Whats is biological control?

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Whats is biological control?

"the action of parasites, predators, or pathogens in maintaining another organism's population density at a lower average than would occur in their absence".(Paul de Bach, 1964).

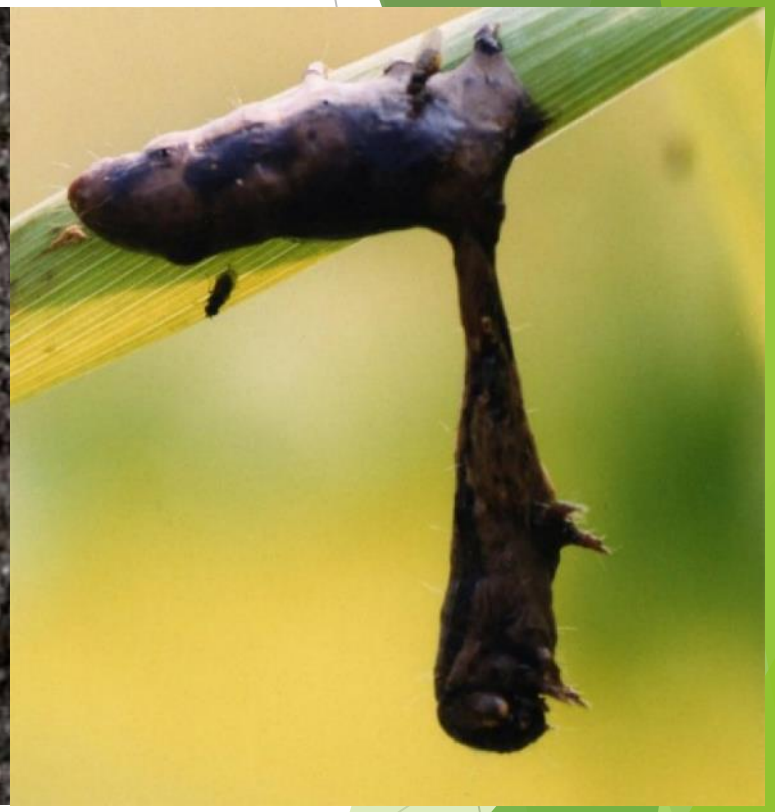
Whats is biological control?

A natural phenomenon that consists of the regulation of the number of plants and animals by natural enemies, also called agents of biotic mortality. Therefore, all species of plants and animals have natural enemies that can attack them in their various stages of life. Parra et al. (2002)

When one organism controls another organism

Who are the natural enemies?

Microorganisms



Predators

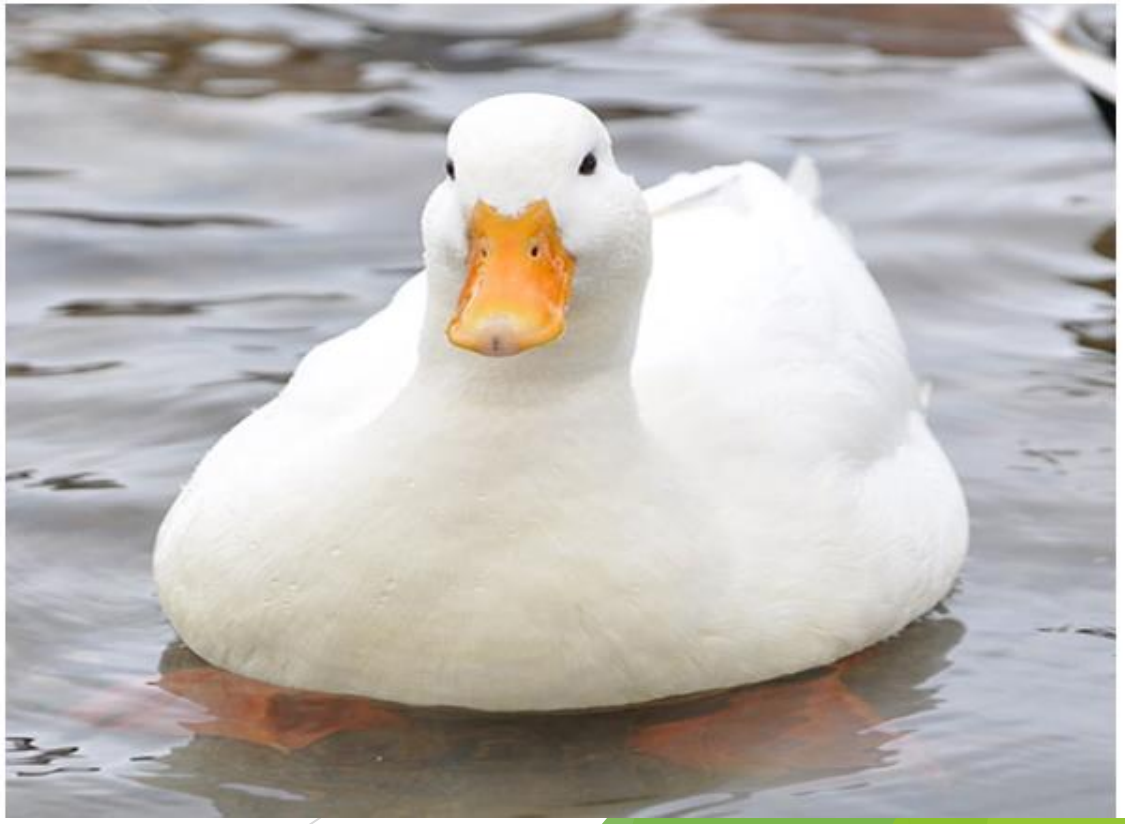
Parasitoids

Birds

Agricultores se aliam a marrecos contra pragas do arroz

Nanda Melonio

sexta-feira, 3 fevereiro 2012 20:36



Biological control of invasive weeds with insects

Austrália, control of cactus *Opuntia stricta*, with *Cactoblastis cactorum* moth, idrotuzed from Argentina

Biological control with parasitoid insects and predators

According to Parra et al. (2002) there are 3 types of Biological Control programs:

i) Classical Biological Control (or inoculative).

ii) Natural Biological Control (or conservative).

iii) Applied Biological Control (or augmentative).

Classical Biological Control

- Defined for the importation and colonization of parasitoids and predators, aiming at or controlling exotic pests (eventually native).

- It only applies to perennial or semi-perennial crops.

First success case

Rodolia cardinalis

X

Icerya purchasi

1888

Importaded from
Austrália - EUA

CBC

- Most used in the past when insect rearing techniques were incipient, poorly developed;
- Usable for new introduced pests;
- Natural enemies rearing are very difficult.
- Programs run by public government agencies
- No economic interest (time to carry out pest control).

Natural Biological Control (or conservative).

- Concerning the population of natural occurrence (natural enemies);

- Preservation of natural enemies (increase) by manipulating the environment;

➢ **Use of selective insecticides at correct times,**

➢ **Reduce doses of chemicals,**

➢ **avoid inappropriate cultural practices,**

➢ **preserve habitats or food sources for natural enemies.**

CBN

Predatory ants

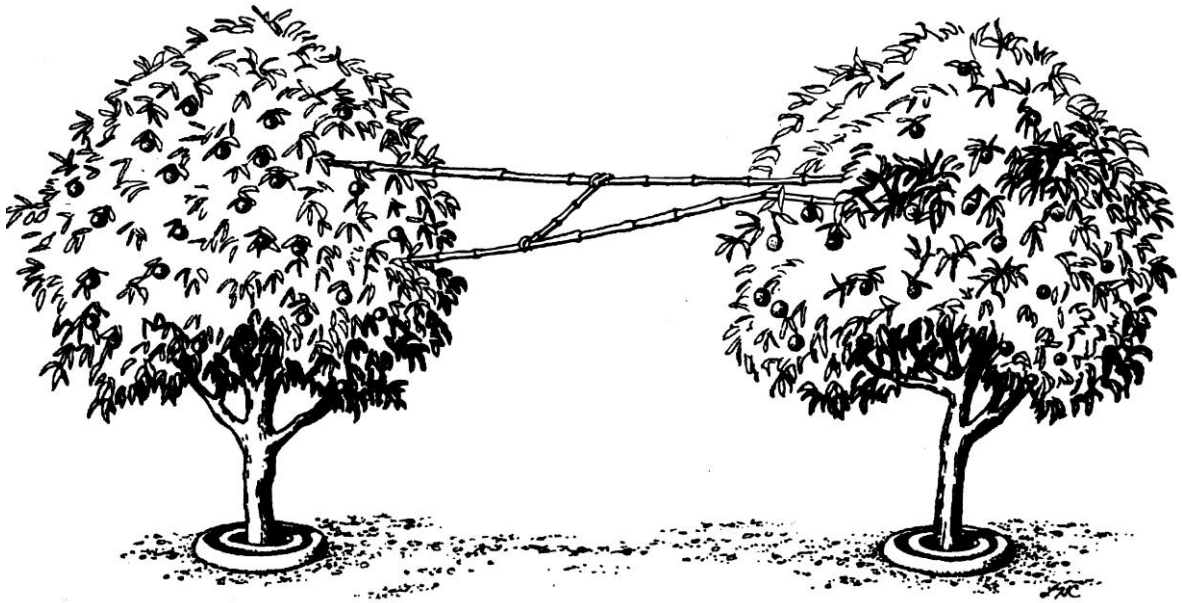
Oecophylla smaragdina

x

Citrus pest

Bosch et al. (1982)

China 300 a.C.



CBN- Selectivity

Insecticide property in killing pests without killing natural enemies.

i) Physiological selectivity: insecticidal molecule has little effect on the natural enemy. (ex. chitin synthesis inhibitors)

ii) Ecological selectivity: the contact between the insecticide and natural enemies is avoided.

Applied Biological Control (or augmentative).

- Flooding releases from parasitoids or predators;
- Mass rearing in the laboratory;
- Fast reduction of the pest population to its equilibrium level.

  - Well-accepted by farmers, quick action, very similar to that of insecticides.
  - ≠ CBC, slow action and its application exclusively in perennial and semi-perennial cultures.

ABC Mass rearing

ABC- Mass rearing

A systematic, automated activity in integrated facilities, with the aim of producing a relatively large supply of insects for distribution(Leppla e Adams,1987).

Questions?

BC success case in Brazil

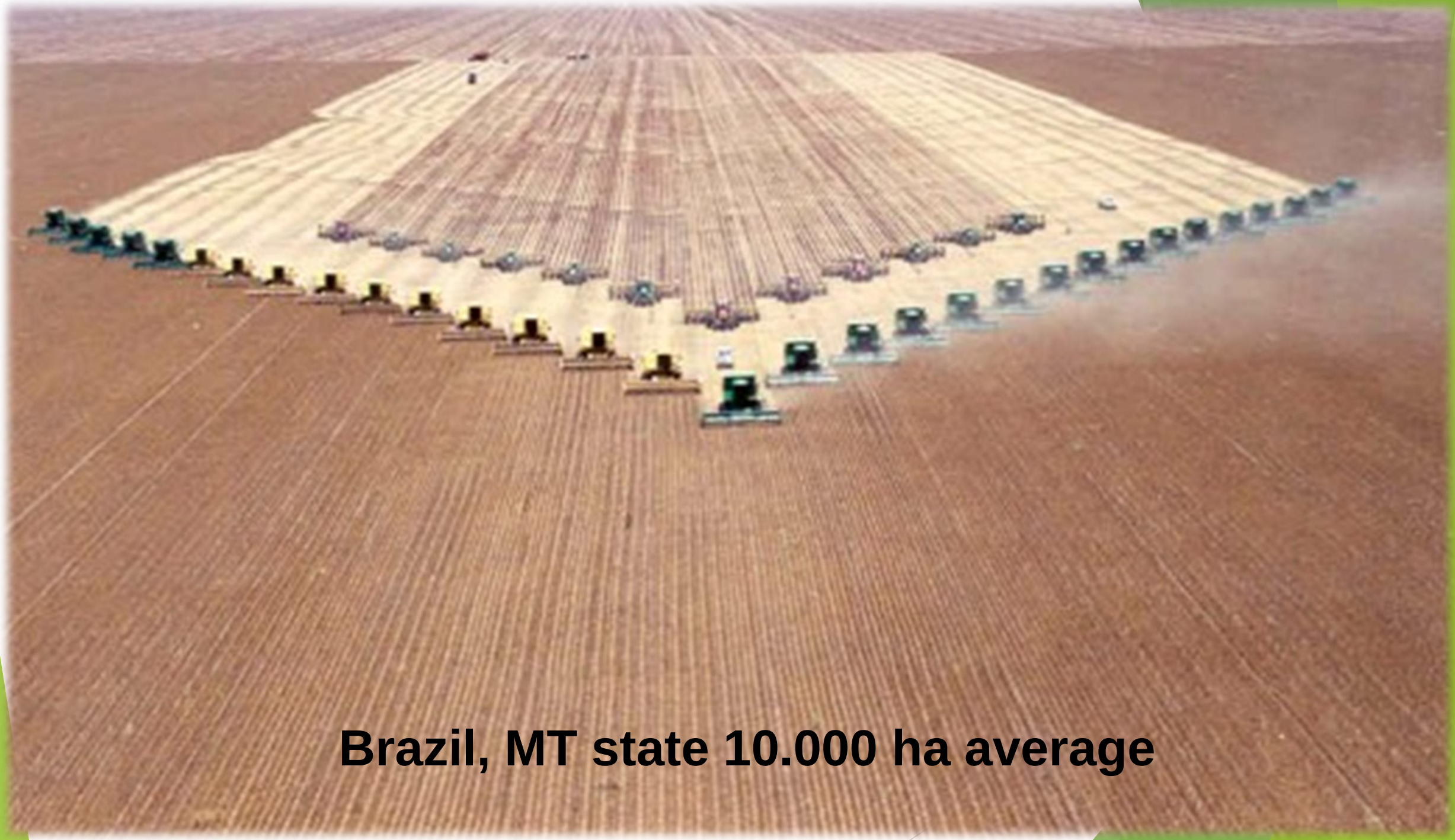
With macro

&

Importance of insect rearing for biological control programs

Europe the biggest users.

- Netherlands more than 90% of the measurements are biological control
- More than 400 natural enemies products registered



Brazil, MT state 10.000 ha average

Trichogramma

Factitious host
Anagasta kuehniella

Factitious host *A. kuehniella* production

Factitious host *A. kuehniella* production

Larval development

Factitious host *A. kuehniella* production

Adults cage

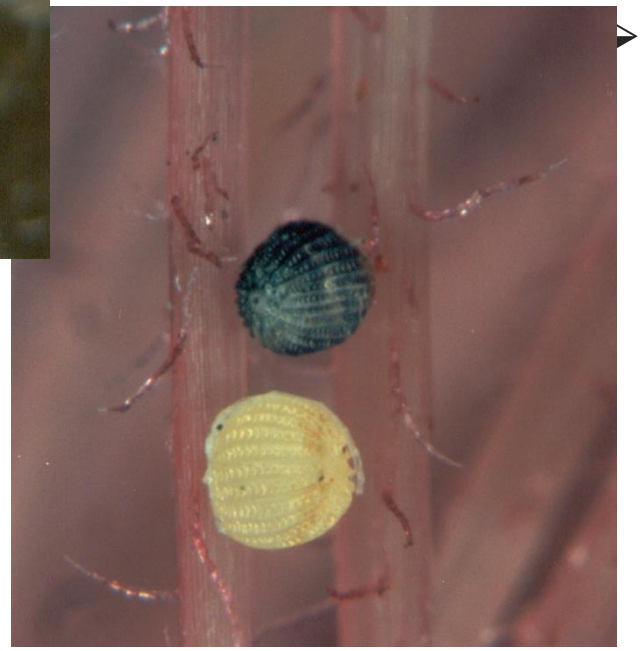
Factitious host *A. kuehniella* production

Anagasta kuehniella eggs

Trichogramma pretiosum

VS Lepidoptera

- Egg parasitoid (microwasp)
- Action time 3 days
- Release by drones
- Manual release, tractors



Quality Control IMPORTANT!“Dose”

Strains

Dark eggs

Exit hole

Well done rearing
Well done logistics

Dose and cost *Trichogramma pretiosum*

- Variable dose in general, 50 thousand individuals/ha in 3 releases
- High infestations can change for 100 thousand
- Cost of R$ 40 reais (US$ 10) = 100 thousand wasps. Marcelino Borges (Koppert)
- Release via drone, R$ 7-8/ha (U$1,75-2) sugarcane plant, R$ 12/ha (US$ 3) cereal, R$ 20/ha (U$ 5). Marcelino Borges (Koppert)

Cotesia flavipes

sugarcane borer control

Applied (Augmentative) BC

niques for Rearing the Sugarcane Borer on an Artificial Diet[1]

S. D. HENSLEY[2] and ABNER M. HAMMOND, JR.

ment of Entomology, Louisiana State University, Baton Rouge 70803

Domigos Gallo
USP/ESALQ

Source: https://www.agrolink.com.br/problemas/broca-do-

Diet preparation

Adults moths

Larval development

Vial 500 mL

Parasitism by *C. flavipes*


Biocontrol

Separation of the pupae wasp

Pupae storage


BIOCONTROL

Release

Cotesia flavipes

8 points/ha

4 points/ha, 6.000 parasitoides

https://www.youtube.com/watch?v=5mkIP6VxrOg

CB aplicado

World

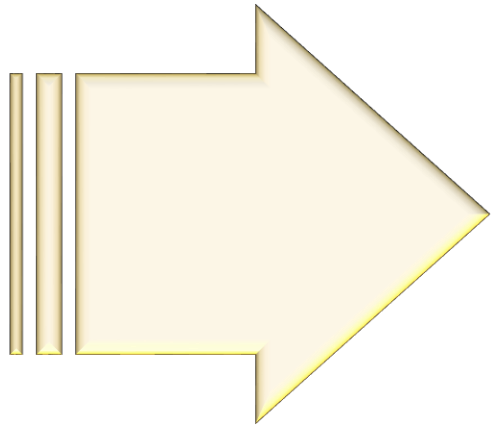
↳ 20 million ha (van Lenteren, 2008)

Brazil (sugarcane)

↳ 5,5 million ha

Cotesia flavipes program

Infestation rate

10%  **2%**

1970 in São Paulo

Economical losses

US$100 milhões

US$20 milhões

Question?

The history of BC in Brazil, the importance of a scientific society, graduation courses and technology transference.

Beginning: BC- Classical

1921- 32 years after *Rodolia cardinalis* at USA

Encarsia berlesei

Source: Moraal and Jongema, entomologische berichten 71 (3) 2011.

Vs

Pseudaulacaspis pentagona

Source: Moraal and Jongema, entomologische berichten 71 (3) 2011.

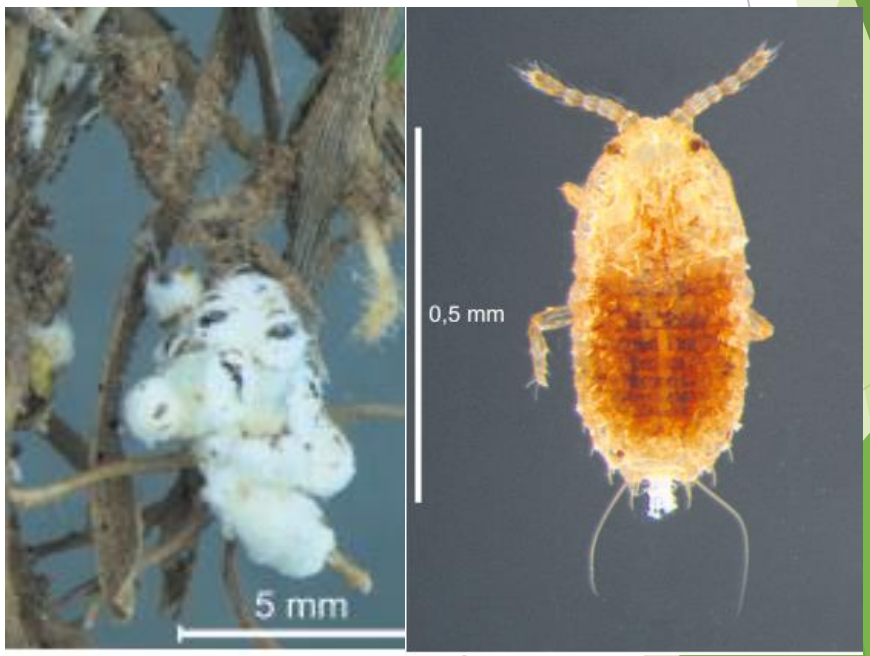
Success: 1967

Neodusmetia sangwani

Source: Batista Filho et al Arq. Inst. Biol., v.84, 1-8, e0432016, 2017.

Vs

Antonina graminis



Source: Batista Filho et al Arq. Inst. Biol., v.84, 1-8, e0432016, 2017.

Graduation programs

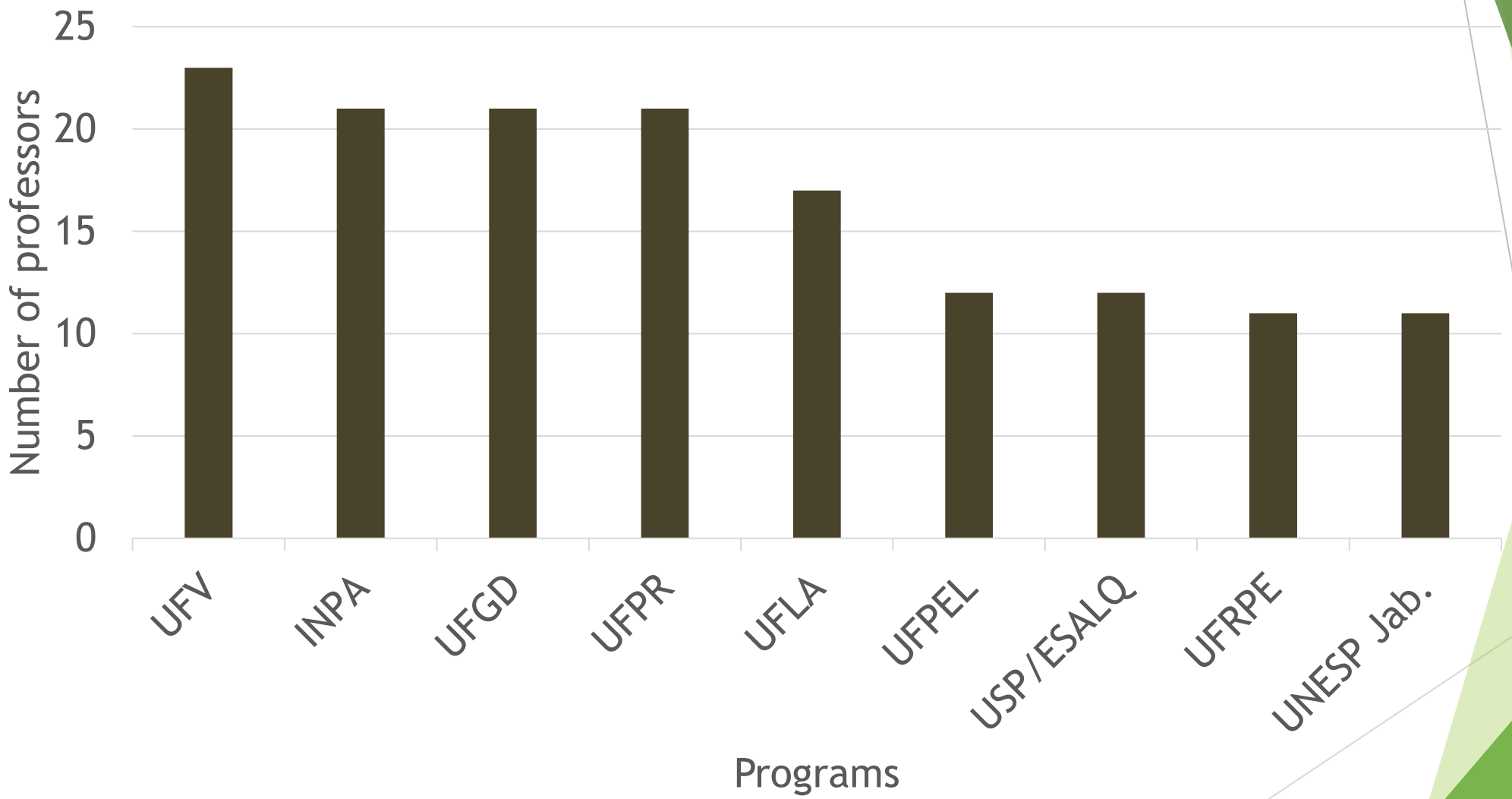
USP/ESALQ oldest Graduate Program in Entomology
First graduate class (1968)

American entomologist
Roger N. Williams-Ohio
Allen Steinhauer-Maryland

Graduation programs

- INPA
- UFGD
- UFLA
- UFPel
- UFPR
- UFRPE
- UFV
- UNESP Jaboticabal

Entomology graduation programs




SOCIEDADE ENTOMOLÓGICA DO BRASIL
1972

CBE- Brazilian Congress of Entomology
Siconbiol- Symposium of BC

CBE= 2000 average audience

Siconbiol= 700 average audience

Insect rearing technical course for BC

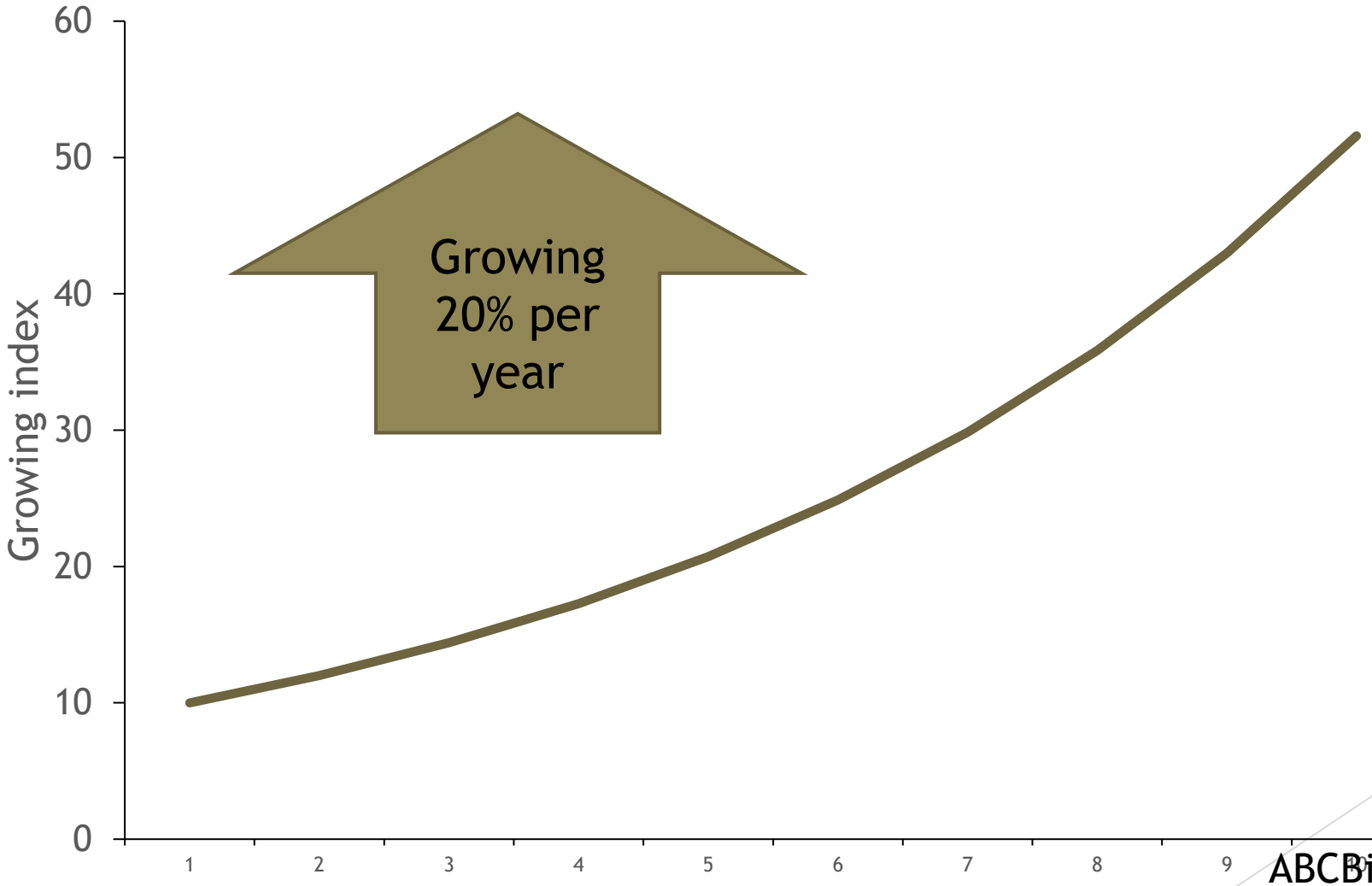
Since 1980's

Annually or bi-annually


ABCBio
ASSOCIAÇÃO BRASILEIRA DAS EMPRESAS
DE CONTROLE BIOLÓGICO
CropLife
BRASIL

Companies associated

Market in Brazil



ABCBio, 2017

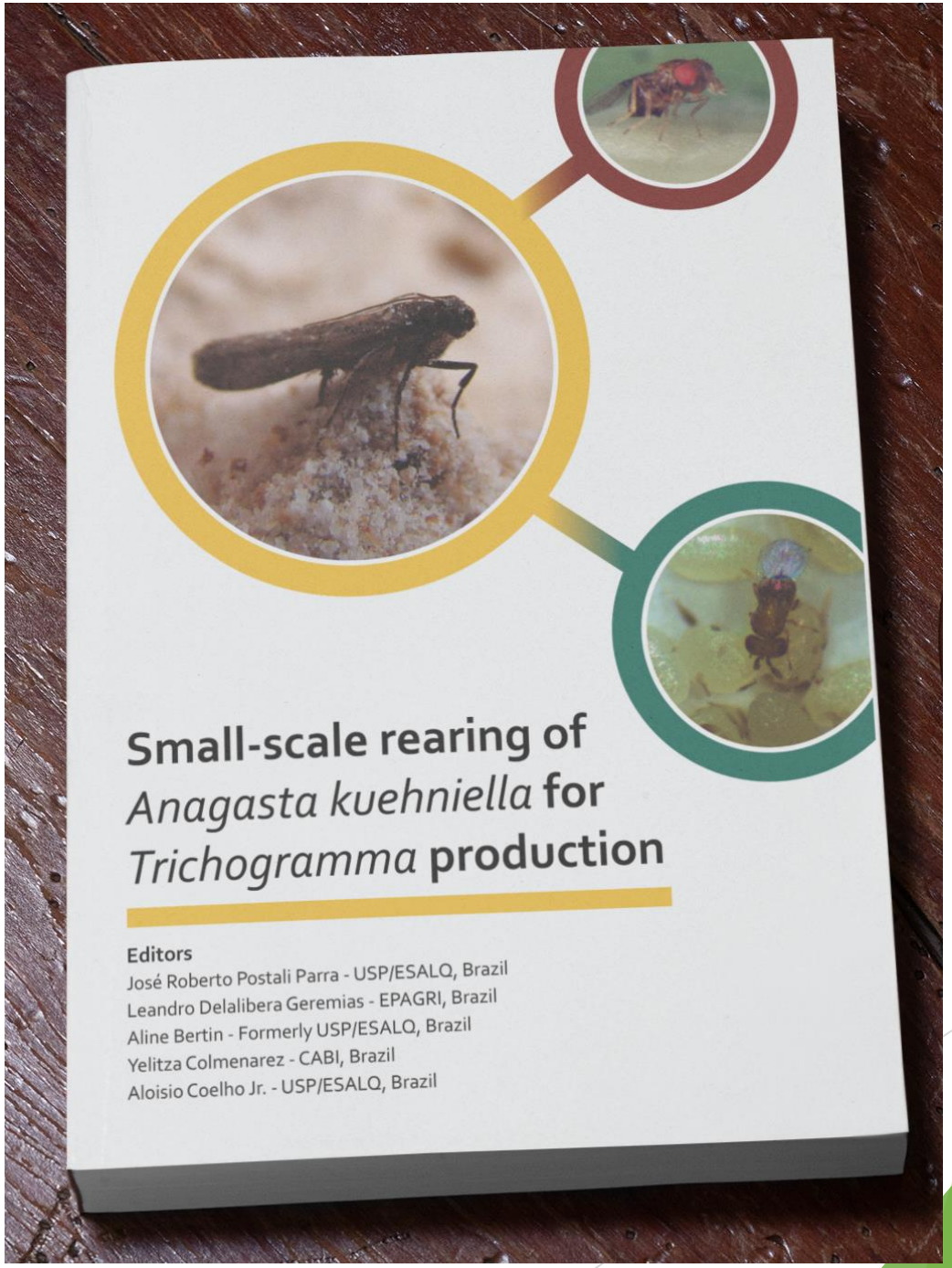
How to rear *Anagasta kuehniella* and *Trichogramma* spp.

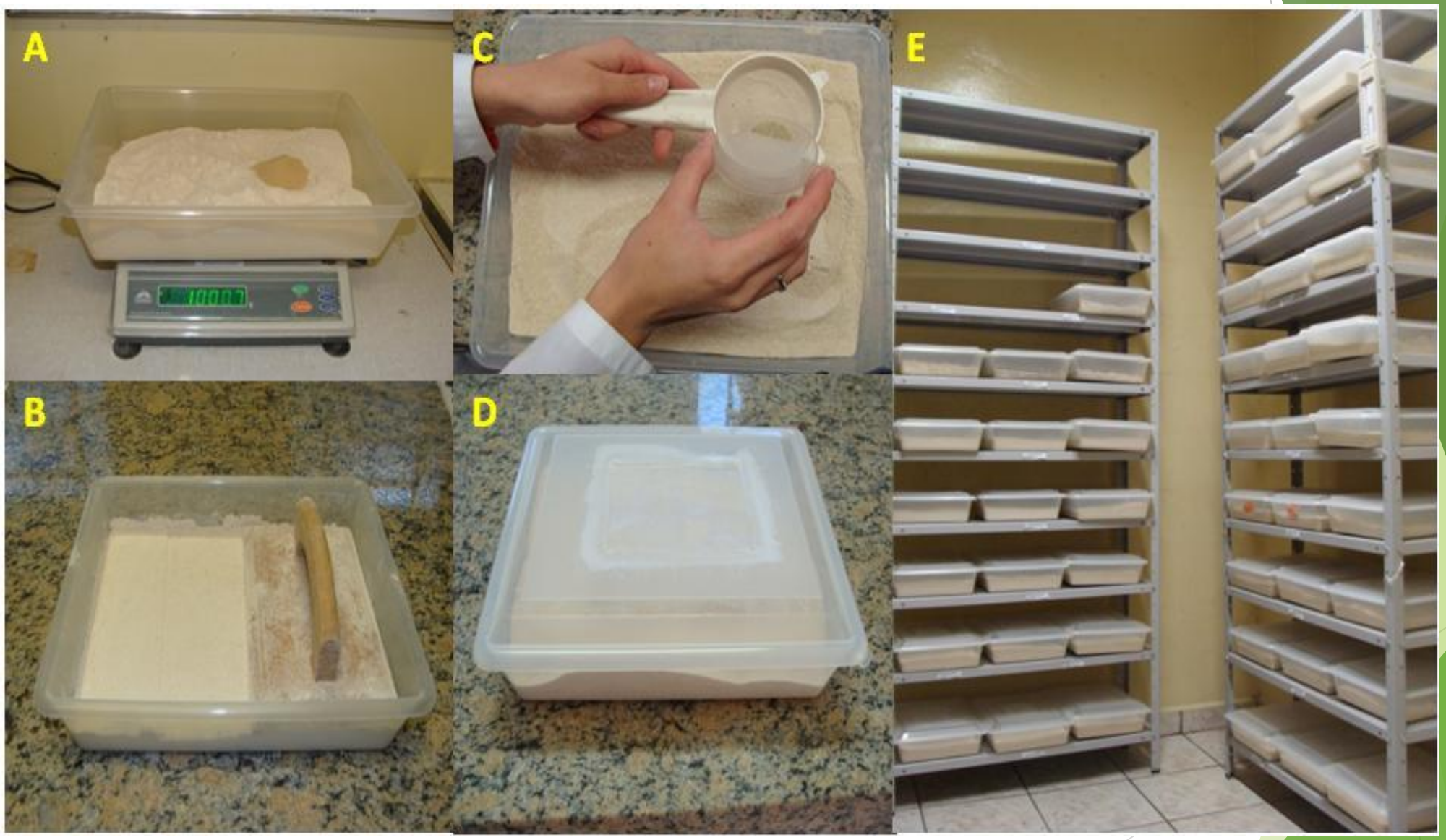
&

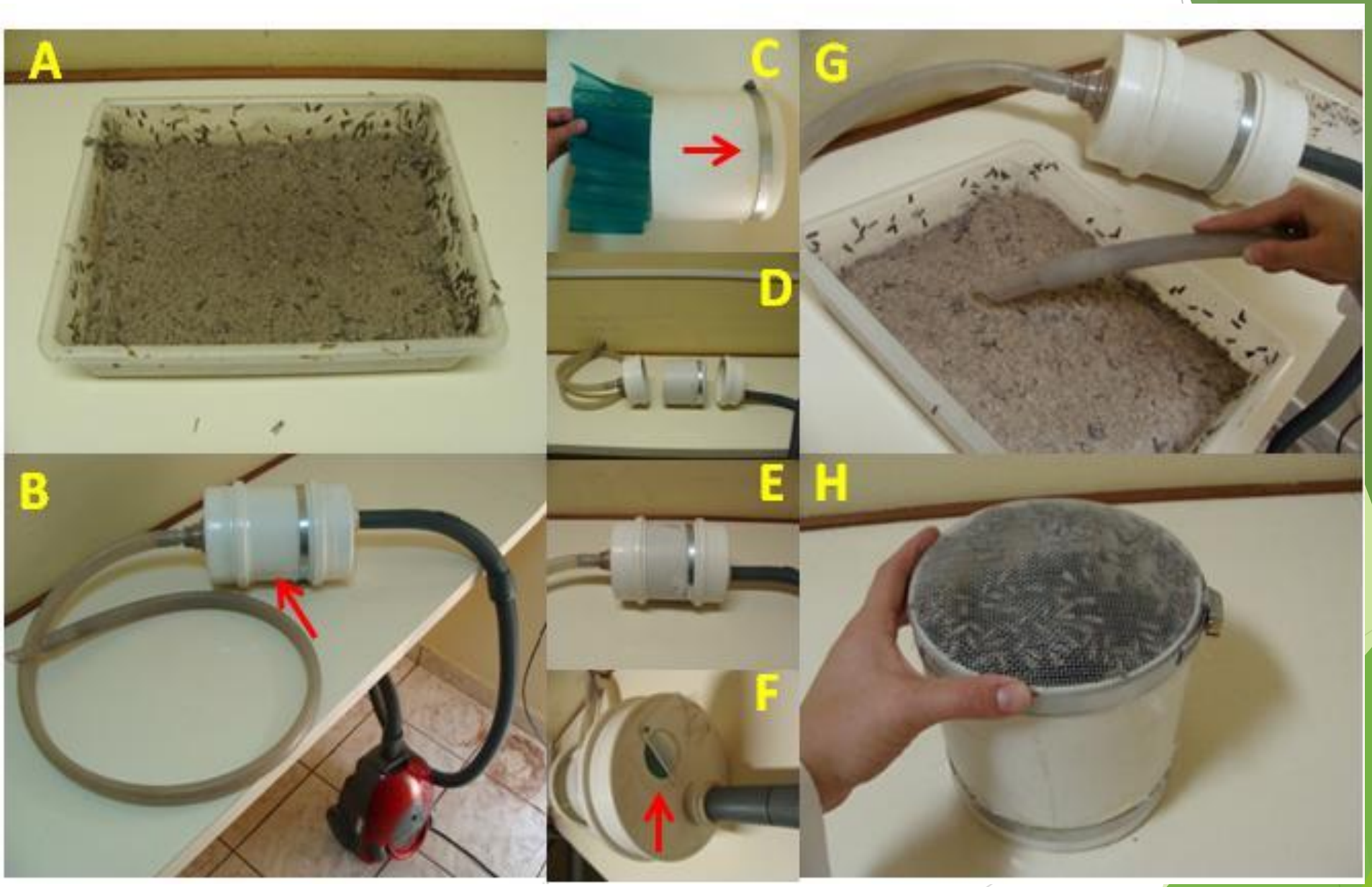
SPARCbio

Anagasta kuehniella Zeller rearing

Coming soon


Small-scale rearing of
Anagasta kuehniella for
Trichogramma production
Editors
José Roberto Postali Parra - USP/ESALQ, Brazil
Leandro Delalibera Geremias - EPAGRI, Brazil
Aline Bertin - Formerly USP/ESALQ, Brazil
Yelitza Colmenarez - CABI, Brazil
Aloisio Coelho Jr. - USP/ESALQ, Brazil


A
C
E
B
D


A
C
G
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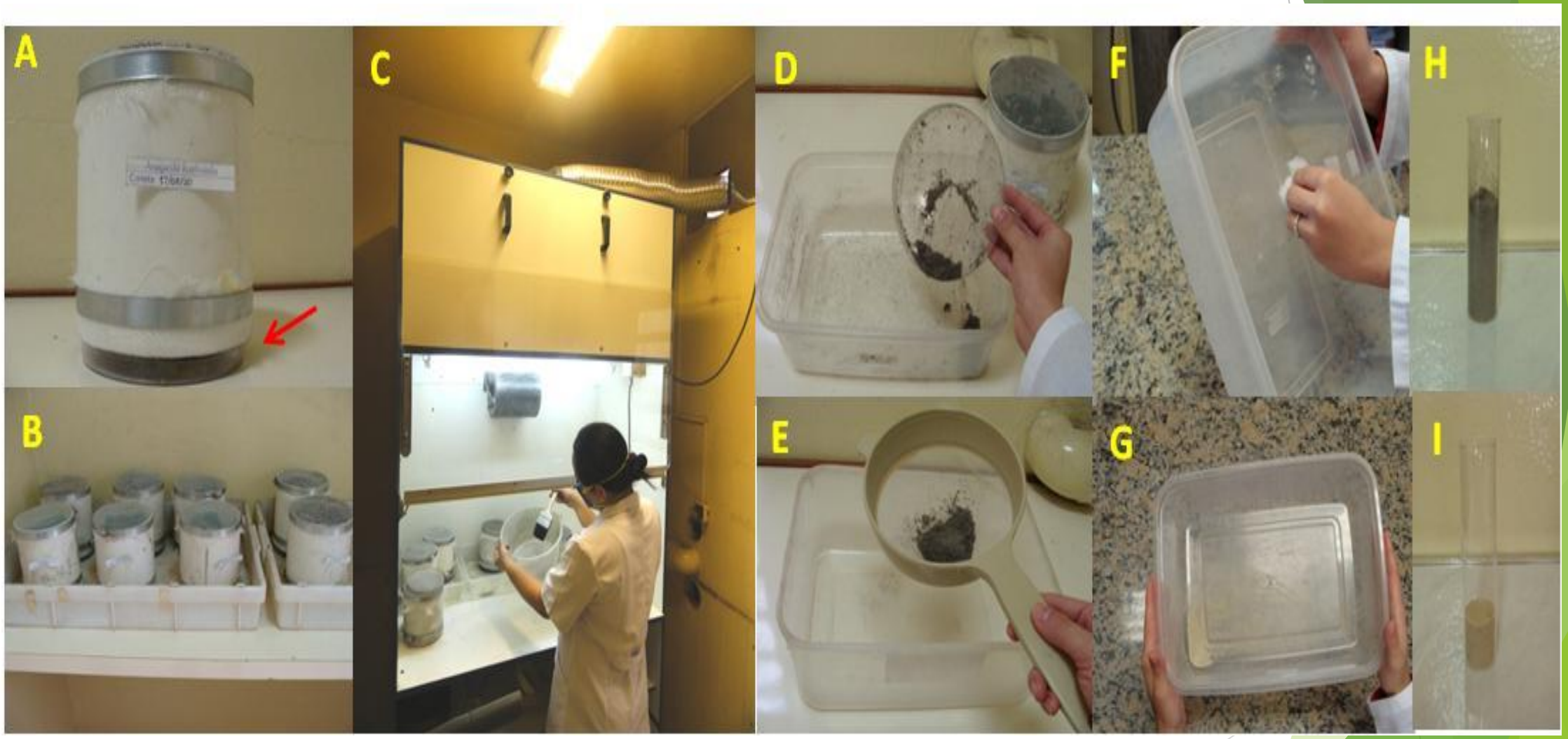
A
B
C
D
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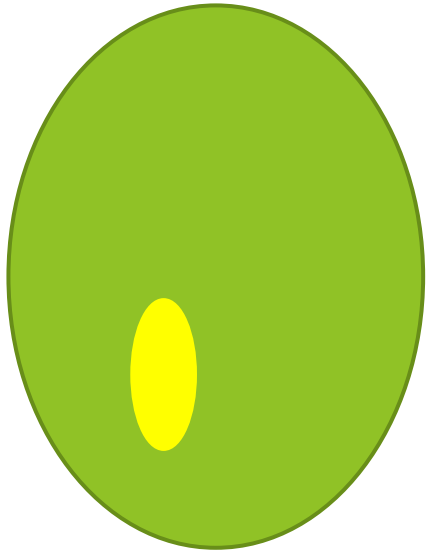
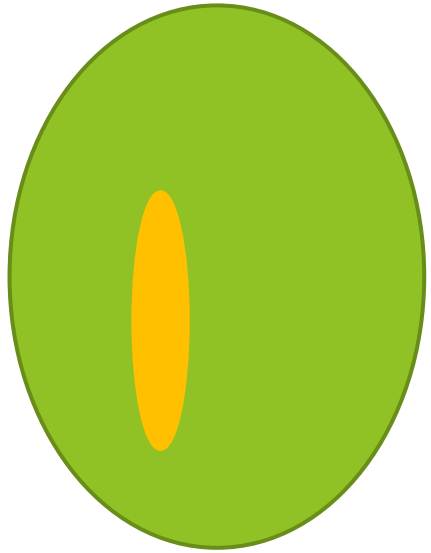
Trichogramma spp. rearing

At 25°C become dark at 3° day

- **Egg**
  24 hrs 25°C

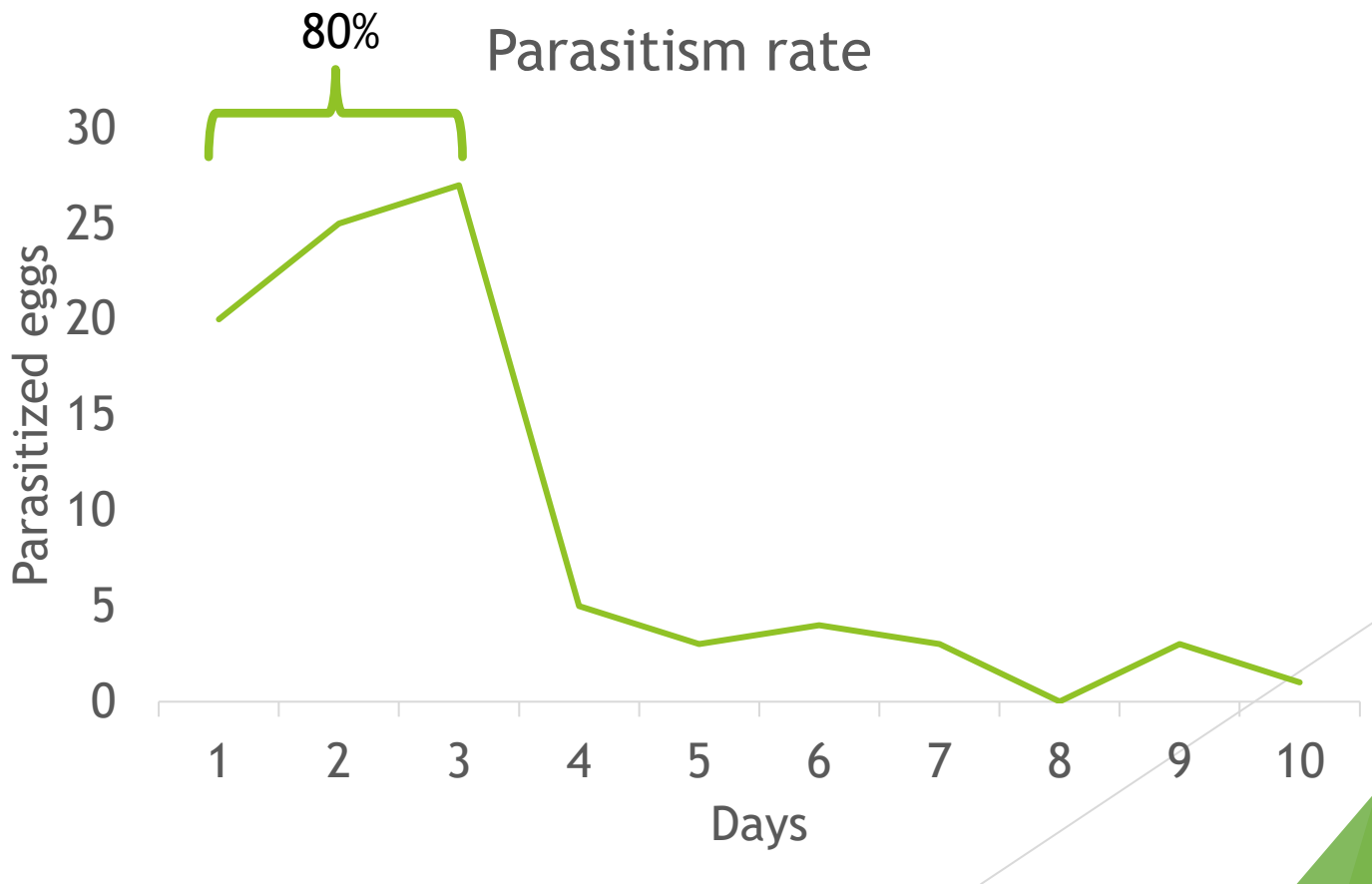


- **Larvae**
  2 days 25°C



- **Pupae**
  7 days 25°C

- Life-span approx. 10 days*
- 65-120 eggs
- *feed on honey, host-feeding



More than 1 eggs per egg

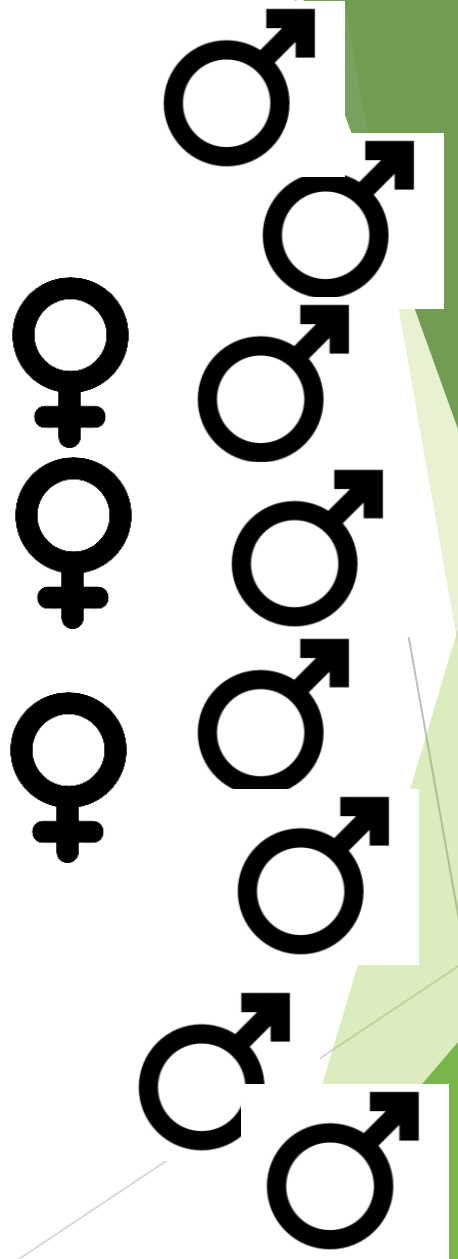
1 egg per egg

More than 1 egg per egg Super/multi

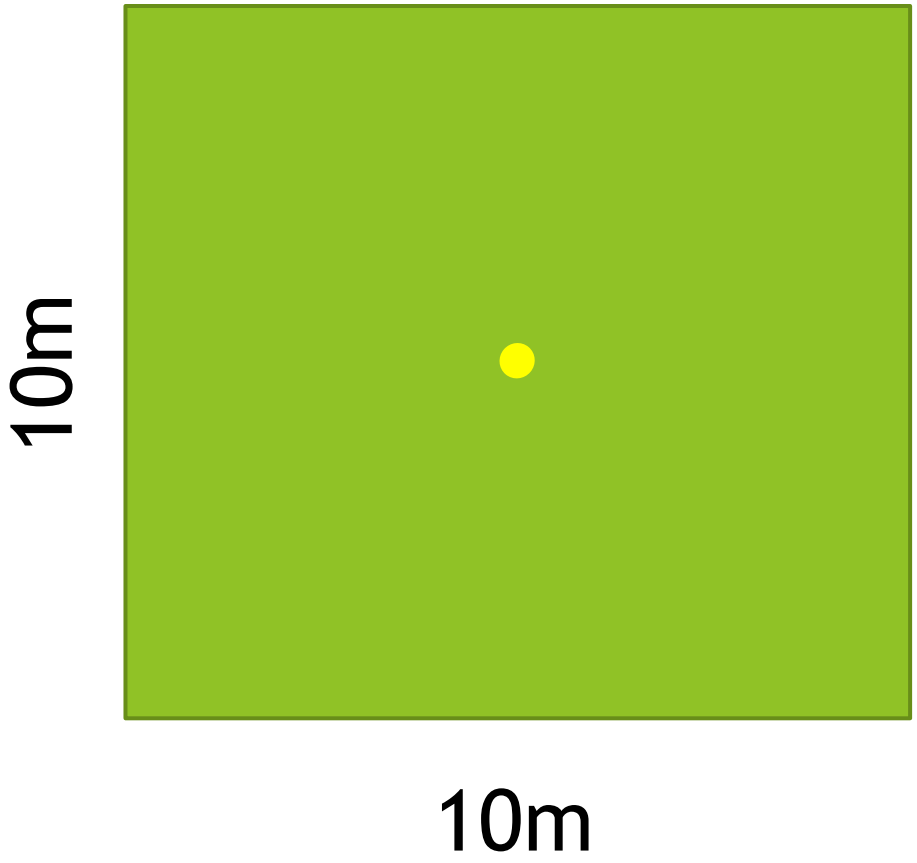
Erinnyis ~50 *Trichogrammas* eggs

More than 1 egg per egg
Super/multi

OR



Field accion time 3 days



- 100 m^2
- 24 hours

There is diferences among the *Trichogramma* strains?

Strains

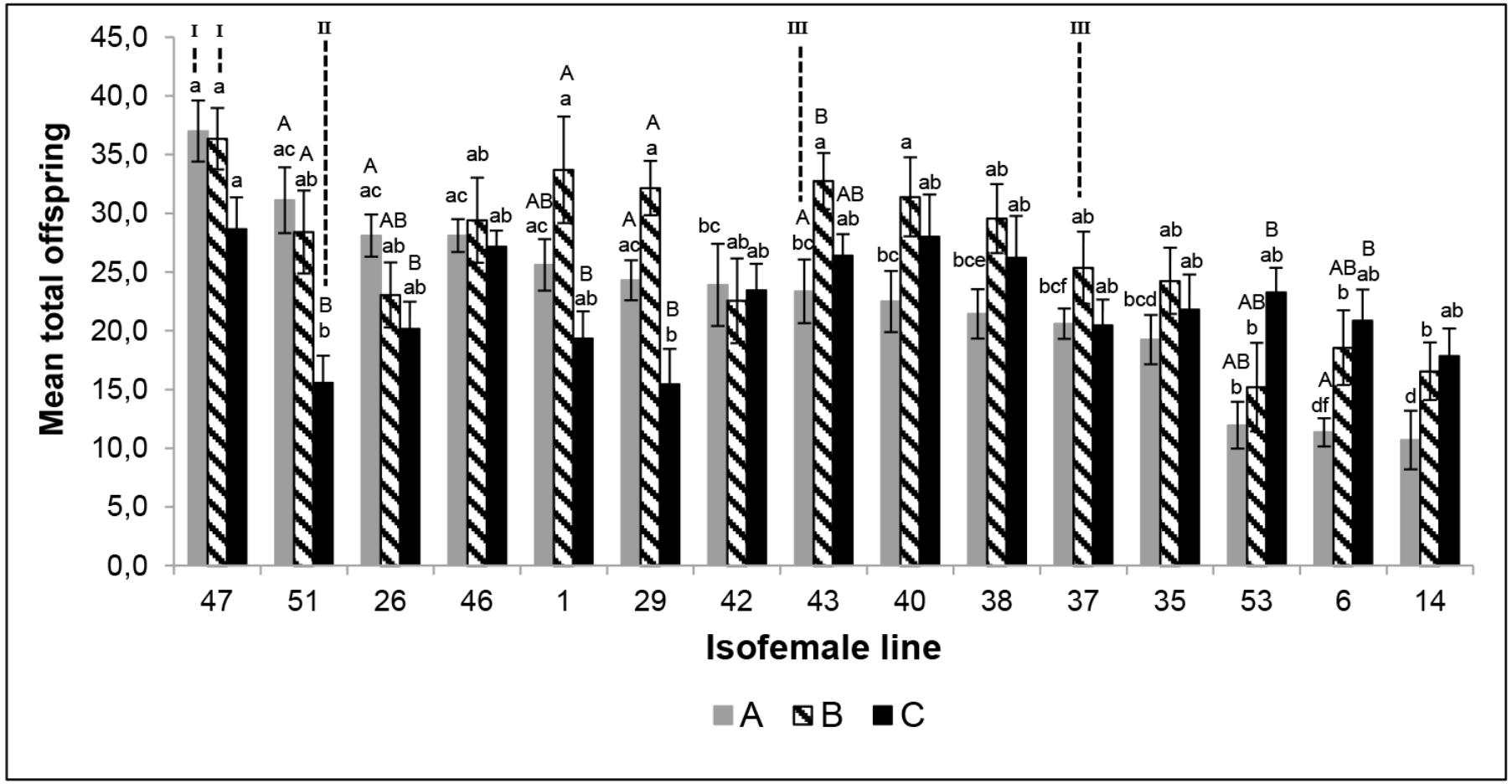

Mean total offspring
45,0
40,0
35,0
30,0
25,0
20,0
15,0
10,0
5,0
0,0
47
51
26
46
1
29
42
43
40
38
37
35
53
6
14
Isofemale line
A
B
C

Tabela 9. Duração média da geração (T), taxa líquida de reprodução (R_o), razão infinitesimal de aumento (r_m) e razão finita de aumento (λ) para duas populações de *Trichogramma pretiosum*. Temperatura: 25 ± 1 °C; UR: 70 ± 10%; fotofase: 14 horas (Bleicher; Parra, 1990b)

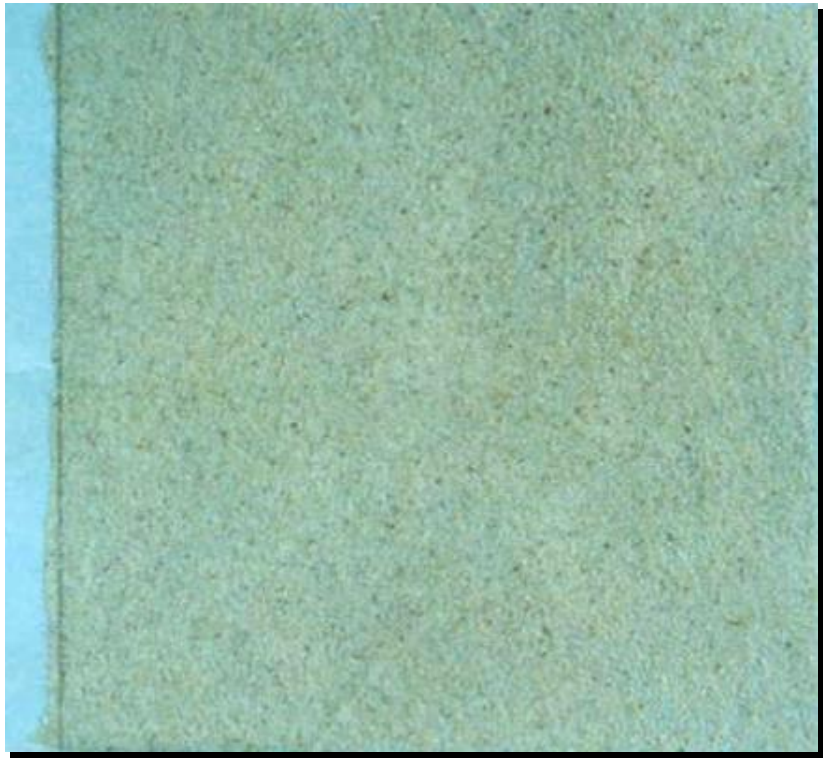
Populações	T (dias)	R_o	r_m	λ
Trichogramma pretiosum (população Iguatu)	15,47	102,13	0,2990	1,3485
Trichogramma pretiosum (população Goiânia)	14,15	44,38	0,2680	1,3074

RESEARCH ARTICLE

Laboratory Performance Predicts the Success of Field Releases in Inbred Lines of the Egg Parasitoid *Trichogramma pretiosum* (Hymenoptera: Trichogrammatidae)

Aloisio Coelho, Jr[1]*, Paul F. Rugman-Jones[2], Carolina Reigada[1], Richard Stouthamer[2], José R. P. Parra[1]

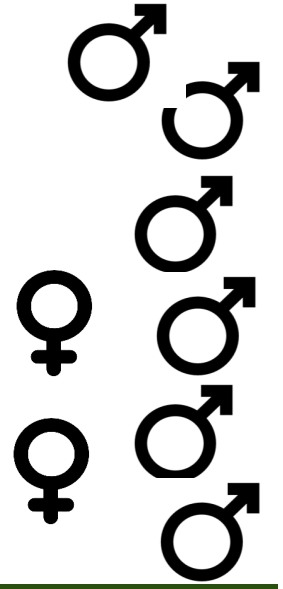
1 Escola Superior de Agricultura "Luiz de Queiroz"- ESALQ/ Universidade de São Paulo – USP, Piracicaba, SP, Brazil, **2** Department of Entomology, University of California, Riverside, California, United States of America



- 1:10 (Parasitoid:egg)
- Pure honey droplet
- Environmental conditions

Low parasitism

ou



Super parasitism

Good Parasitism

1:10

- 1 g of eggs = 36.000 eggs
- 1 cm^2 = 500 eggs
- Sex ratio 0.75

Temperature (°C)	egg-adult developmental time (days)
18	21,14
20	17,00
22	13,58
25	9,51
28	7,15
30	6,90
32	6,46

Laboratório de Biologia de Insetos

OBRIGADO!
Thank you!

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