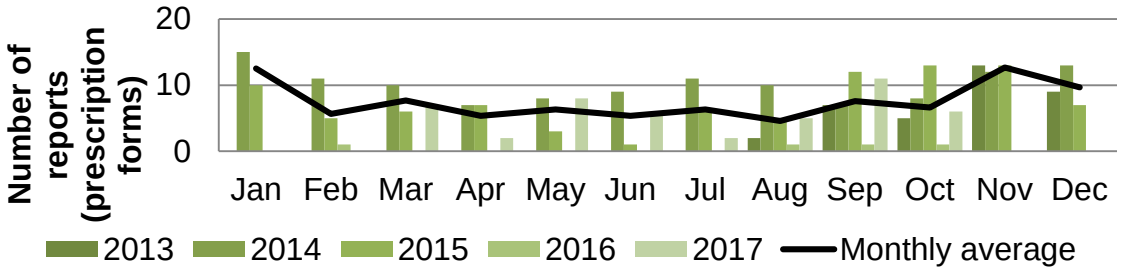
The global scenario- Climate change



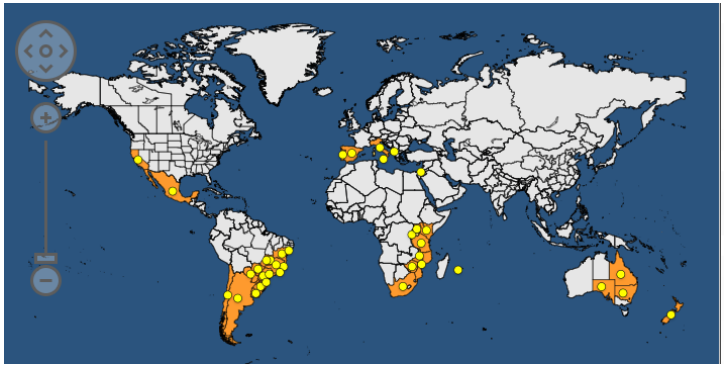
Climate change effects – Different aspects



Crop Distribution



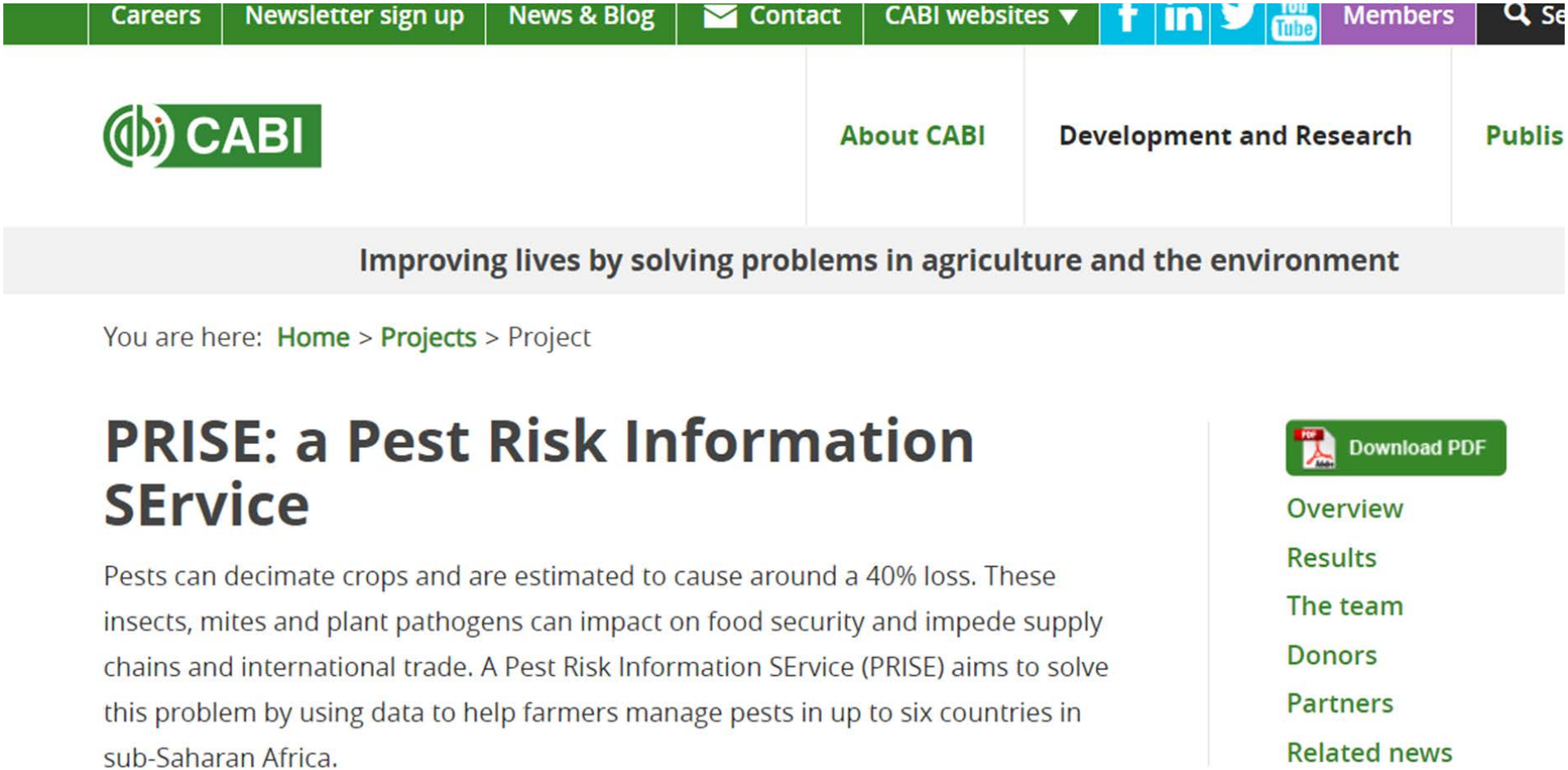
Pest incidence



Introduction new pests

Biological control agents

PRISE- Early warning systems



Modeled Potential distribution of RPM in South America using Maxel

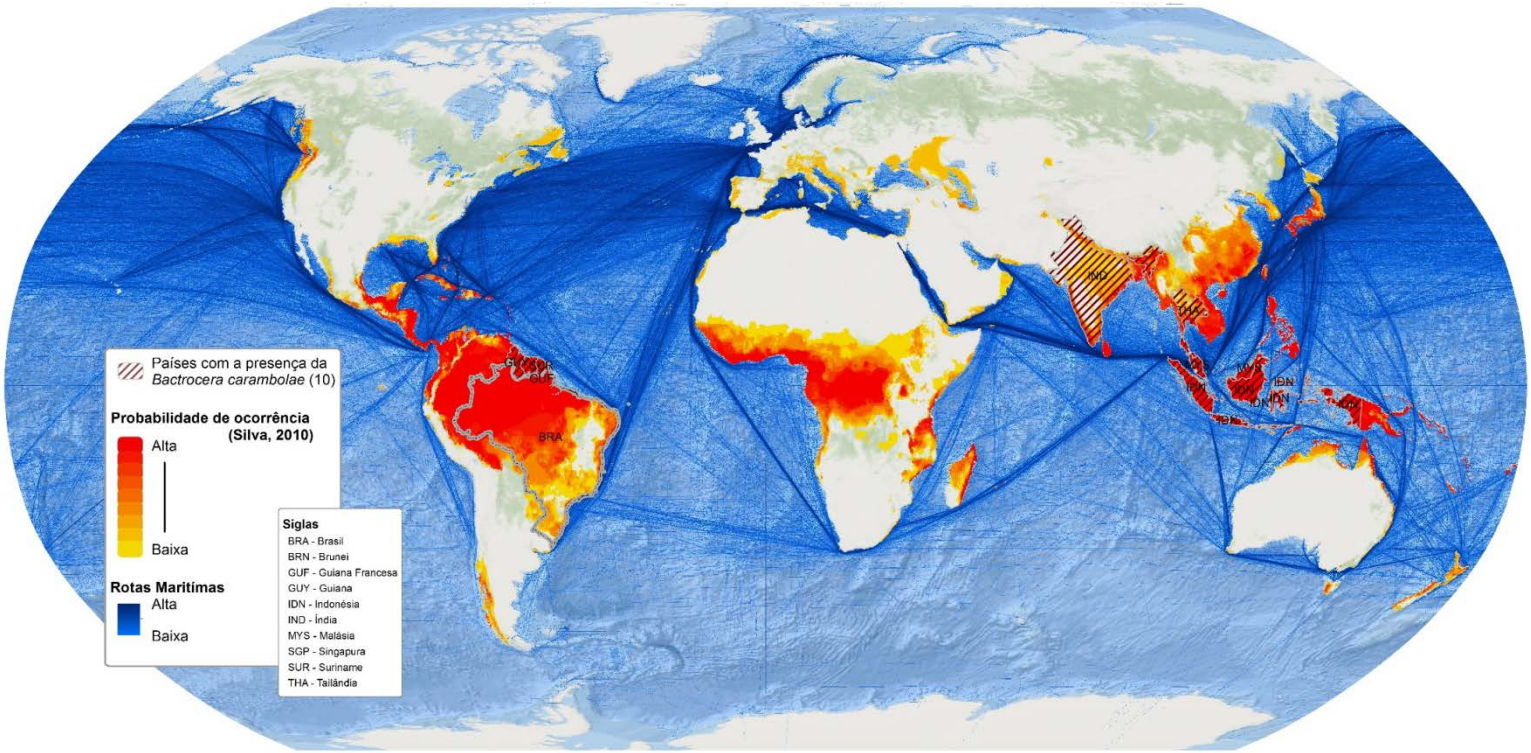
Fig. 4 Modeled potential *Raoiella indica* distribution in South America using Maxent

The potential dispersion of *R. indica* to other regions of South America could seriously impact the cultivation of coconuts, bananas, exotic and native palms and tropical flowers such as the Heliconiaceae.

Source: Amaro & de Morais, 2012

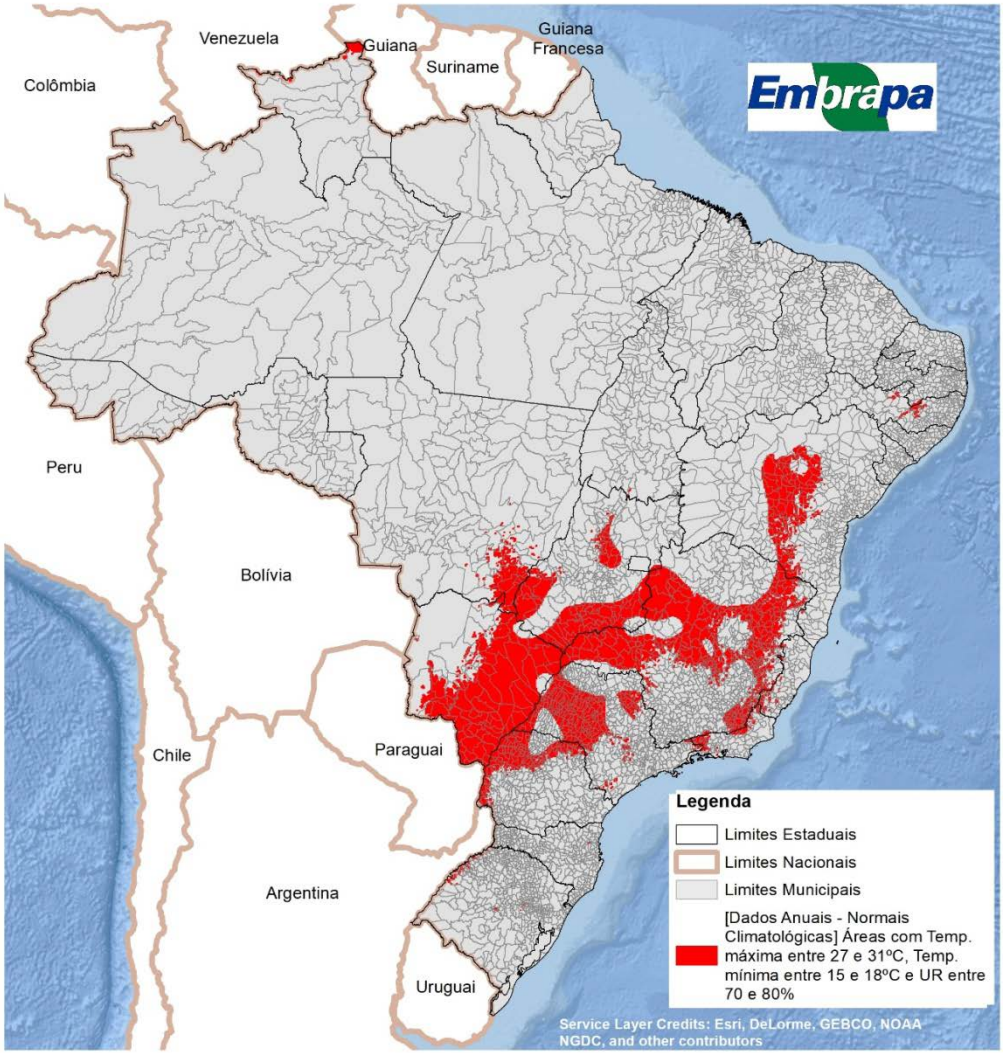
Climatic conditions and predicted climate change Vs Potential establishment areas around the world

Presence of Bactrocera carambolae and potential regions for the establishment of the specie around the world



Source: Silva (2010) and Halpern et al. (2008)
Elaborated by: Marinho-Prado et al. (no prelo). EMBRAPA Territorial

Prevention of entry and contingency actions for quarantine pest in Brazil – Influence of predicting increasing temperatures



More suitable areas for the occorence of *Thaumastocoris peregrinus*

Source: EMBRAPA Territorial, IBGE (2013); INDE (2010); INMET (2016)
Elaborated by: Pessoa et al. (2016)

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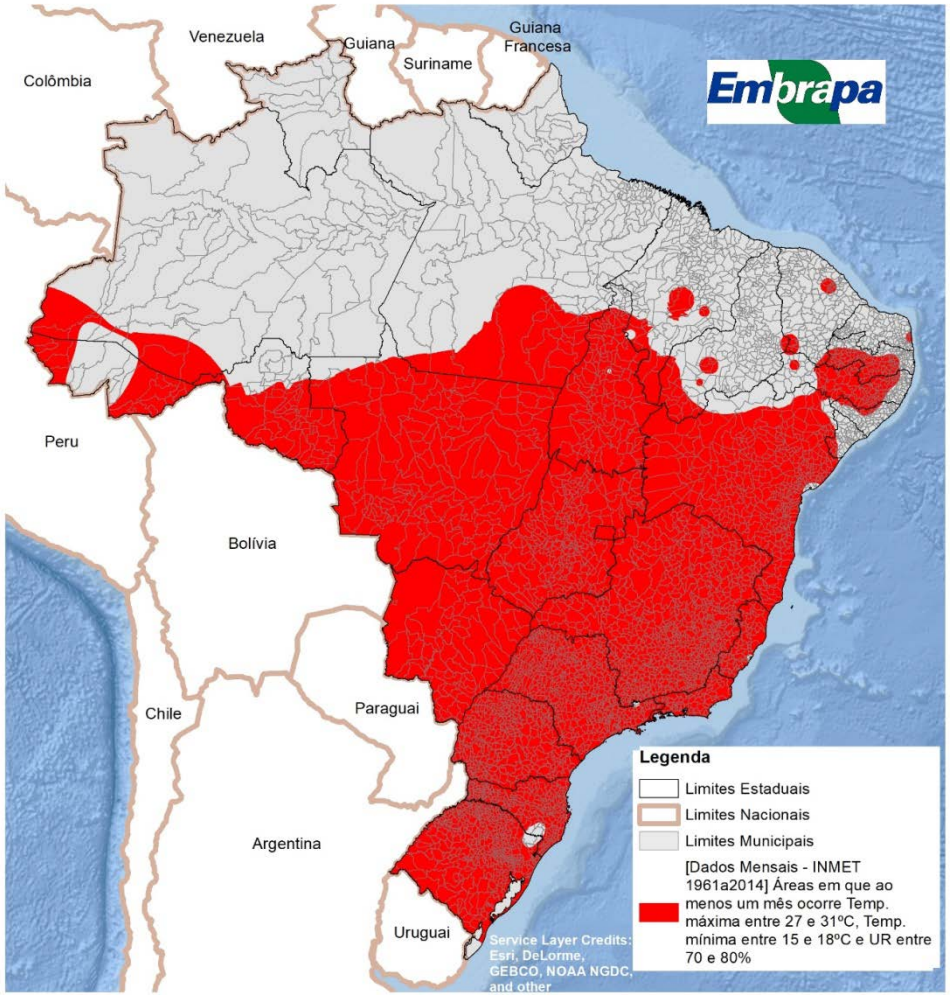


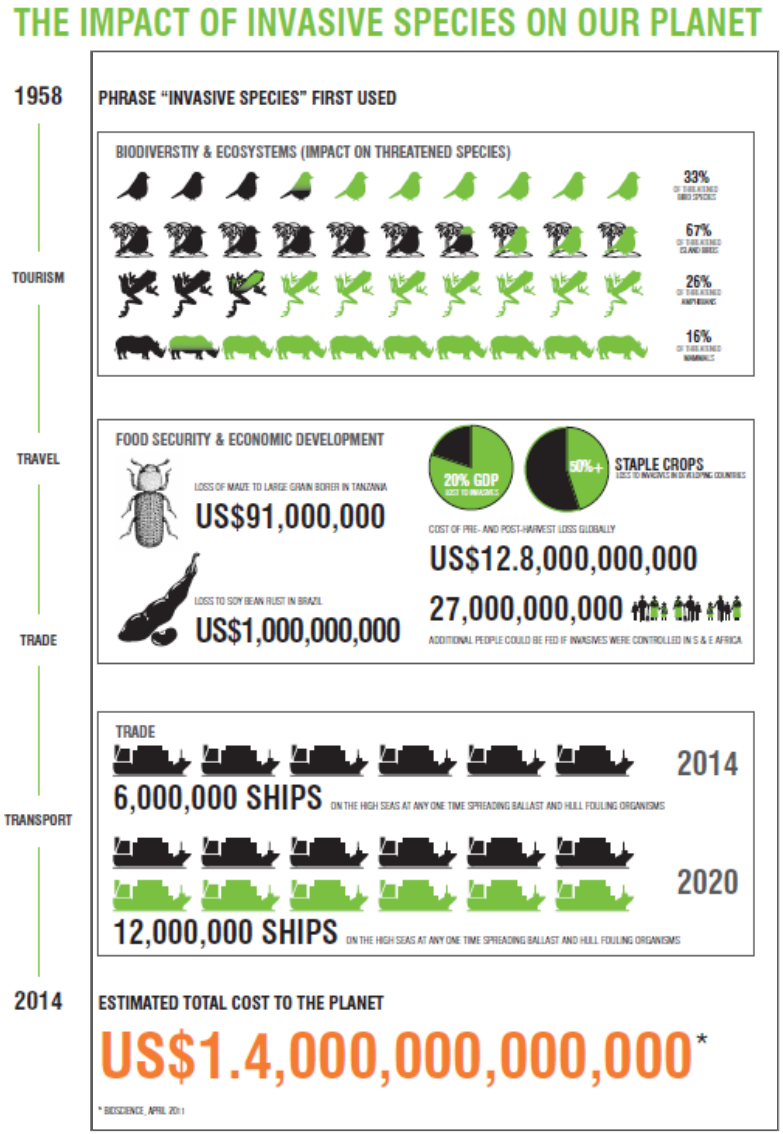
More suitable areas for the occorence of *Thaumastocoris peregrinus*

At least 1 month with Max Temperature between 27 and 31ºC

Source: EMBRAPA Territorial, IBGE (2013); INDE (2010); INMET (2016)
Elaborated by: Pessoa et al. (2016)

The costs: A global problem…

Loss to the world economy as a result of invasive non-native species is estimated at 5% of annual production



Food Security

- Invasive weeds can reduce crop yields and stock carrying capacity by 90%

Health

- Major impact on humans and animals

Gender

- Weeding is a back-breaking and time consuming task often performed by women

Trade

- 40% of EU Border Rejections due to pesticide residues

Biodiversity

- Biggest threat after habitat loss

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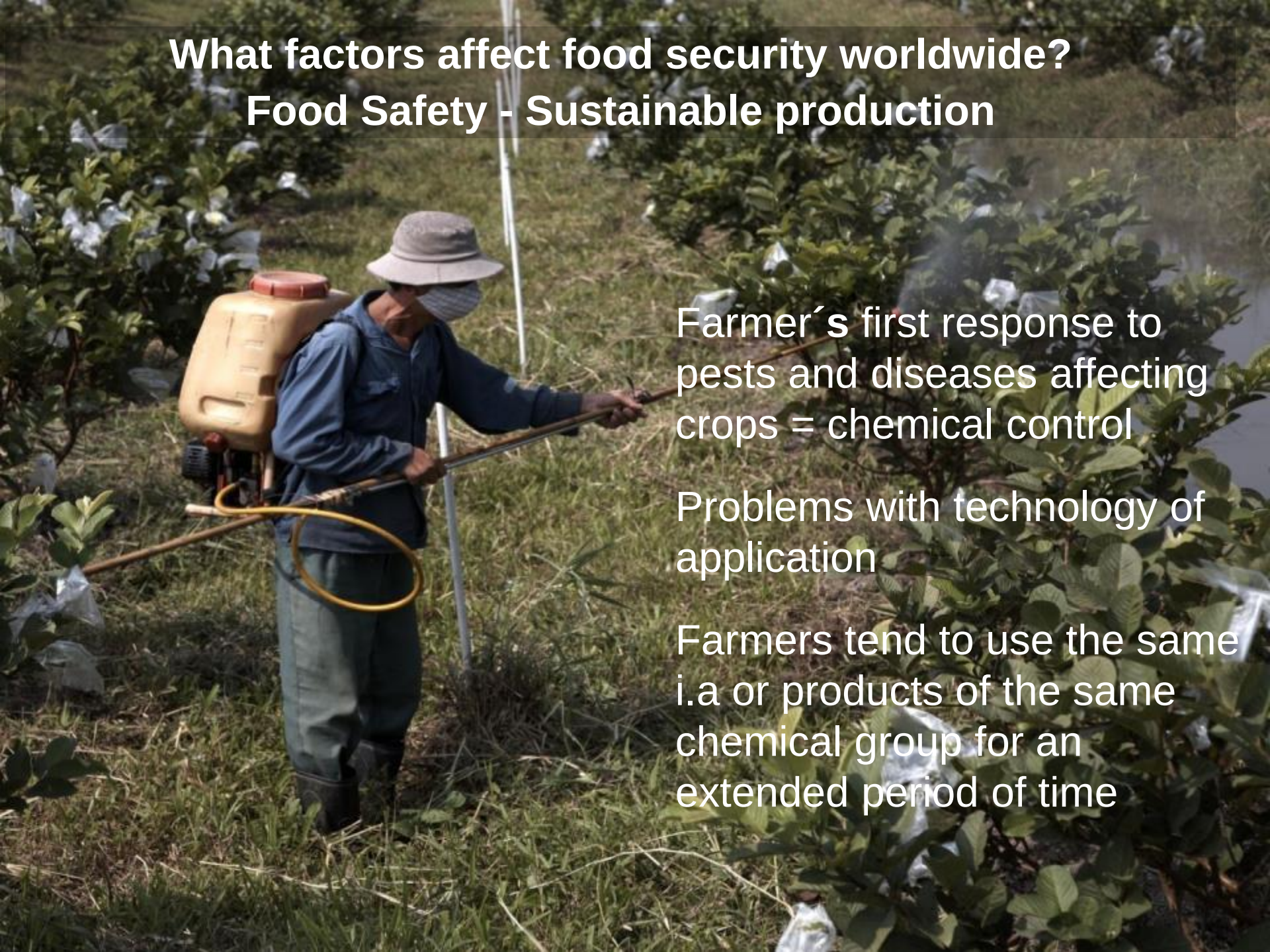
What factors affect food security worldwide?
Food Safety - Sustainable production



Farmer´**s** first response to pests and diseases affecting crops = chemical control

Problems with technology of application

Farmers tend to use the same i.a or products of the same chemical group for an extended period of time

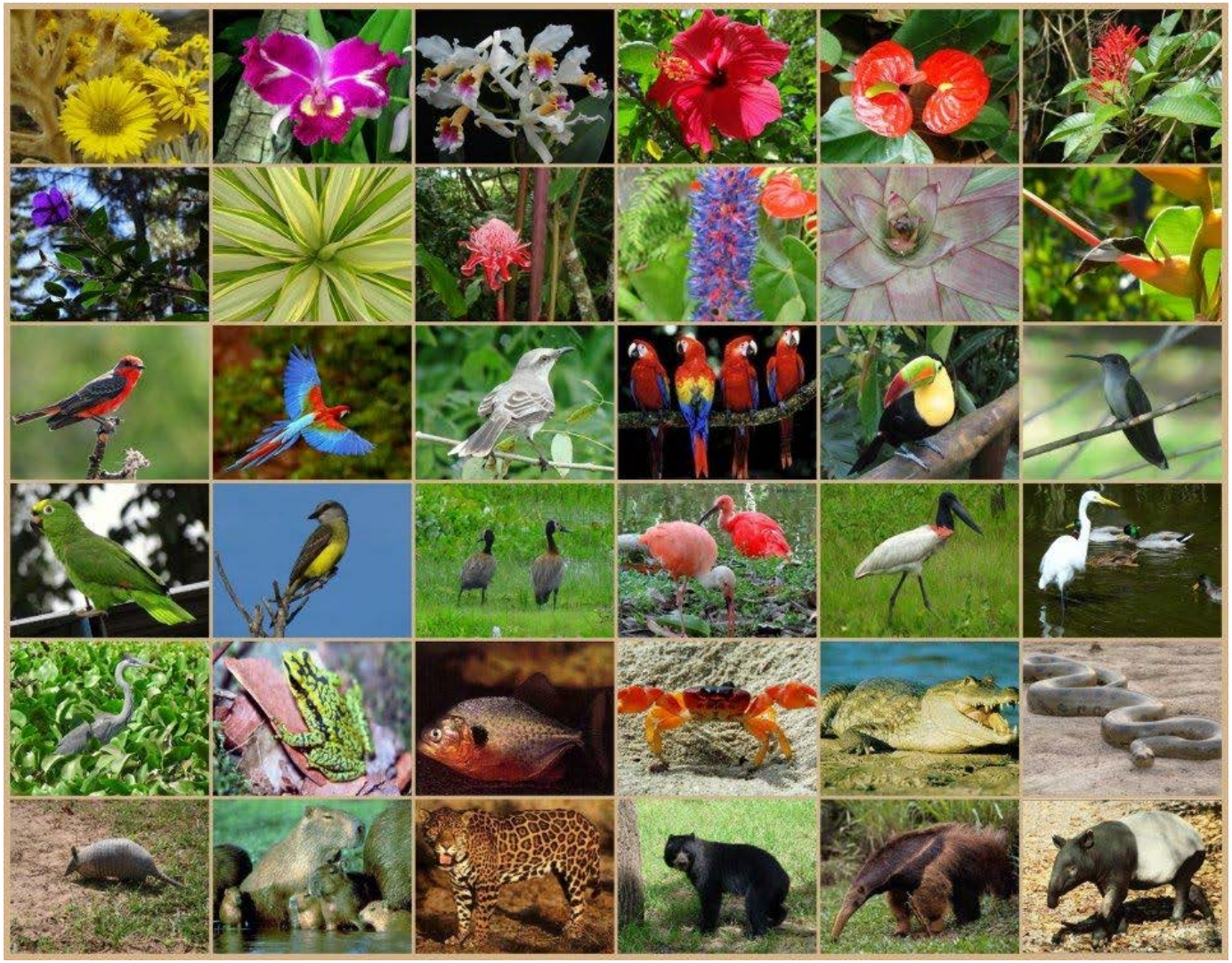
Resistant Arthropods Leading the Global List

Common Name	Species	Order	No. active ingredients
Two Spotted Spider Mite	*Tetranychus urticae*	Acari	79
Diamondback Moth	*Plutella xylostella*	Lepidoptera	76
Green Peach Aphid	*Myzus persicae*	Hemiptera	68
Colorado Potato Beetle	*Leptinotarsa decemlineata*	Coleoptera	48
Silverleaf Whitefly	*Bemisia tabaci*	Hemiptera	39
European Red Mite	*Panonychus ulmi*	Acari	38
Cotton Aphid	*Aphis gossypii*	Hemiptera	37
Cotton Bollworm	*Helicoverpa armigera*	Lepidoptera	33
Tobacco Budworm	*Heliothis virescens*	Lepidoptera	33
Egyptian Cotton Leafworm	*Spodoptera littoralis*	Lepidoptera	30

Source: Arthropod Pesticide Resistance Database – Michigan State University (2015)

Potential for the Use of Biological Control in LAC

Neotropical Region– High Biodiversity



Neotropical Region

High Biodiversity and high potential for the implementation of biological control programs

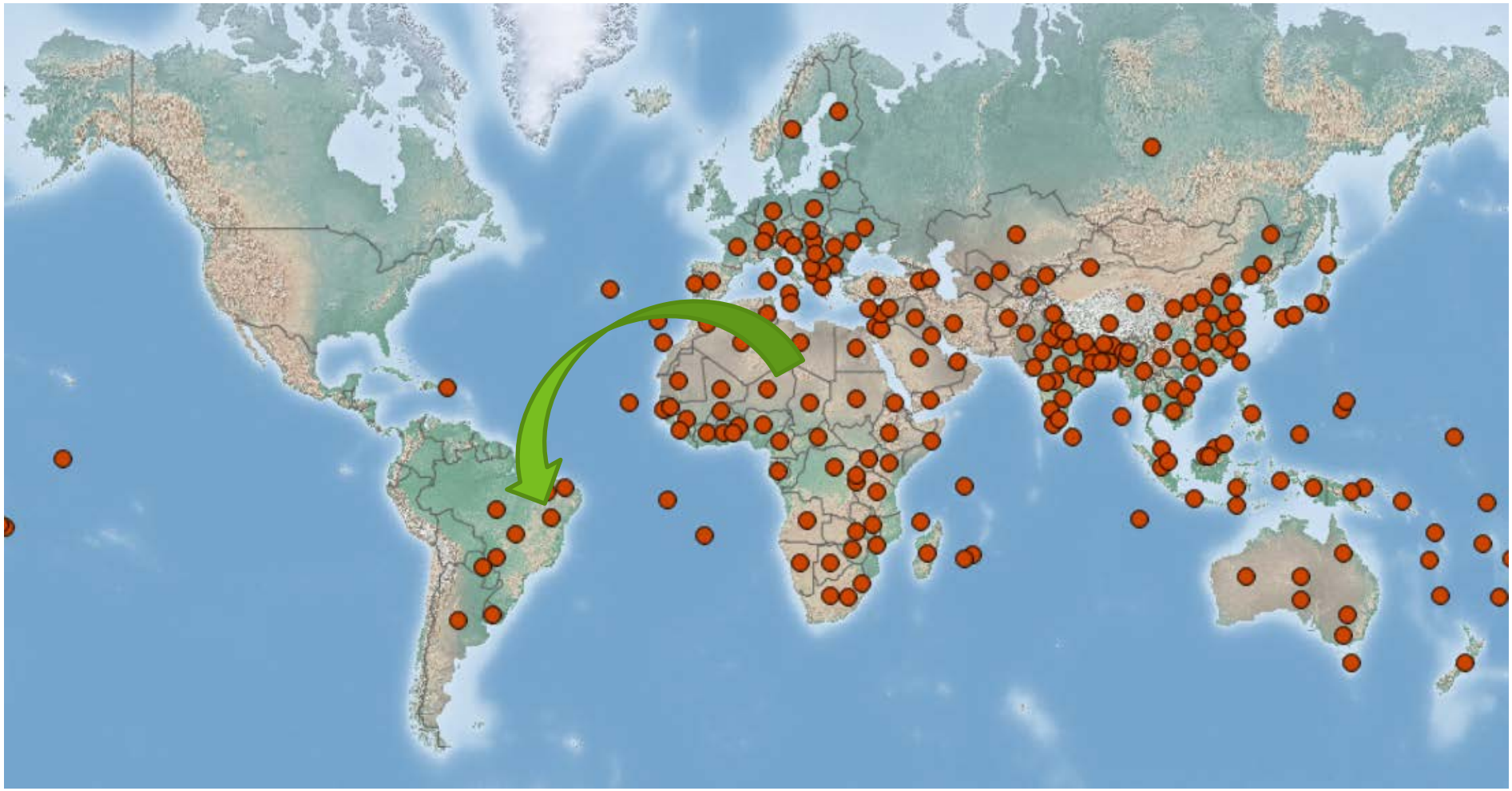





Helicoverpa armigera (Lepidoptera: Noctuidae)

- It was introduced in Brazil in 2013 - Czepak et al. (2013)
- It caused **significant economic losses** attacking key commodities in the country: Soybean, Cotton, corn, among others.
- Despite the efforts to control the pest with chemical control farmers did not get a good control, this was a favourable situation for the use of Biological Control agents.
- More than 2 billions of USD lost in Europe (Ávila et al., 2013)

Helicoverpa armigera (Lepidoptera: Noctuidae)
Distribution



CABI, 2018

Change of practices of control

Chemical vs Biological Control

https://www.grupocultivar.com.br/artigos/helicoverpa-pelo-brasil-mudanca-de-habitos

Helicoverpa pelo Brasil: mudança de hábitos

#Grandes Culturas, #Pragas

Whatsapp Tweetar Compartilhar 0 G+ Compartilhar

A agricultura brasileira é, historicamente, um dos principais alicerces da economia do País, desde os primórdios da colonização até o século 21, evoluindo dos grandes monocultivos para a diversificação da produção. A atividade agrícola faz parte do setor primário, onde se cultiva e se colhe para subsistência, exportação ou comércio.

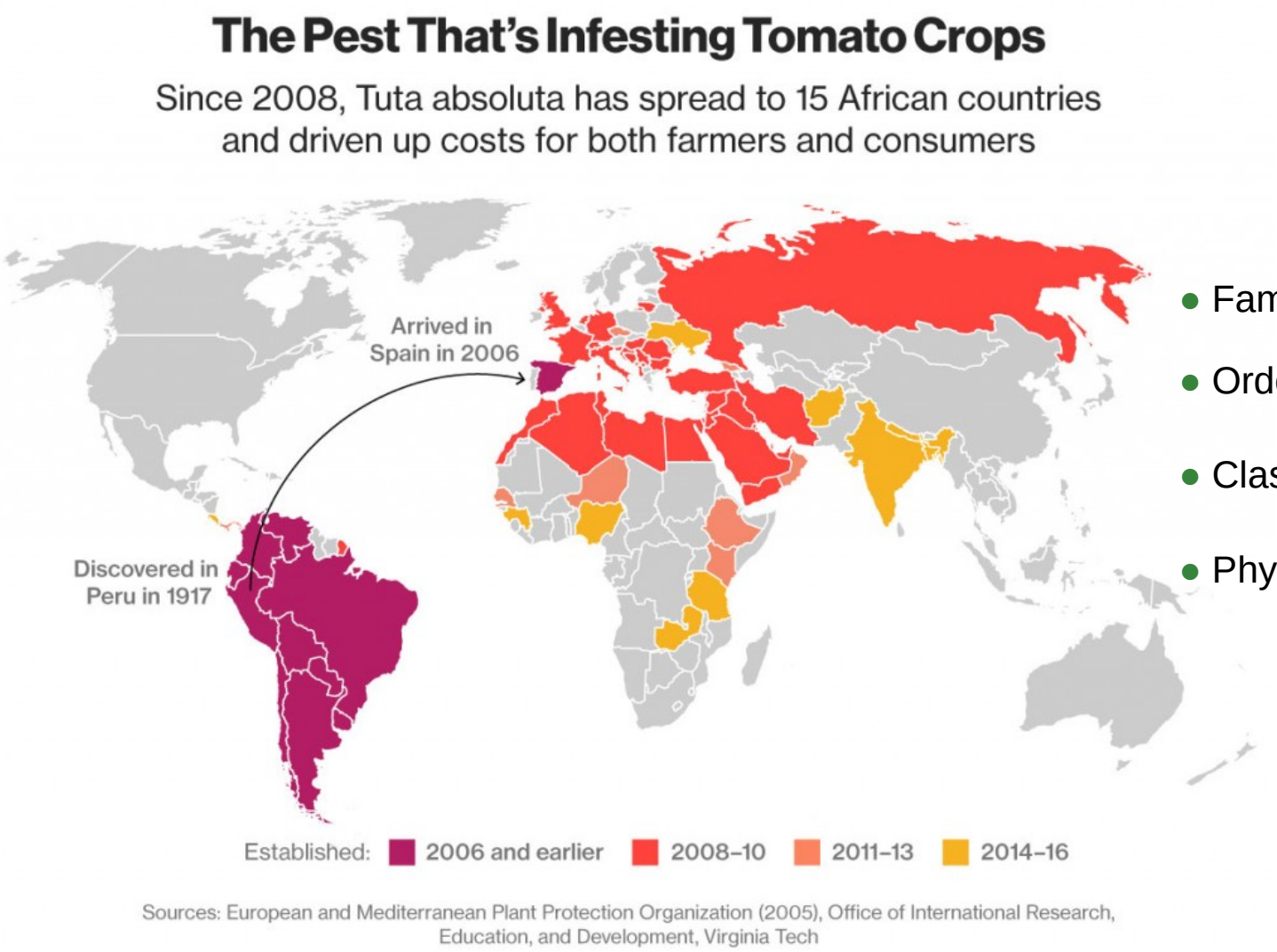
Segundo as projeções do agronegócio publicadas pelo Ministério da Agricultura,

Helicoverpa armigera (Lepidoptera: Noctuidae)
Management

Trichogramma pretiosum

- The biological control program of *H. armigera* has been implemented with the use of inundative releases of *Trichogramma pretiosum*.
- After its introduction to Brazil the adoption of Biological Control as control method increased due the difficulties in controling the pest with chemical control.
- Cultural practices and use of Entomopathogens are part of the IPM package of control

Tuta absoluta (Meyrick, 1917)



- Family: Gelichiidae
- Order: Lepidoptera
- Class: Insecta
- Phylum: Arthropoda

Tuta absoluta damage

Tomato leafminer

- Attacks all aerial parts of the host
- Can be spread by seedlings,
- Economic impact
- Increase in the cost of tomato production (additional costs for crop protection)

Management of *T. absoluta*

Biological Control

Weekly release of the parasitoid
100.000 300.000 parasit./ hectare

+

Bacillus thuringiensis

Potencial vs Use

Natural Enemies of *Tuta absoluta*

Parasitoids of eggs

Trichogramma spp.	Trichogrammatidae	Hym.
Anastatus sp	Eupelmidae	Hym.
Arrhenophagus sp.	Encyrtidae	Hym.
Copidosoma sp.	Encyrtidae	Hym.
Copidosoma desantisi	Encyrtidae	Hym.
Copidosoma hoehleri	Encyrtidae	Hym.

Potencial vs Use
Naturales enemies of *T. absoluta*

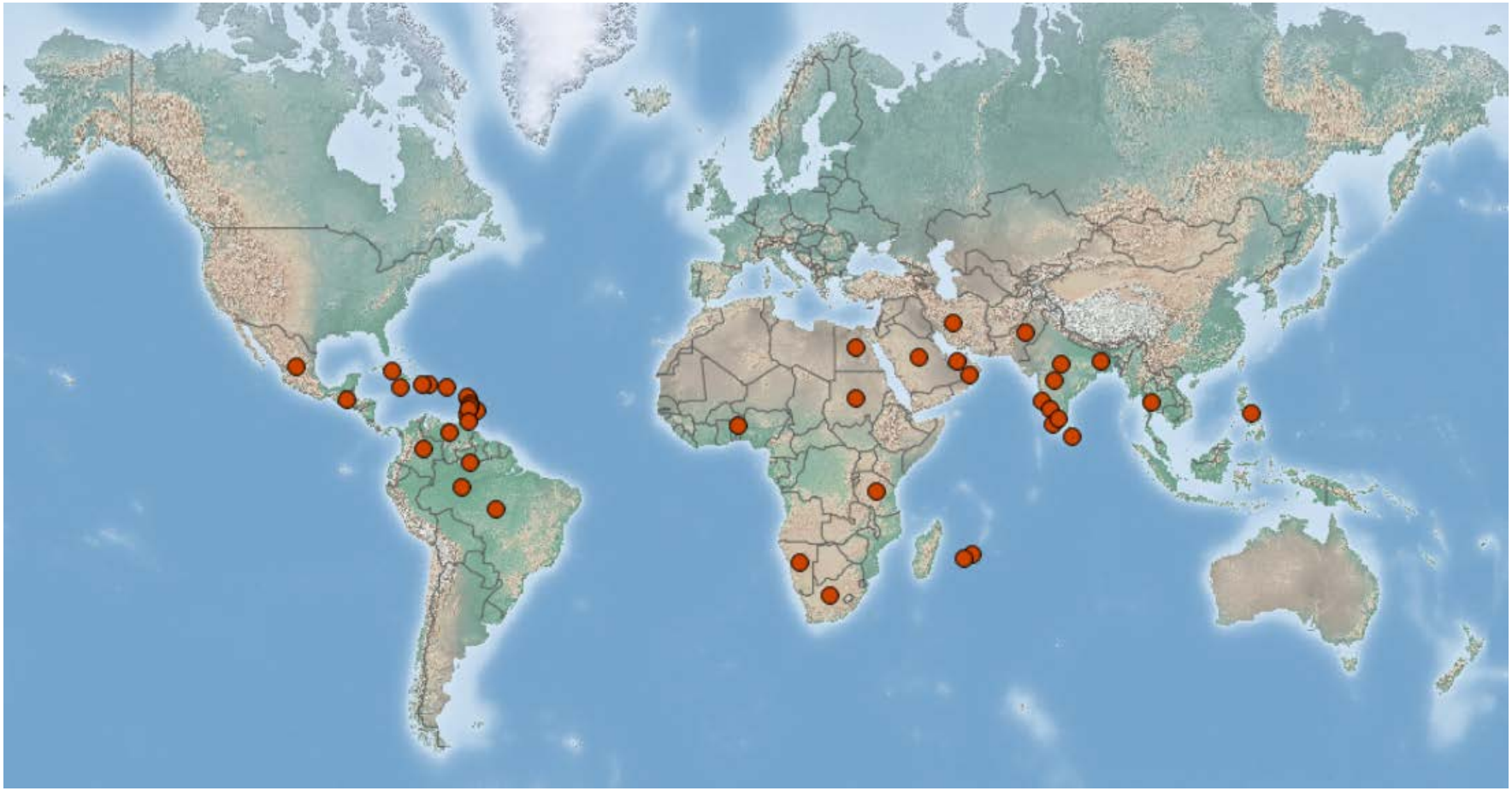
Predators reported: Van Lenteren (2016)

Campyloneuropsis infumatus	Miridae	Hem.
Engytatus vaians	Miridae	Hem.
Maccroplophus basicornis	Miridae	Hem.
Orius insidiosus	Anthocoridae	Hem.
Geocoris punctipes	Geocoridae	Hem.

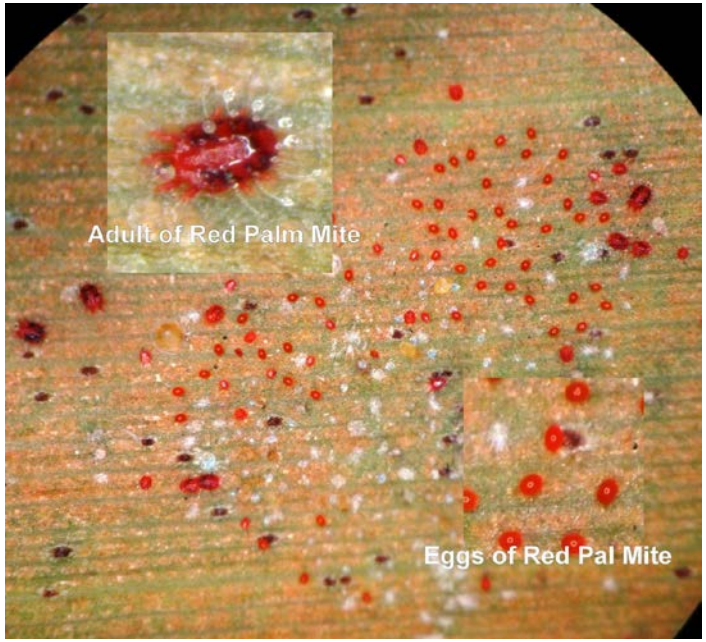
Red Palm Mite – *Raoiela indica* (Acari: Tenuipalpidae)

- It was introduced in the Caribbean in 2004 and rapidly spread to several Caribbean countries, United States of America, Mexico, Venezuela, Colombia and Brazil.
- Cause significant damage in Coco production in the Caribbean, affecting also the Banana production in the region

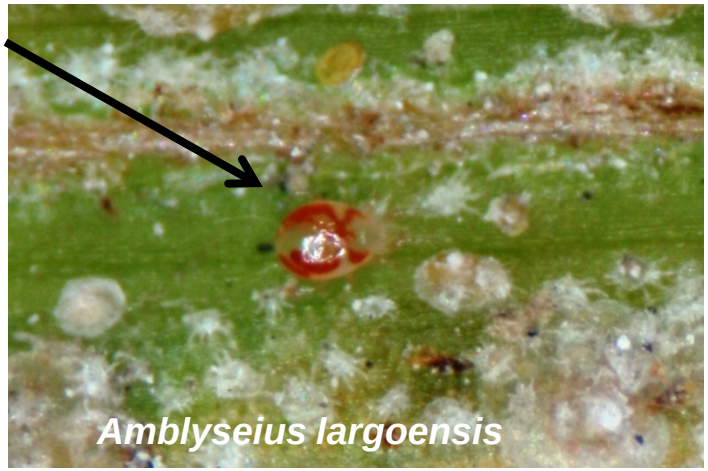
Red Palm Mite – *Raoiela indica* (Acari: Tenuipalpidae)



Red Palm Mite – *Raoiela indica* (Acari: Tenuipalpidae)



- One of its natural enemies (predatory mites) appears to have been introduced with the pest, identified as *Amblyseius largoensis*
- Other predators identified as N.E of the pest as *Chrysopa* sp., but limited availability in the market



Integrated Crop Management
Sustainability, Food Security and Food Safety

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Biological Control as part of Integrated Pest Management

Multidisciplinary collaboration platform

Didactic material - IPM

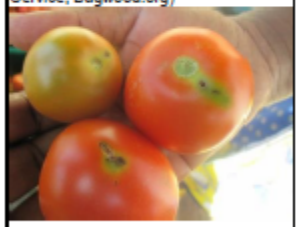
GUÍA PARA EL MANEJO DE PLAGAS : LISTA VERDE

Gusano minador del tomate

Tuta absoluta

Larva de *T. absoluta* (Marja van der Straten, NVWA Plant Protection Service, Bugwood.org)

Adulto de *T. absoluta* (Marja van der Straten, NVWA Plant Protection Service, Bugwood.org)



Agujeros de salida en frutos de tomate (Peter Kodwaran, Ministry of Agriculture Livestock and Fisheries, West Pokot)

Prevención

- Usar plántulas libres de plagas. Inspeccionar nuevas plántulas cuidadosamente antes de trasplantarlas en el campo o en invernaderos
- Tapar los marcos de puertas y ventanas del invernadero, y las aberturas con malla a prueba de insectos (con malla inferior a 1.6 mm)
- Retirar y destruir las malezas que actúan como plantas hospederas alternativas, ej: *Datura*, *Solanum*
- Limpiar las herramientas después de su uso en campos infestados
- Evitar la rotación de cultivos con solanáceas como berenjenas, papas (patatas), tomates y chiles dulces (pimientos)
- Inspeccionar los contenedores de cosecha, cajas de campo y materiales de embalaje. Destruir o desinfectar si se sospecha la presencia de *T. absoluta*
- Destruir los residuos de plantas después de la cosecha (quemar o enterrar)

Monitoreo

- Monitorear temprano para los daños causados por *T. absoluta* en hojas, tallos y frutos, especialmente en la parte superior de la plántula por:
  - Huevos en hojas y tallos
  - Minas y excrementos en las hojas, tallos y frutos. Las minas en hojas son anchas y se vuelven marrones y necróticas. Las minas en frutas causan pudrición
  - Agujeros de salida en la superficie de los frutos
  - Adultos en el envés de las hojas
- Usar trampas de feromonas, de luz o amarillas adhesivas para detectar temprano la presencia de la plaga
- Colocar una trampa de feromonas por un lote de menos de 3 500m^2 y dos trampas por lote más grande. Colocarla a la misma altura que el cultivo y revisar cada semana y notar los números de adultos capturados. Después de contar los adultos, limpiar las trampas cuidadosamente. Asegúrese de no mojar las feromonas

Medida curativa

- Retirar las plantas infestadas y quemar o enterrar a una profundidad de más de 50 cm
- No tirar los frutos infestados en los bordes del campo, los puntos de recolección o en los mercados
- Aplicar productos del nim en el suelo, parte superior de las hojas o directamente en las larvas para matarlas
- Cuando las poblaciones de *T. absoluta* son bajas (1-3 adultos capturados por semana) usar trampas de agua con feromonas para atrapar en masa los adultos y reducir las poblaciones
- Liberación de enemigos naturales como la avispa *Trichogramma*, hemípteros y ácaros depredadores disponibles en su país

Note: Plaguicidas pueden estar disponibles para el control de esta plaga. Consulte con el Ministerio de Agricultura de su país para saber qué plaguicidas están registrados en su país y las restricciones locales para su uso.

CREADO: Junio 2015
PRODUCIDO POR: Plantwise

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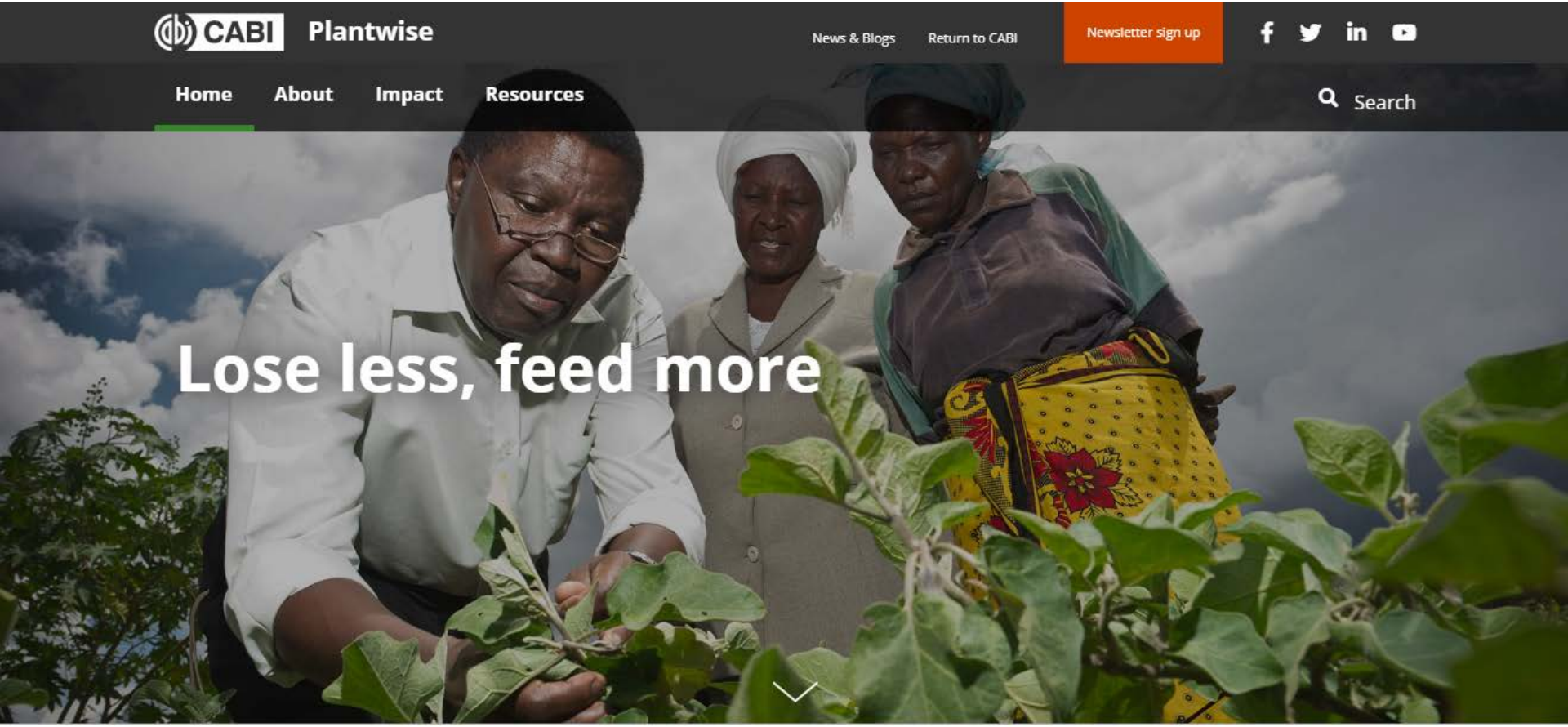
Plantwise is a CABI-led global initiative. www.plantwise.org

Technology transfer: Familiarization with Technology of Aplication of Bioproducts

Programme Plantwise

www.plantwise.org



Technical assistance–Knowledge and familiarization with IPM and Biological Control agents

- Training of extension officers in biological control: sustainable control methods, application technology and Integrated Pest Management. Technology transfer to producers.

Technology transfer

Plant Clinic service

BioProtection Portal- an online tool that facilitates the identification, supply and application of bioproducts

KNOWLEDGE FOR LIFE

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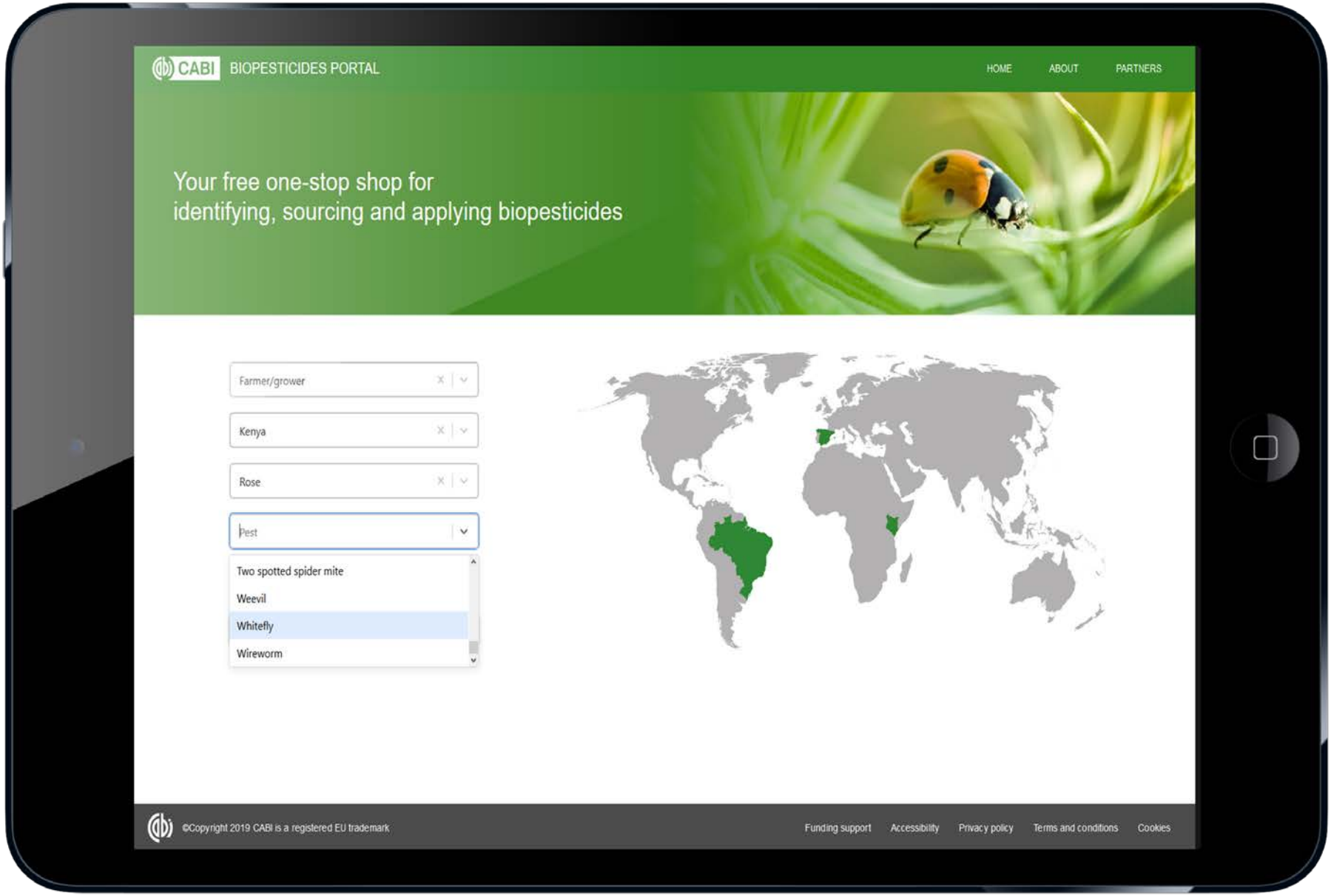
CABI
BIOPESTICIDES PORTAL
HOME
ABOUT
PARTNERS
Your free one-stop shop for
identifying, sourcing and applying biopesticides
Farmer/grower
Kenya
Rose
Pest
Two spotted spider mite
Weevil
Whitefly
Wireworm
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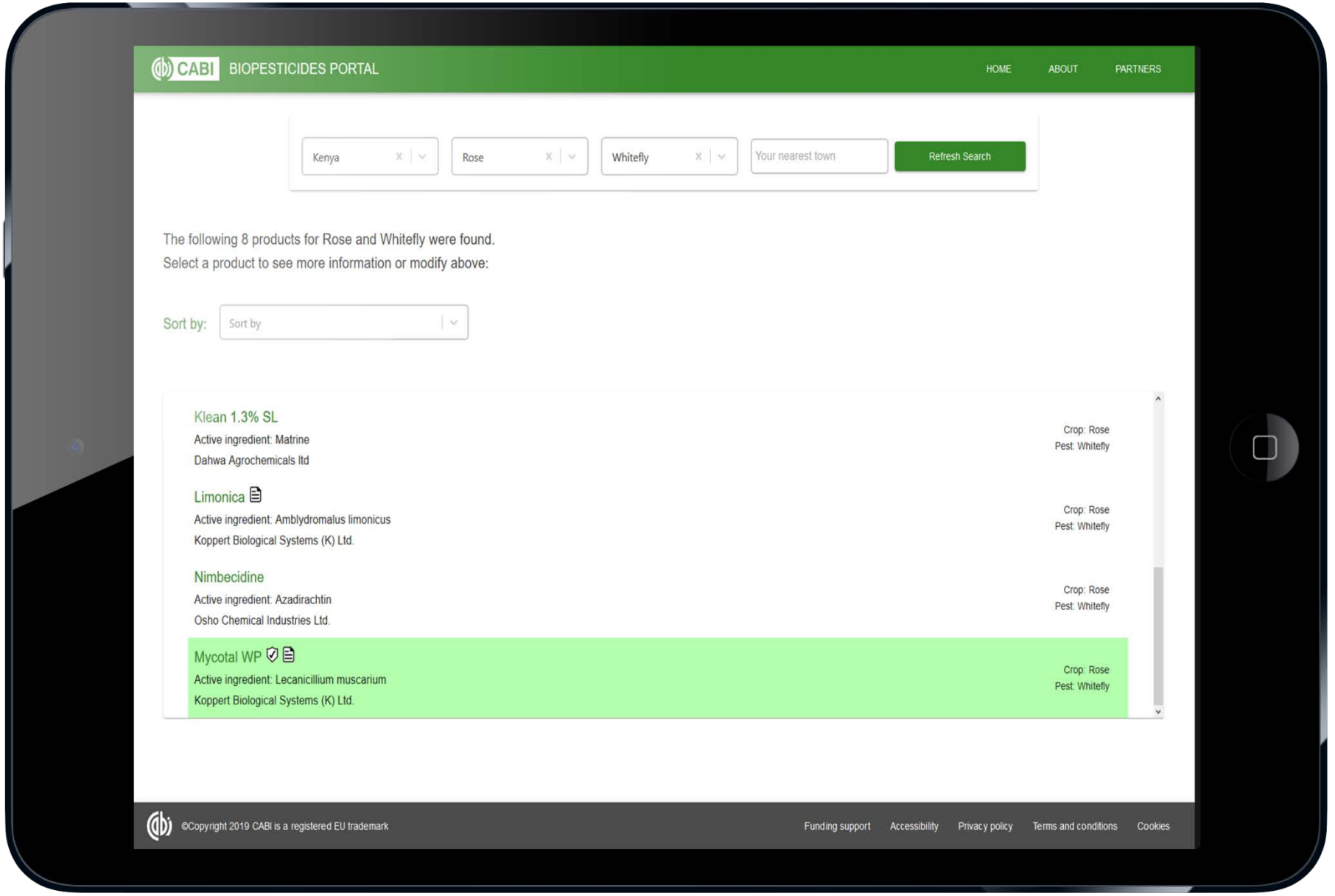
CABI BIOPESTICIDES PORTAL
HOME
ABOUT
PARTNERS
Kenya
Rose
Whitefly
Your nearest town
Refresh Search
The following 8 products for Rose and Whitefly were found.
Select a product to see more information or modify above:
Sort by:
Sort by
Klean 1.3% SL
Active ingredient: Matrine
Dahwa Agrochemicals ltd
Crop: Rose
Pest: Whitefly
Limonica
Active ingredient: Amblydromalus limonicus
Koppert Biological Systems (K) Ltd.
Crop: Rose
Pest: Whitefly
Nimbecidine
Active ingredient: Azadirachtin
Osho Chemical Industries Ltd.
Crop: Rose
Pest: Whitefly
Mycotal WP
Active ingredient: Lecanicillium muscarium
Koppert Biological Systems (K) Ltd.
Crop: Rose
Pest: Whitefly
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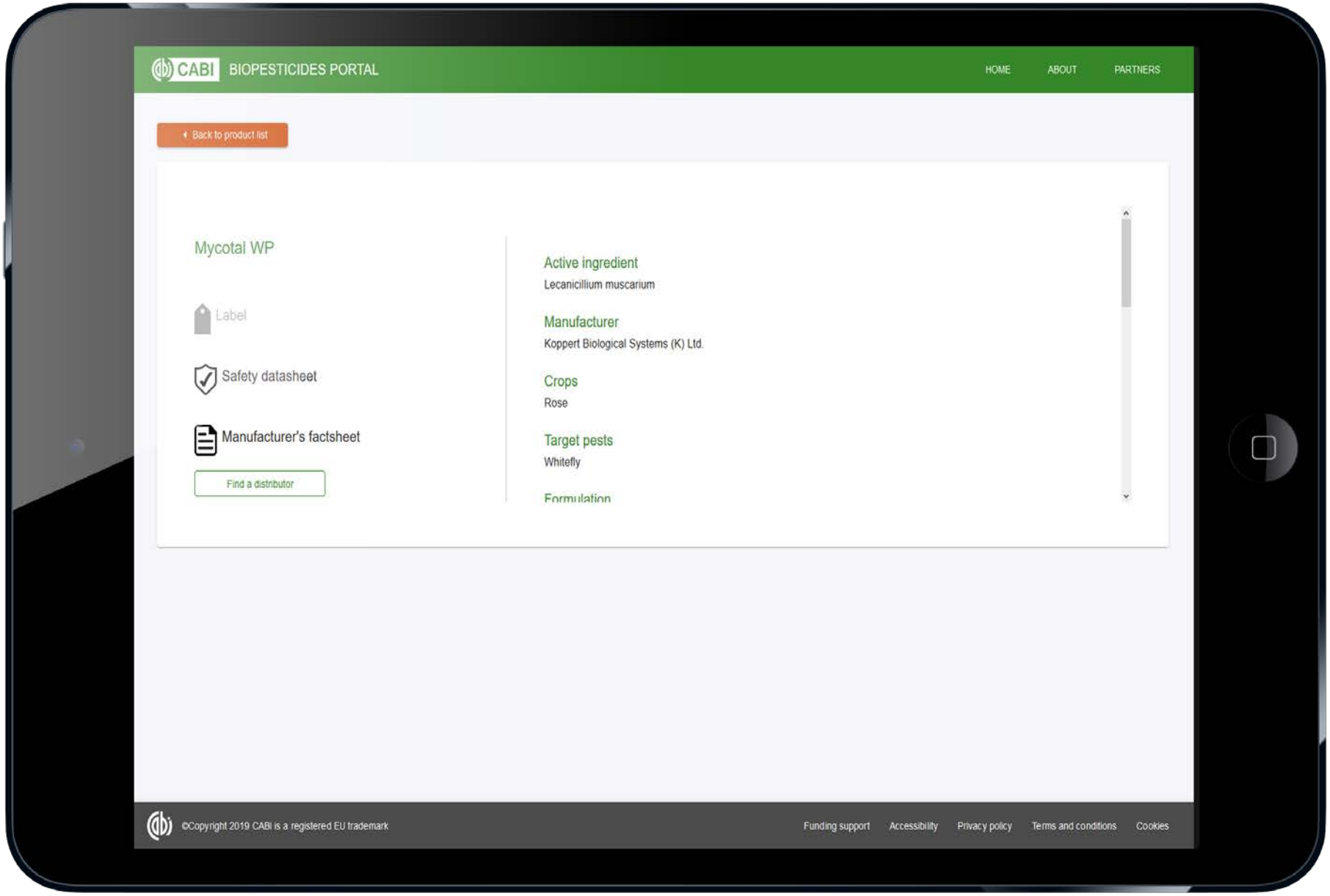
CABI BIOPESTICIDES PORTAL
HOME
ABOUT
PARTNERS
Back to product list
Mycotal WP
Label
Safety datasheet
Manufacturer's factsheet
Find a distributor
Active ingredient
Lecanicillium muscarium
Manufacturer
Koppert Biological Systems (K) Ltd.
Crops
Rose
Target pests
Whitefly
Formulation
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Back to product information

116 Distributors of Koppert found

To get information on product pricing and availability, you can either locate your nearest distributor from the list below or contact Koppert Biological Systems directly at:

Koppert Biological Systems (K) Ltd.

Apex Business Park, Unit 6, Mombasa Road. P.O. Box 41852

00100 Nairobi, Kenya

+(254) 731 202191

Email: info@koppert.co.ke

Distributor name	Location	Telephone	Manufacturer contact
Kipkelion Holdings Limited (Dairies)	Kericho (Kipkelion), Central Rift	0716855550	739426694
Nawal	Mumias, Western	0722555540	739426694
Waldai Agrovet Supplies Ltd	Kericho town, Central Rift	0786680905	739426694
Agri-world Enterprises	Nakuru town, Central Rift	0718976403	739426694
Paves Vetagro Limited	Kitale, Northrift	0720119620	739426694
Mwanga Agrovet	Kisumu, Awori House, Nyanza	0722862237	739426694
Mashambani Agovet	Eldoret Town, Northrift	0723737690	739426694
Baraton	Uasin Gishu, Northrift	0728448818	739426694
Maish Agrovet	Narok, Southrift	0792296394	739426694

Continuous Farmers training

Sustainable approaches can significantly reduce the negative effects of conventional systems while contributing to increased Food Security and Food Safety

Join forces - Surveillance and detection Early awareness system

www.cabi.org

Invasive Species

- Necessary to establish partnership in order to have a regional approach
  - Development a platform for information exchange between NPPOs – Scientific community

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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

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merci
शुक्रिया
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xie-xie
obrigado
efharistó
ありがとう
kiitos
thank you
gracias
zikomo
tak
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urakoze
ke itumetse
danke
terima kasih
dhanyawaad

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