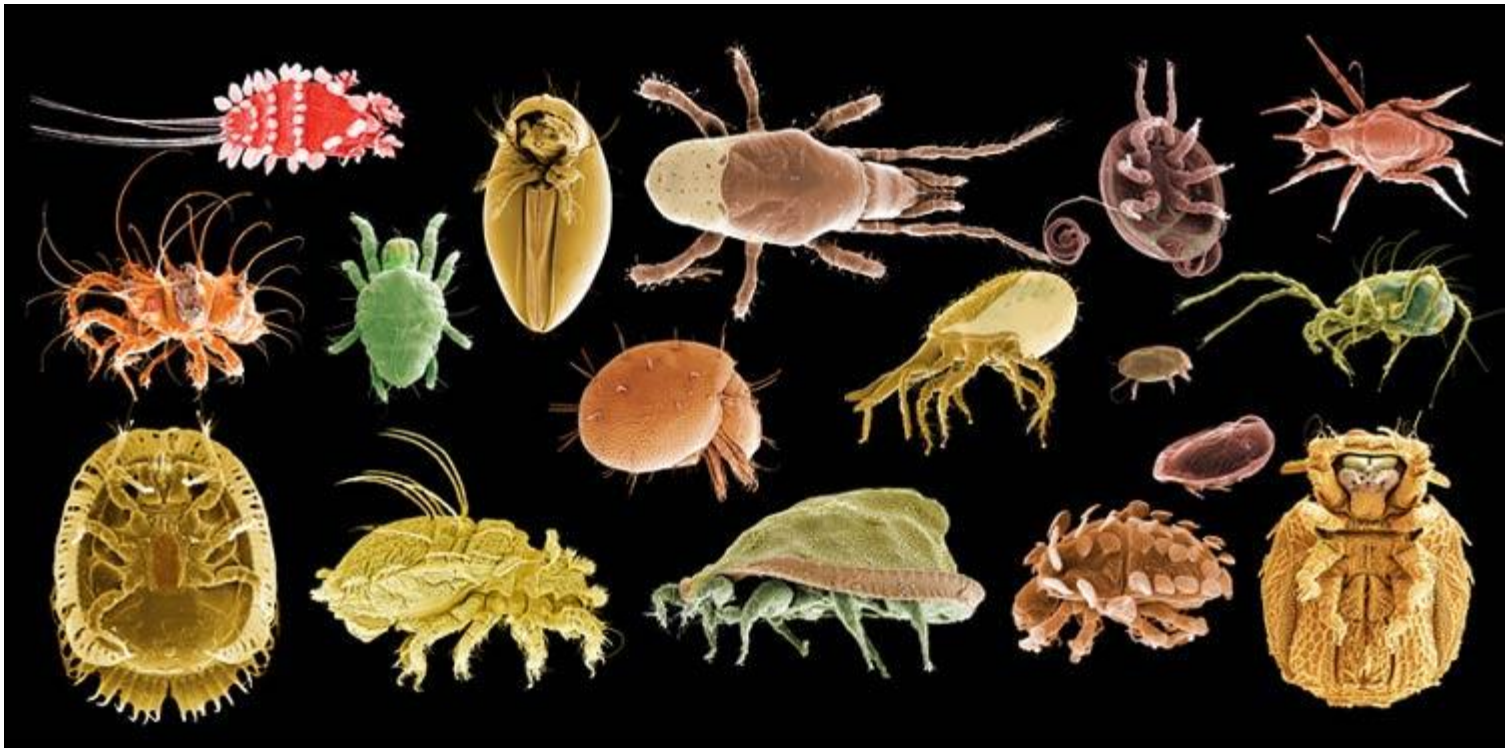
ESALQ

Ácaros de importância agrícola/florestal

LFN0233 - Zoologia e Ambiente
Outubro 2023

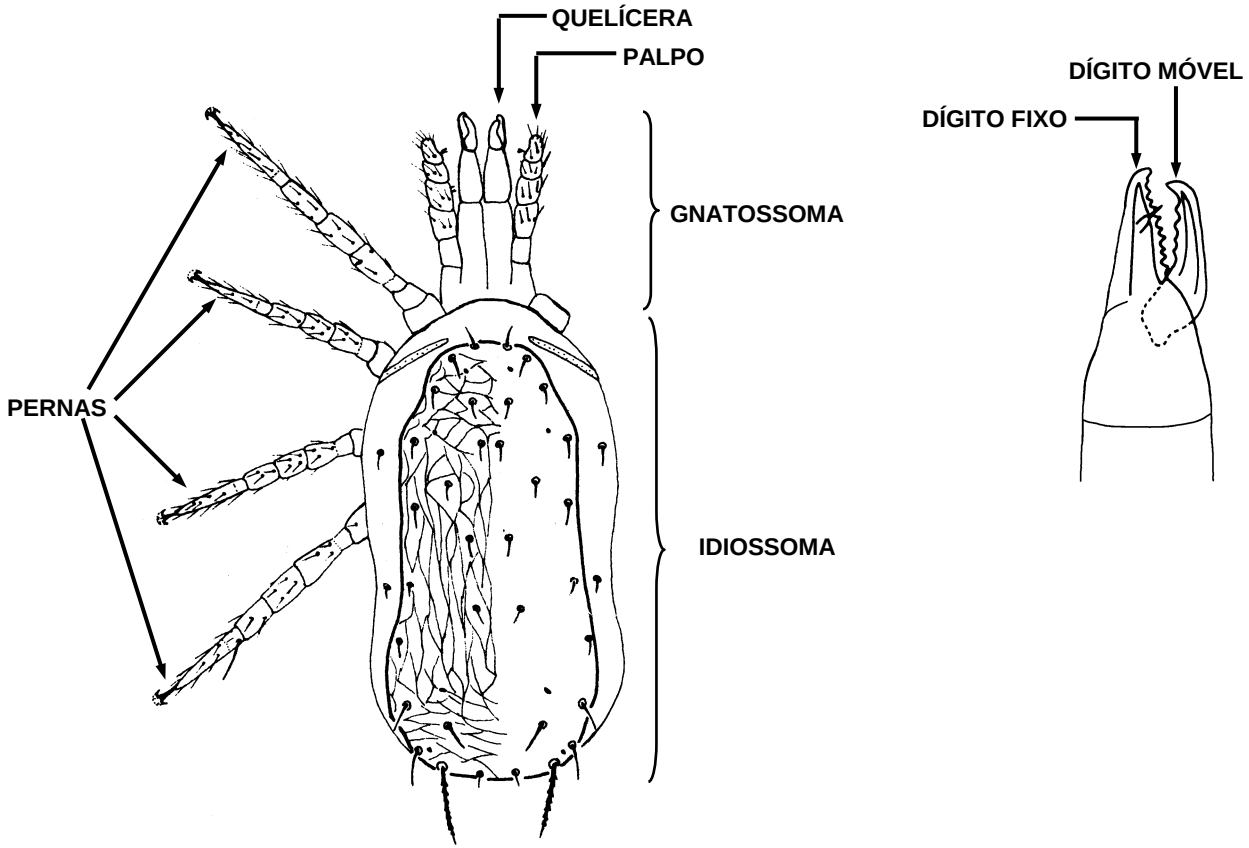
Acari



ATUALMENTE

60.000 espécies descritas

Zhang et al. 2019

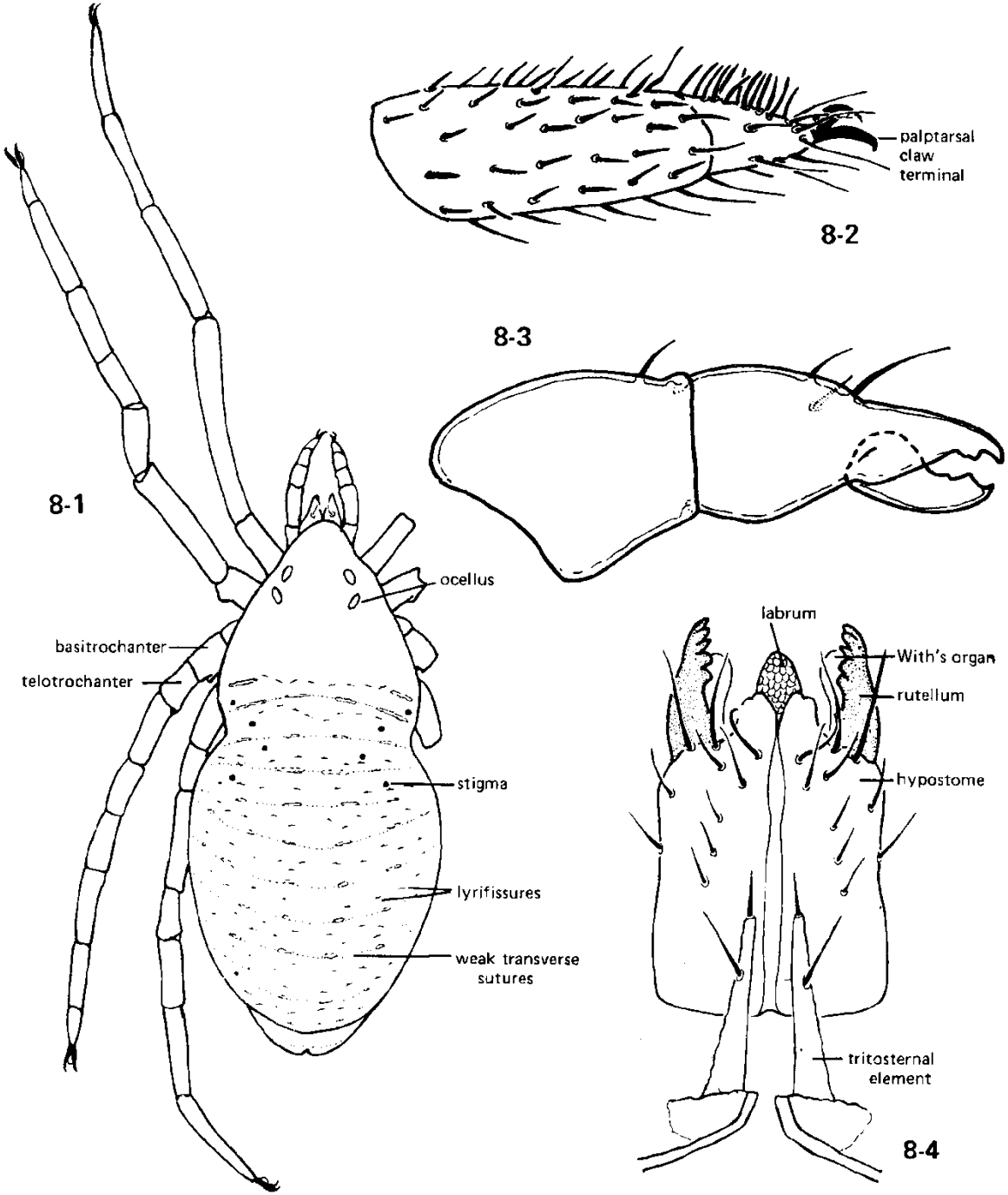


Estruturas e regiões do corpo dos ácaros

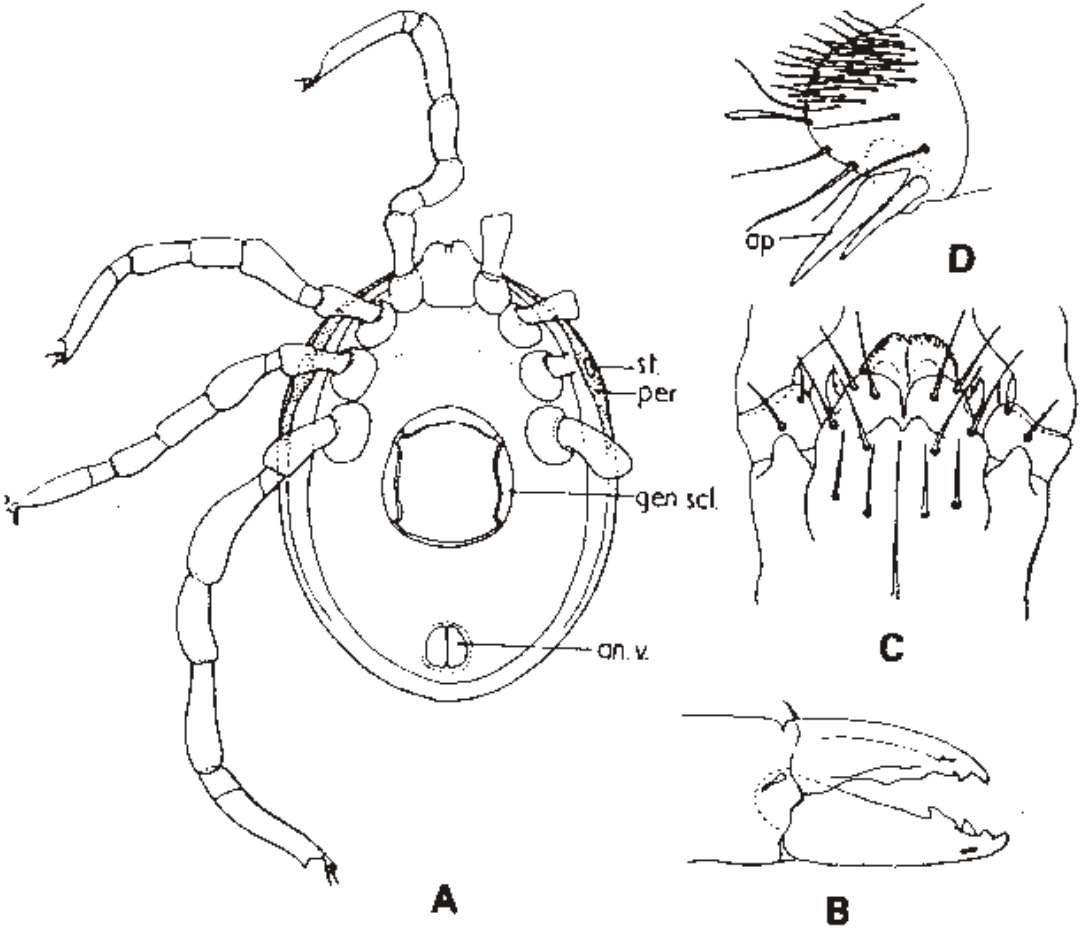
Ologamasidae

Classificação dos ácaros
- 6 ordens -

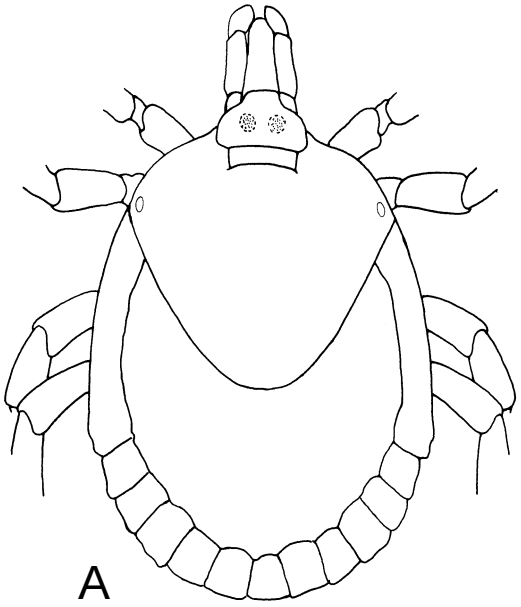
Opilioacarida



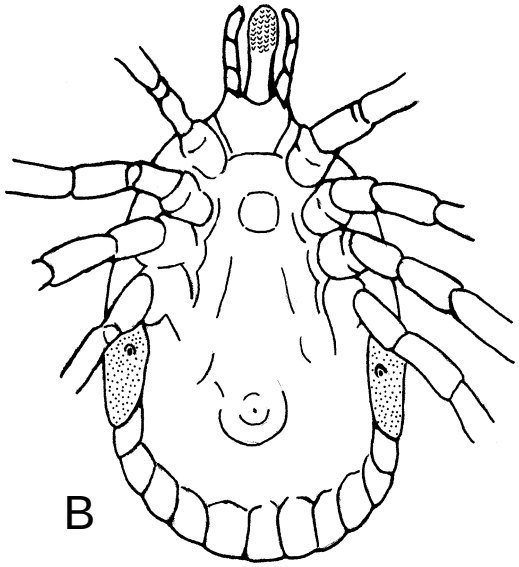
Holothyrida



Ixodida



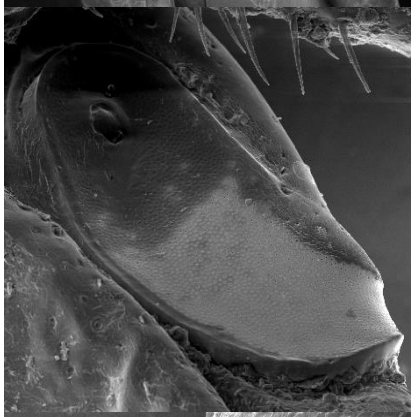
A



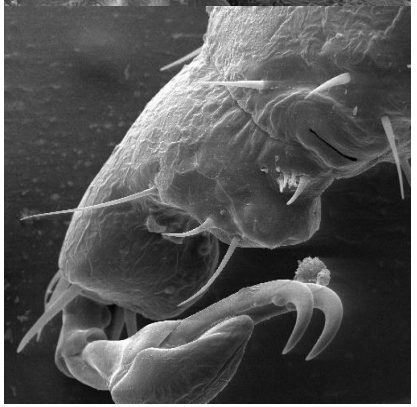
B

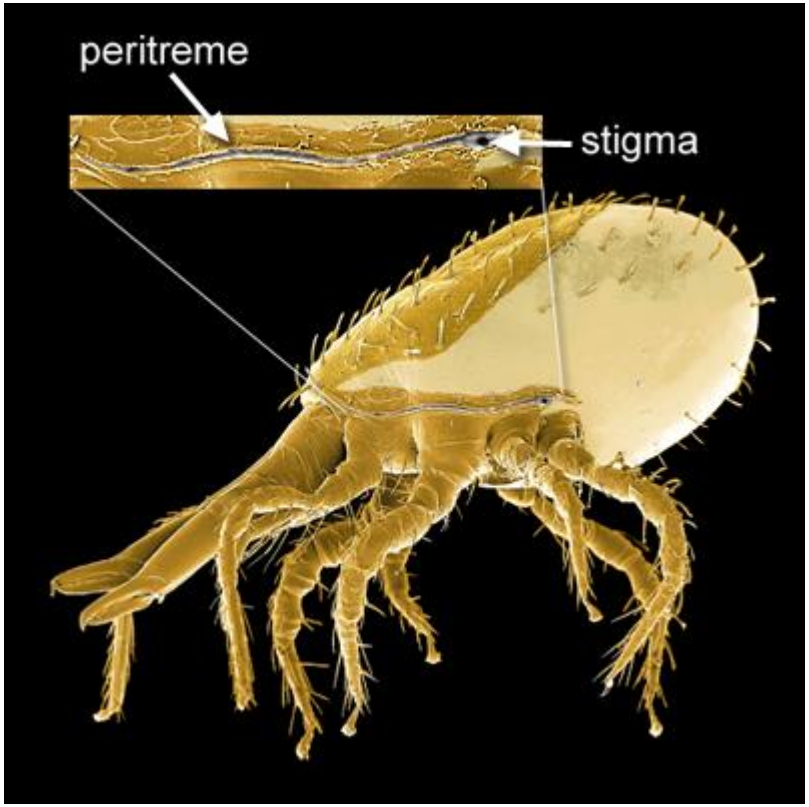
C

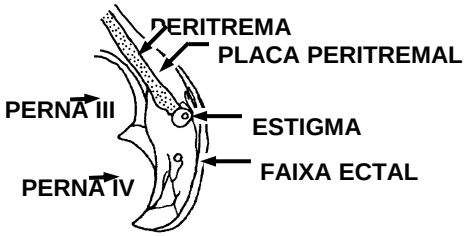
D



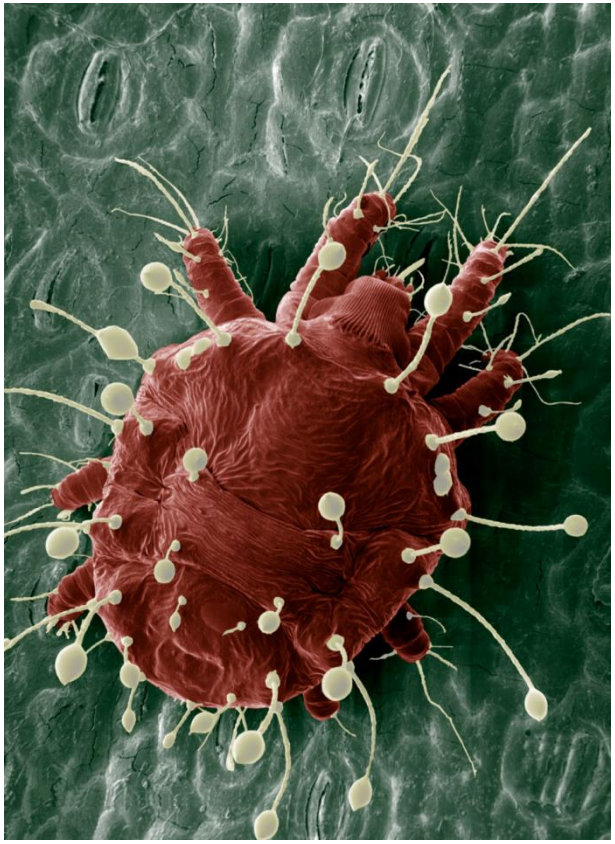
E

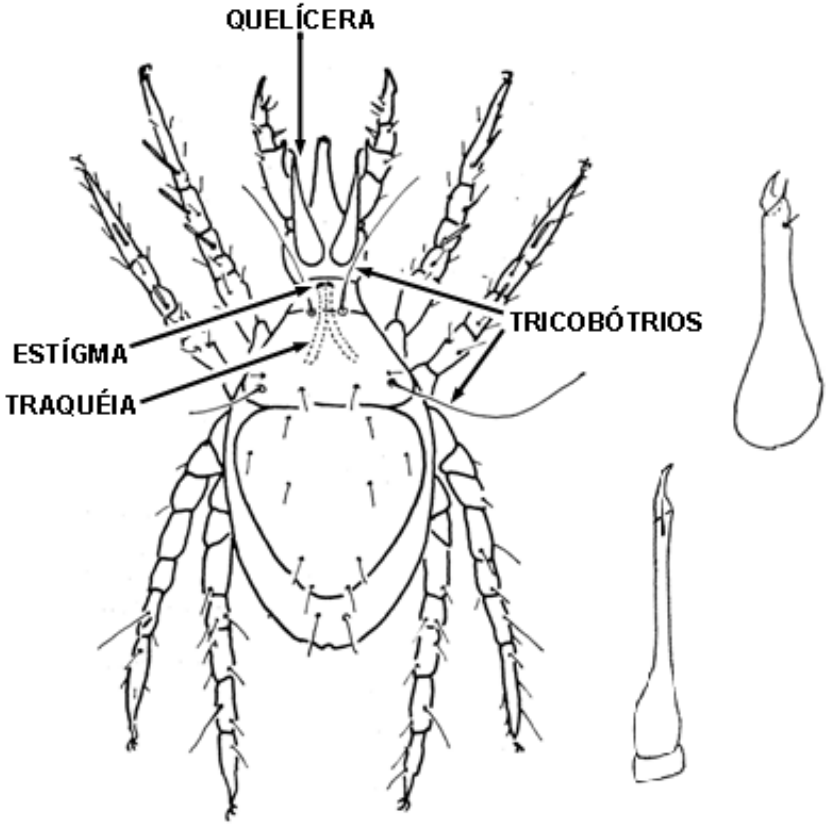




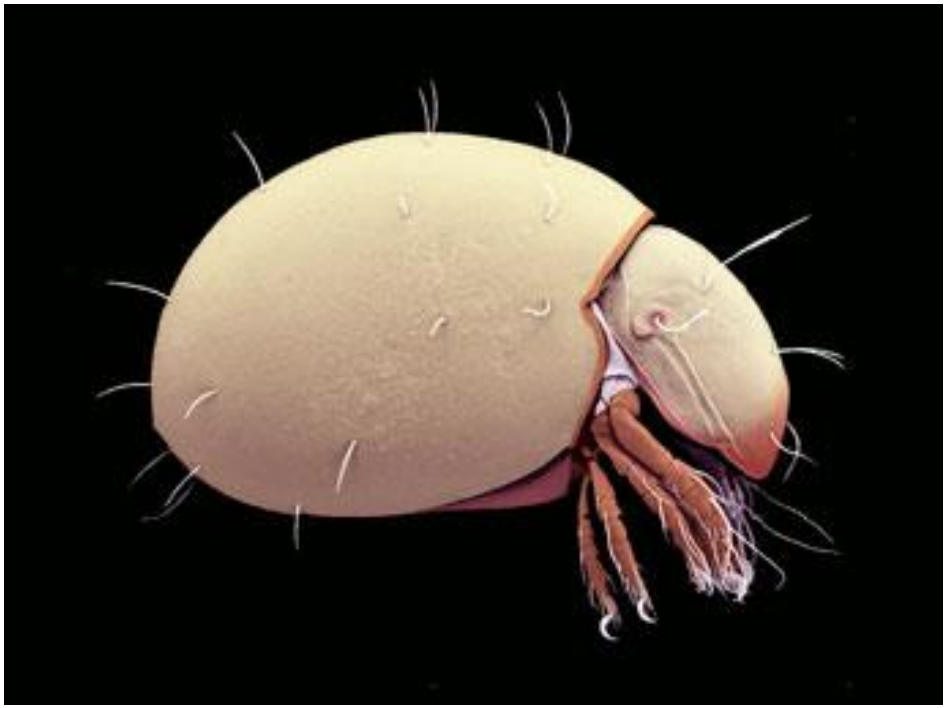


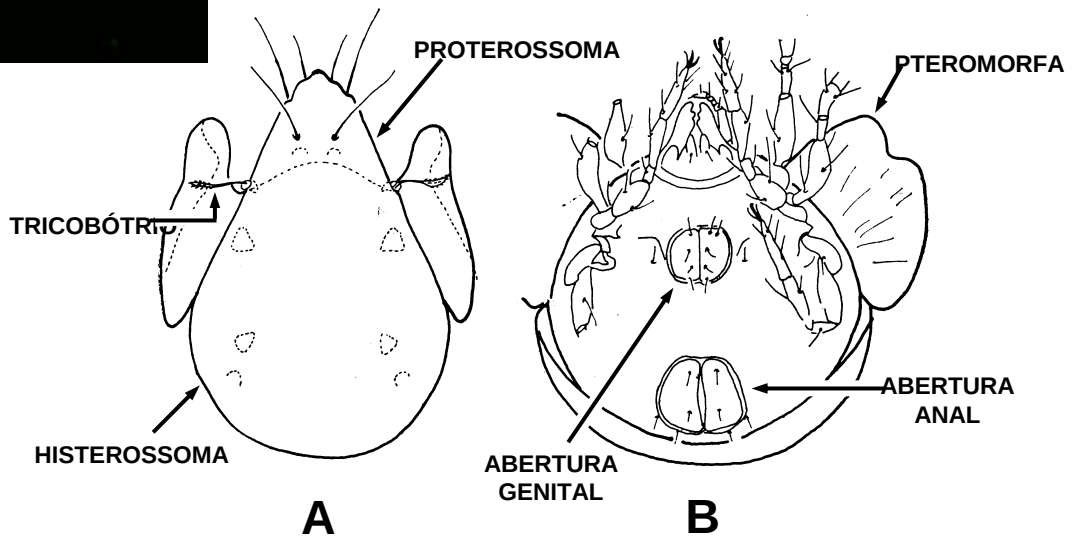
Mesostigmata



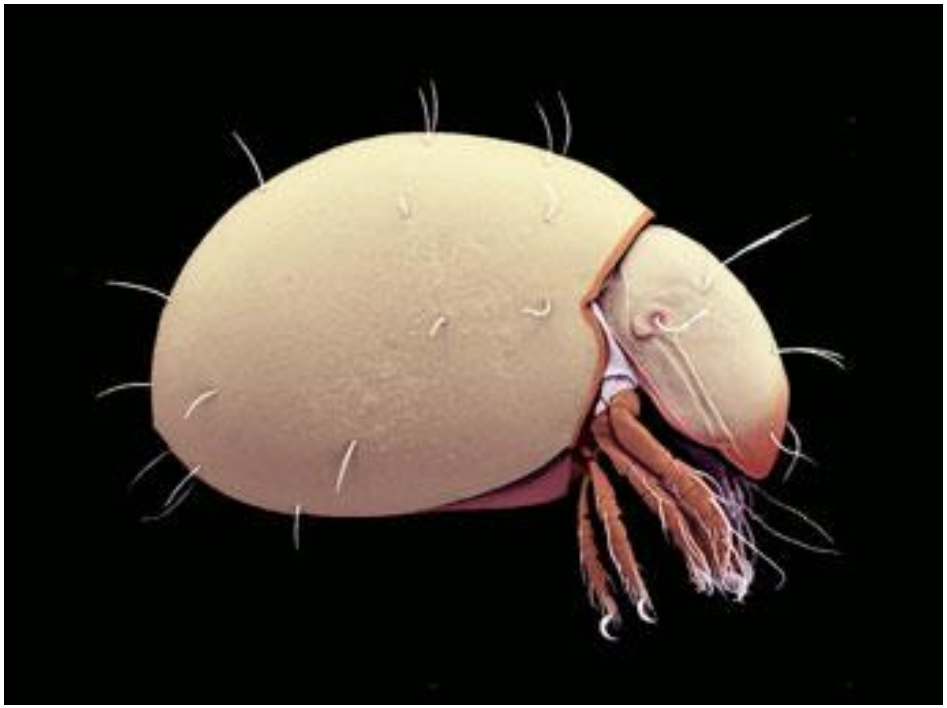


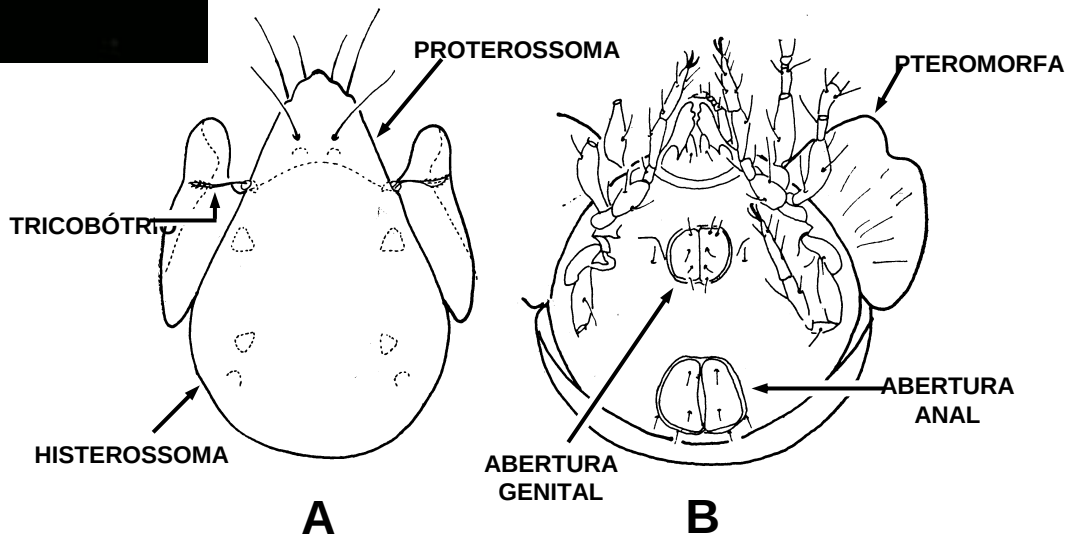
Trombidiformes



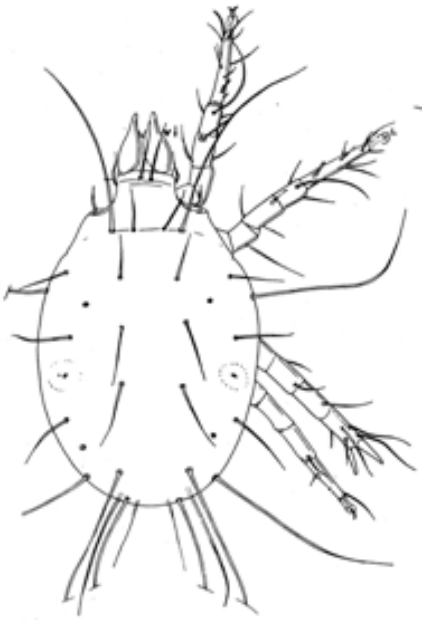


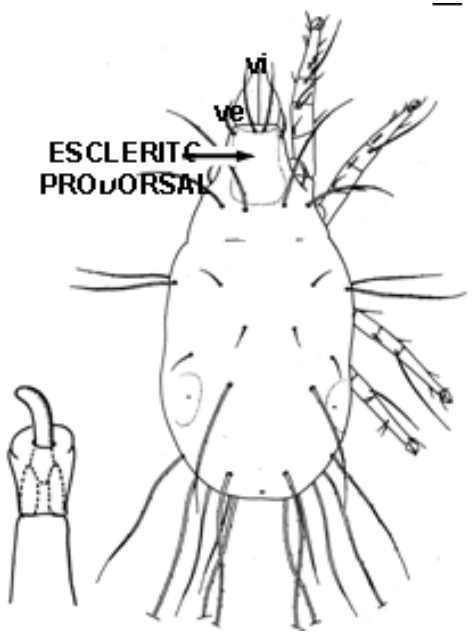
Sarcoptiformes





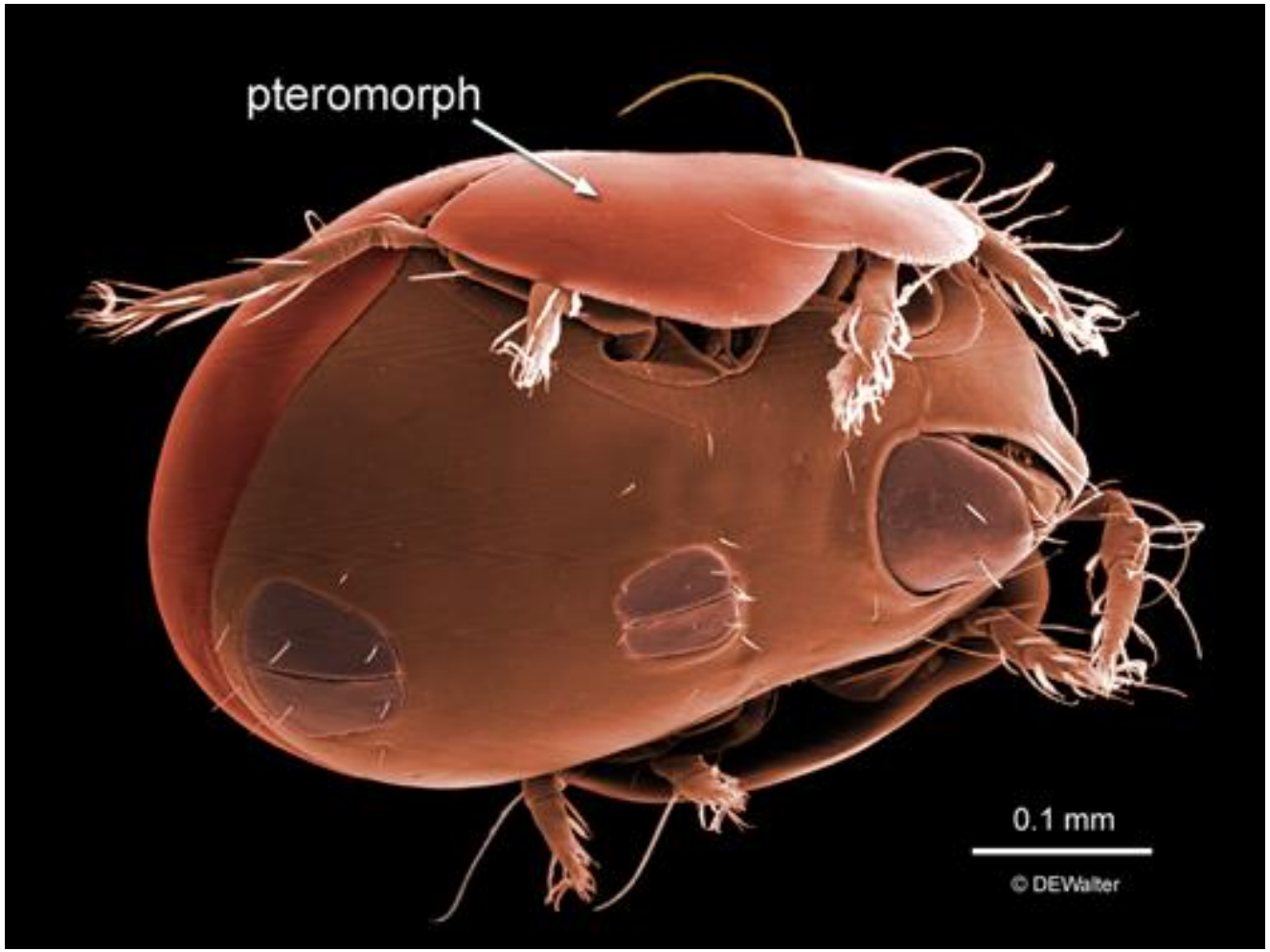
Oribatida (Cryptostigmata)





Sarcoptiformes
Astigmatina

Oribatida



Oribatida

ORIBATIDA

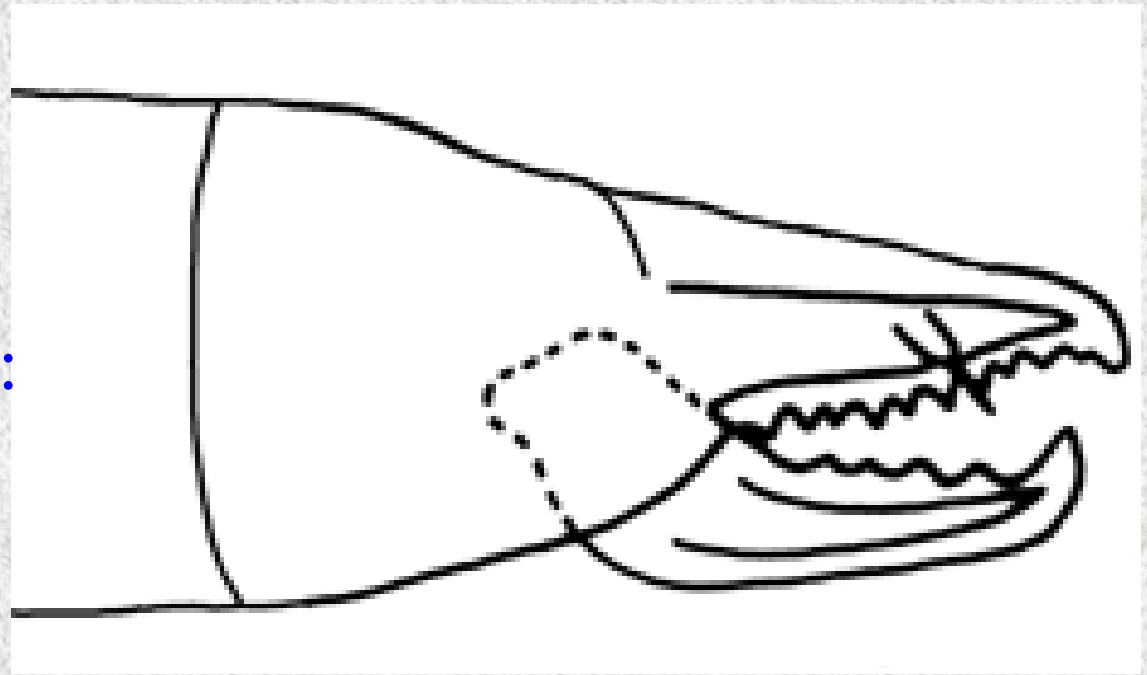
Cultivo Mínimo

Efeitos Negativos dos Ácaros Fitófagos

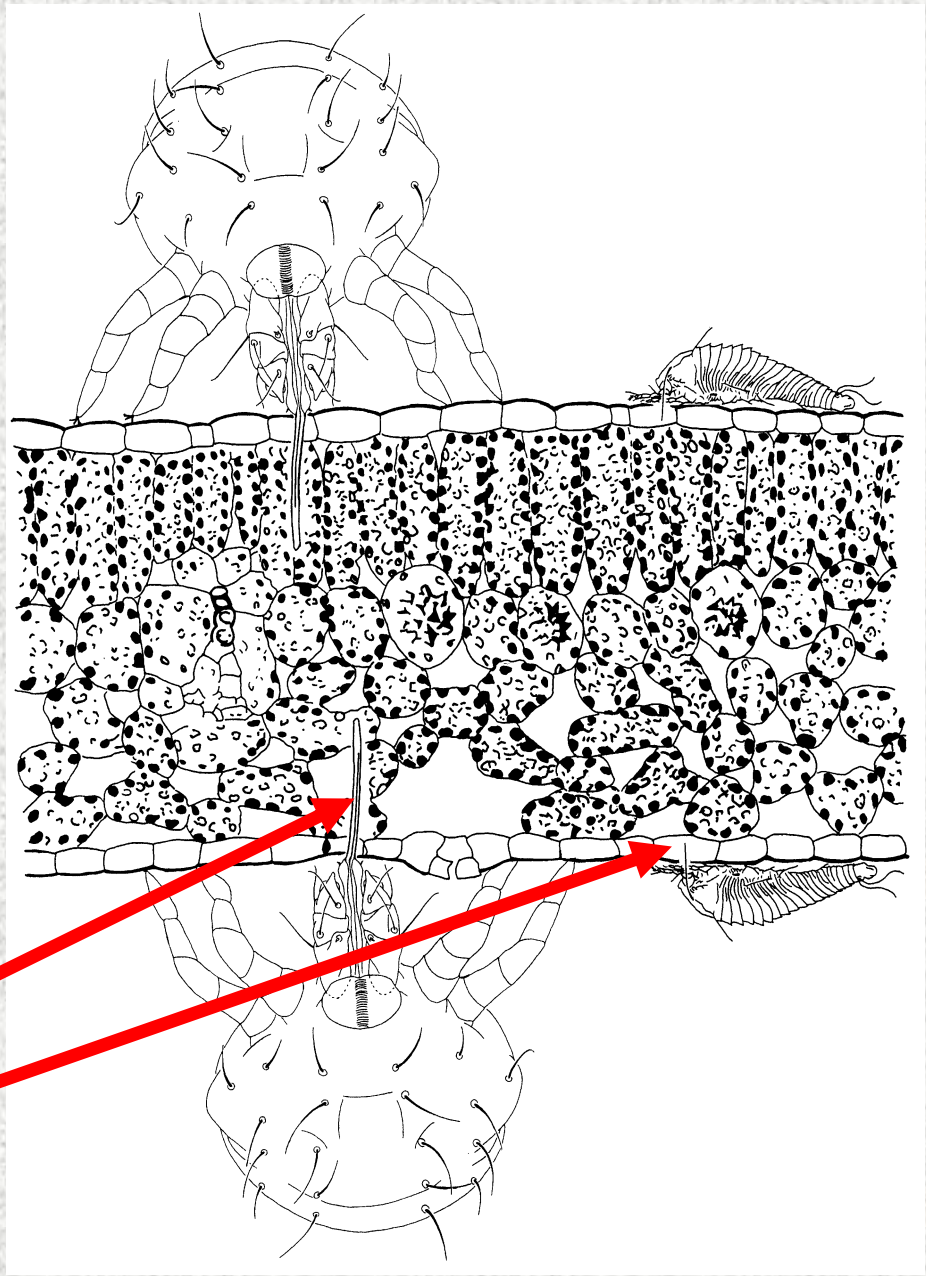
- Pragas
- Vetores
- Facilitadores da ação de patógenos

Alimentação dos ácaros

Predadores, detritívoros:



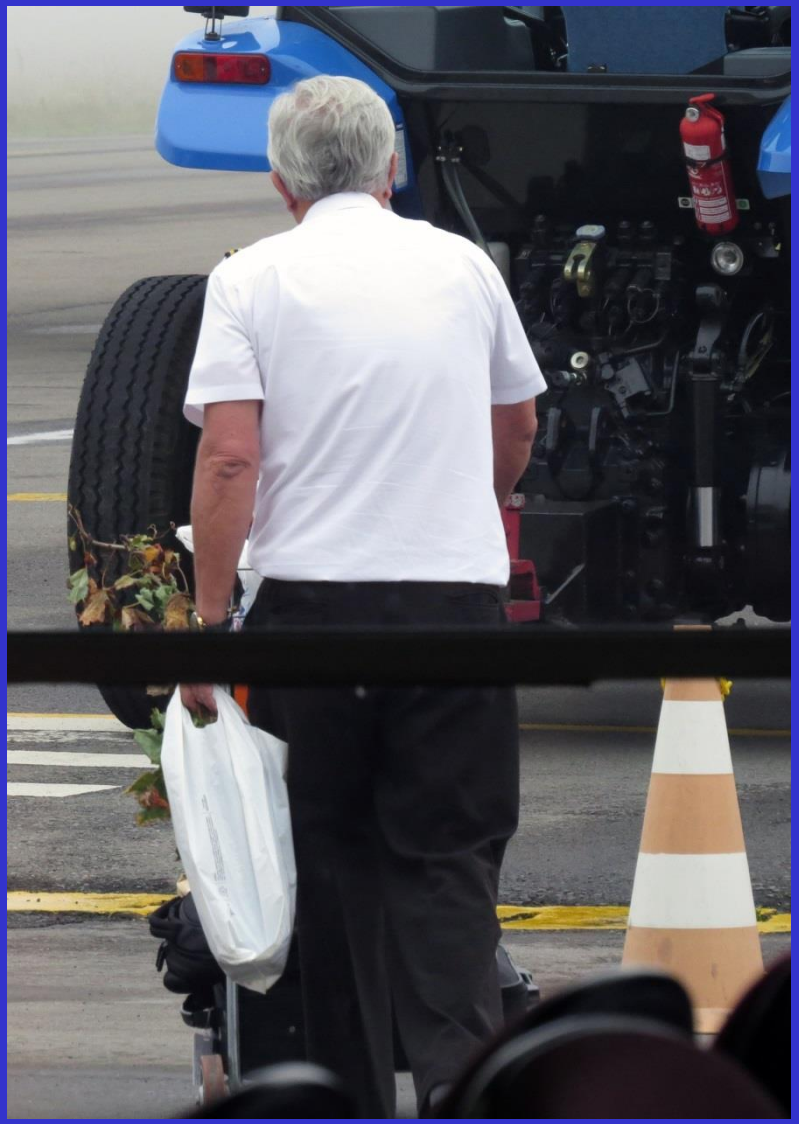
Mutações das quelíceras → Mudança do comportamento alimentar



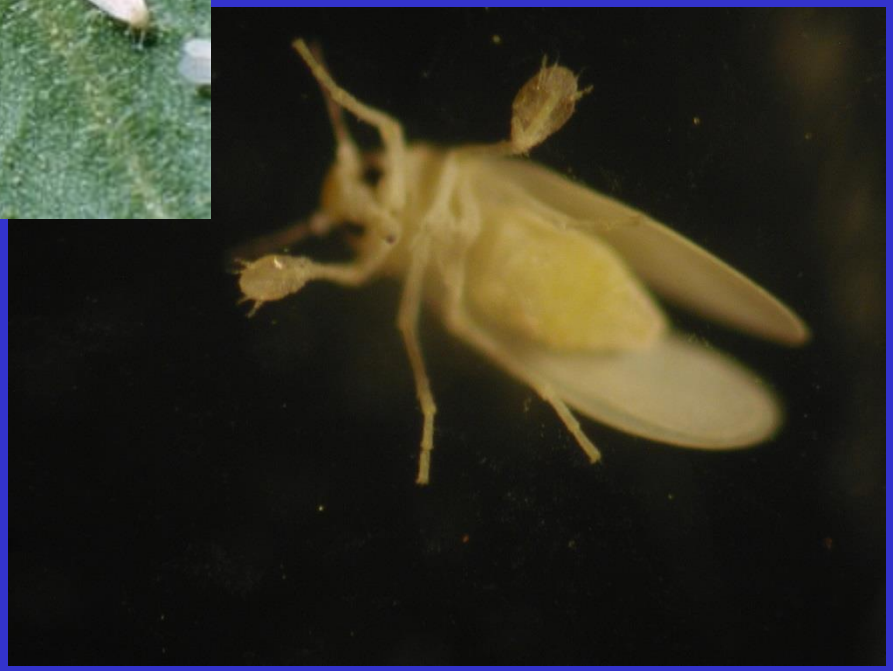
Diferentes formas de quelíceras

Formas de dispersão de ácaros (campo, armazém)

- Vento: diferentes formas
- Vestes de trabalhadores
- Material de plantio
- Forese
- Caminhamento
- Enxurrada (ácaros de solo)



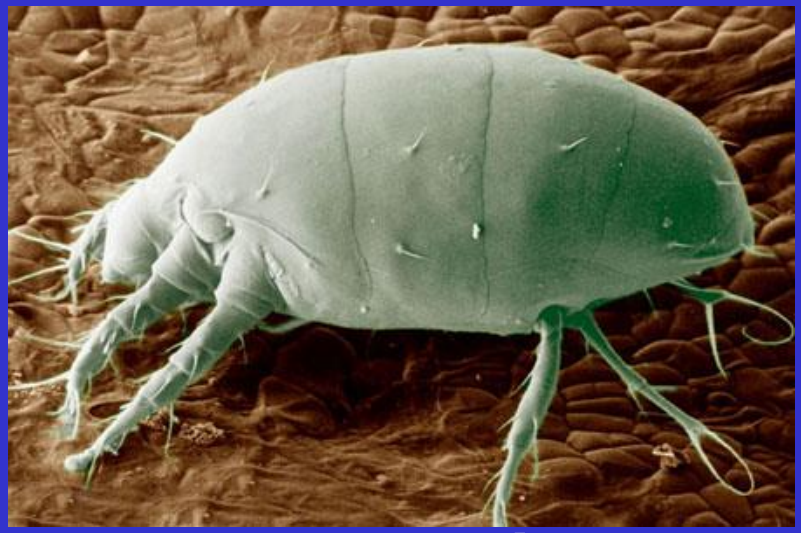
Dispersão pelo ser humano



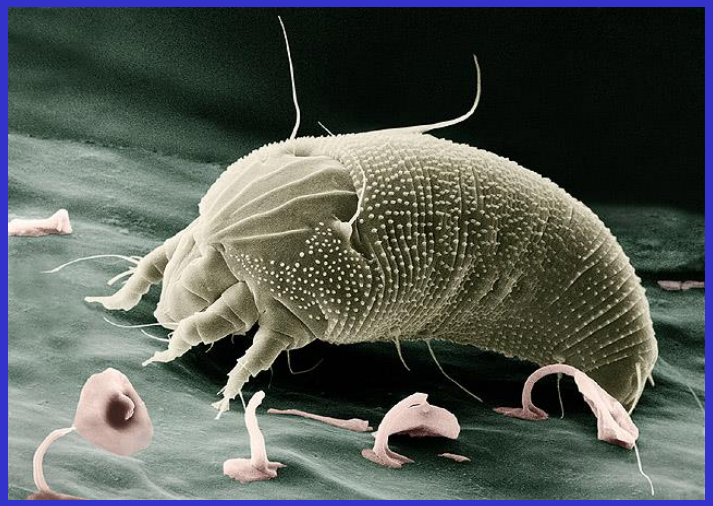
Forese em mosca-branca

Principais Famílias de Ácaros Fitófagos

Tetranychidae

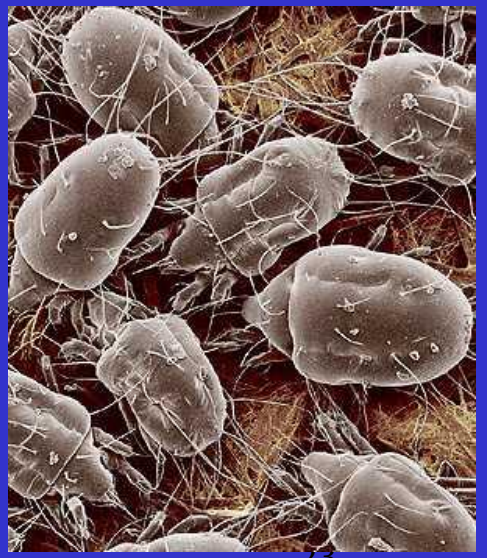


Tarsonemidae



Eriophyidae

Tenuipalpidae



Acaridae

Efeitos da presença de ácaros fitófagos

- Redução de produção e da qualidade
- Custo do controle
- Importância quarentenária na exportação
- Problemas de intoxicação

Espécies mais importantes de ácaros fitófagos no Brasil

- **Ácaro branco dos grãos armazenados - Acaridae**
- **Ácaro-rajado (*Tetranychus urticae*) – Tetranychidae**
- **Ácaro-da-leprose (*Brevipalpus yothersi*) - Tenuipalpidae**
- **Ácaro-branco (*Polyphagotarsonemus latus*) - Tarsonemidae**
- **Ácaro da falsa ferrugem dos citros (*Phyllocoptruta oleivora*) - Eriophyidae**
- **Microácaro do tomateiro (*Aculops lycopersici*)**

Espécies mais importantes de ácaros fitófagos no Brasil

- **Ácaro plano vermelho da seringueira (*Tenuipalpus heveae)* - Tenuipalpidae**
- **Microácaro da face superior da seringueira (*Calacarus heveae*) - Eriophyidae**
- **Ácaro vermelho da erva mate - Tetranychidae**

Sintomas

- Pontos brancos
- Manchas amarelas
- Redução fotossintética
- Queda prematura das folhas
- Presença de teias

Ácaro-rajado

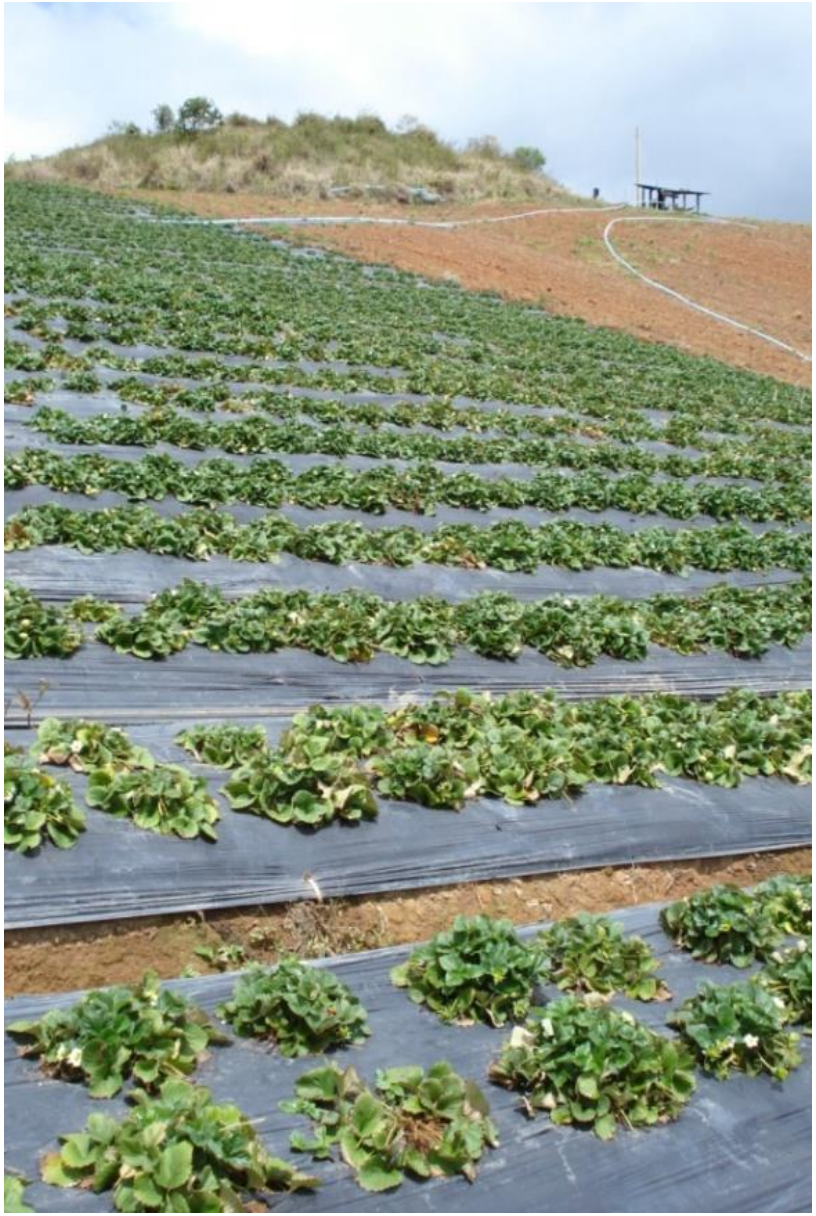
Danos

Folhas na Parte Mediana da Planta

Ácaro-rajado - SOJA

Danos

Tetranychus urticae - Feijão



Tetranychus urticae
Morango

Tetranychus urticae
Mamão

Foto: Hermes Peixoto Santos Pinho

Novo problema ácaro rajado no Espírito Santo e Bahia

Grandes perdas!!!!

New problem caused by *Tetranychus urticae*

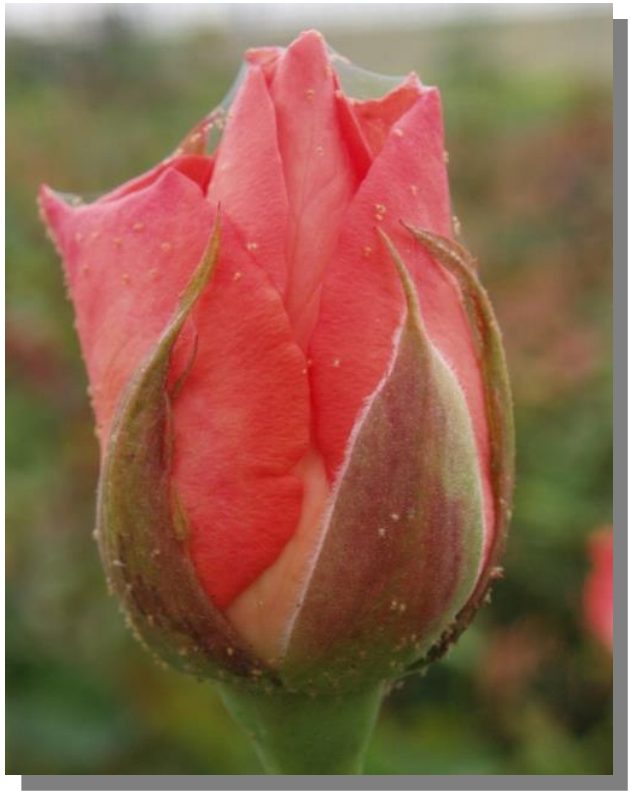
Diapause-like process

- Change in color
- Change in cuticular structures
- Change in behavior

Triggering Factors??

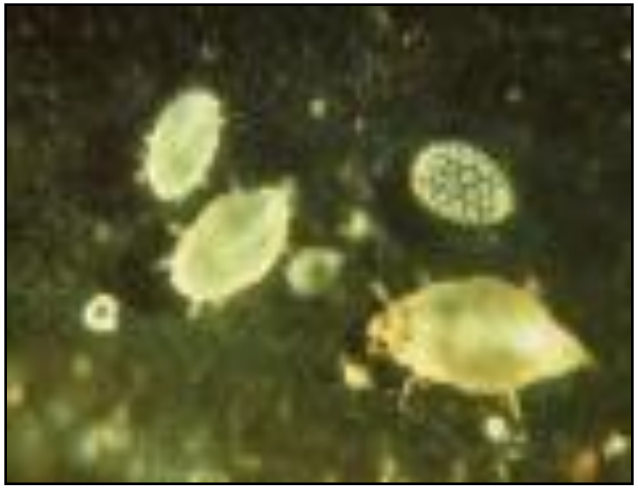
Tetranychus urticae

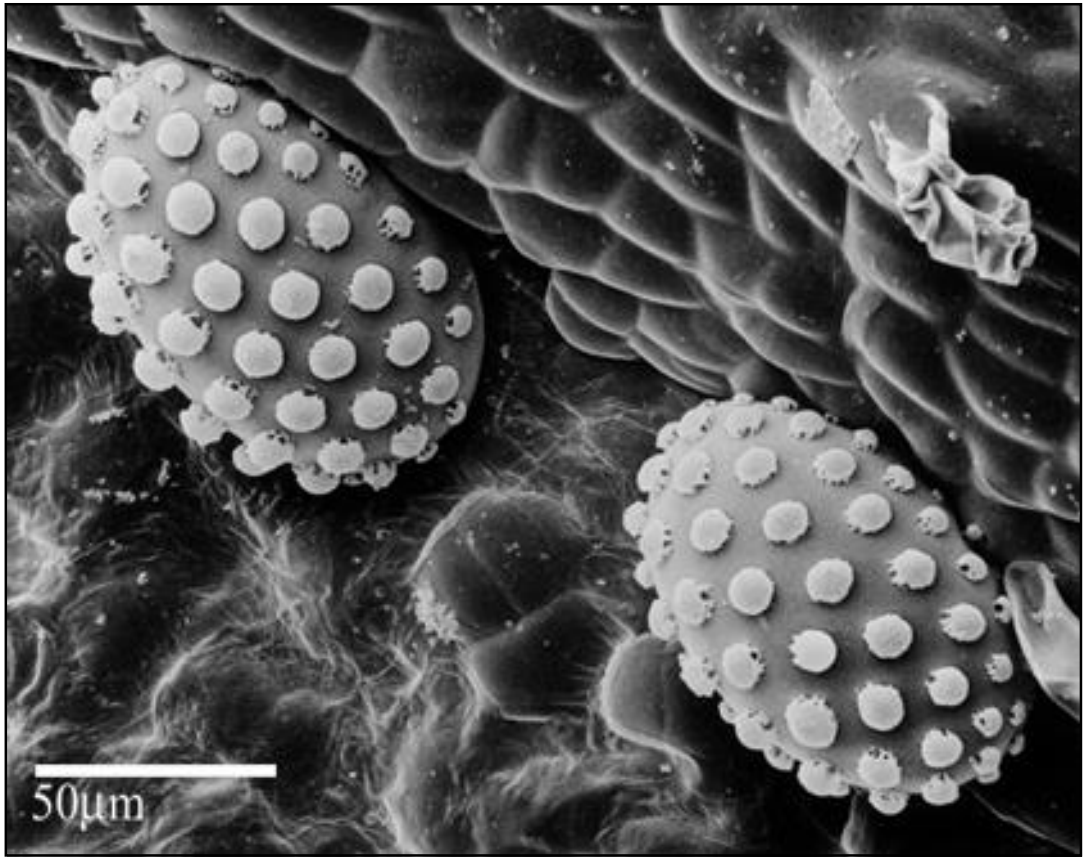
Ornamentais



Tetranychus urticae
Ornamentais

Polyphagotarsonemus latus
ÁCARO BRANCO
Tarsonemidae





Sintomas

- Prateamento ou bronzeamento da folhas
- Encarquilhamento
- Deformações

Ácaro-branco

Folhas no Ponteiro da Planta

Ácaro-branco (*Polyphagotarsonemus latus*)
Acari: Tarsonemidae

Danos

Folhas: bronzeamento face abaxial

Feijão

Foto: Eliane Dias Quintela

Ácaro-branco (*Polyphagotarsonemus latus*)
Acari: Tarsonemidae

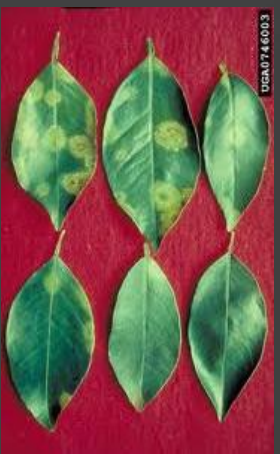
Polyphagotarsonemus latus

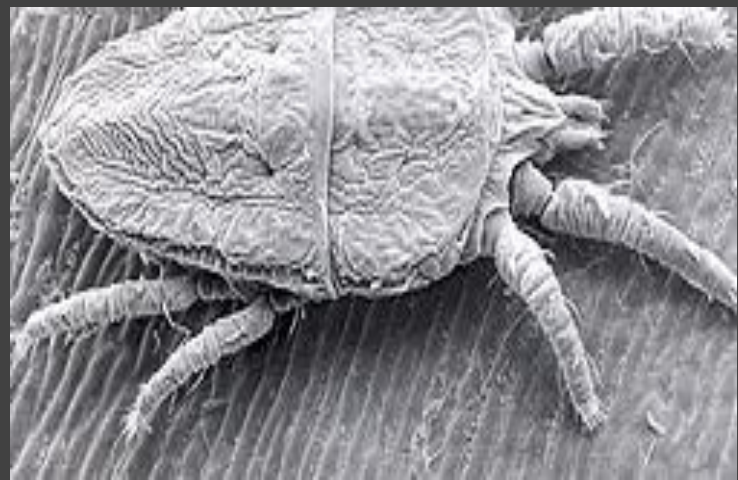
Mamão

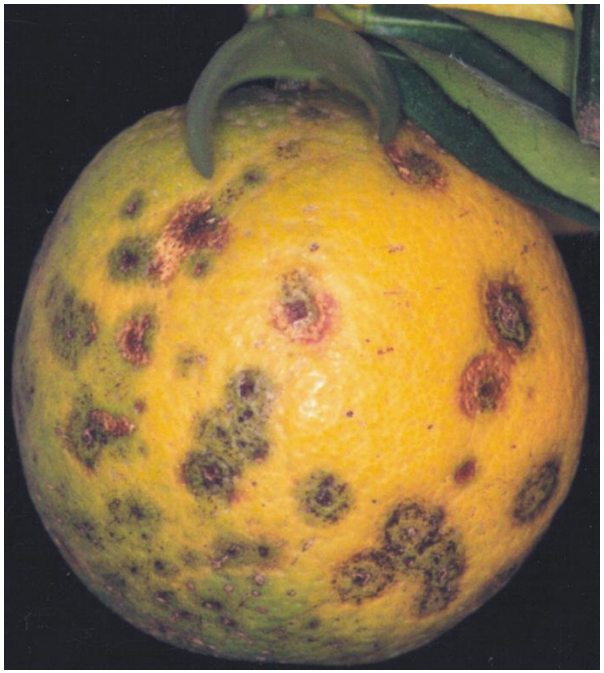
Polyphagotarsonemus latus

Berinjela

Ácaro da Leprose
Brevipalpus yothersi
Tenuipalpidae







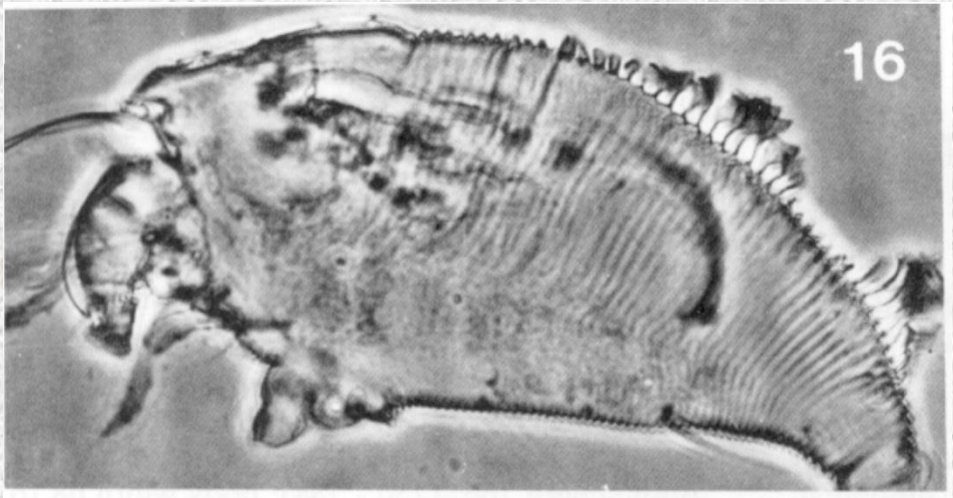
Ácaro-da-leprose
Brevipalpus yothersi

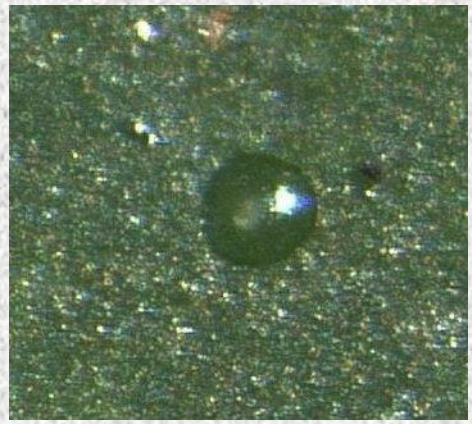
FIGURE 1 – Leprosis symptoms found in sweet oranges in the state of Tabasco. A. Leaf and fruit lesions of Valencia sweet orange with leprosis (Cunduacan). B. Necrotic lesions on a stem of Valencia sweet orange (Huimanguillo). C and D. Different aspects of lesions on the leaves of Valencia sweet orange (Huimanguillo).

Ácaro da lichia - *Aceria litchii* Eriophyidae

Seringueira

Calacarus heveae
Microácaro-da-face-superior-da seringueira

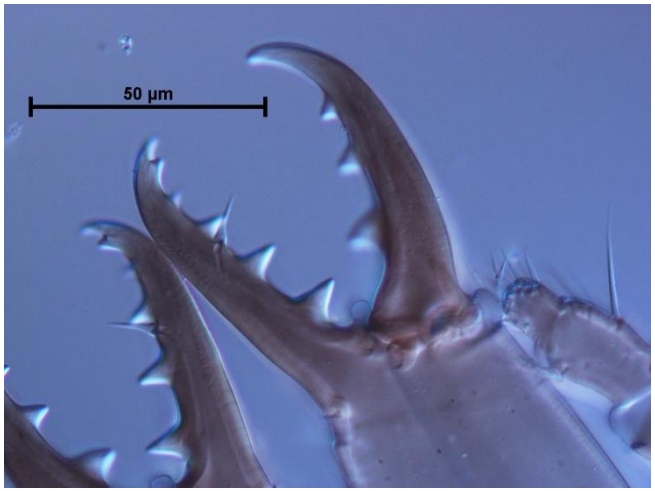




Tenuipalpus heveae
Ácaro-plano-vermelho-da-seringueira

ÁCAROS
(FITÓFAGOS X PREDADORES)

- ✓ **Movem-se rapidamente**
- ✓ **Aspecto brilhante**
- ✓ **Não fazem teia**
- ✓ **Não se alimentam da planta**
- ✓ **Hábito alimentar**



MESOSTIGMATA

Phytoseiidae

Laelapidae

Macrochelidae

Rhodacaridae

Parasitidae

Ascidae

...

BioControl (2018) 63:39–59
https://doi.org/10.1007/s10526-017-9801-4

CrossMark

Biological control using invertebrates and microorganisms: plenty of new opportunities

Joop C. van Lenteren · Karel Bolckmans · Jürgen Köhl · Willem J. Ravensberg · Alberto Urbaneja

COMERCIALIZAÇÃO
Mundo

- ✓ **50 espécies**
  - ✓ **43 parte aérea das plantas**
    - ✓ **41 Phytoseiidae**
  - ✓ **7 solo**
    - ✓ **5 Laelapidae**
    - ✓ **1 Macrochelidae**
    - ✓ **1 Parasitidae**

KOPPERT BIOLOGICAL SYSTEMS

ARBICO organics

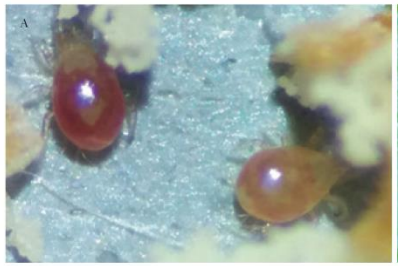
biobest SUSTAINABLE CROP MANAGEMENT

Bioline AgroSciences

COMERCIALIZAÇÃO - Brasil

5 espécies - parte aérea da planta

Amblyseius tamatavensis
Neoseiulus californicus
Neoseiulus idaeus
Neoseiulus barkeri
Phytoseiulus macropilis



1 espécie – solo

Stratiolaelaps scimitus
Laelapidae

BRASIL

Neoseiulus californicus

Phytoseiulus macropilis

Neoseiulus idaeus

MORANGO

Hoje

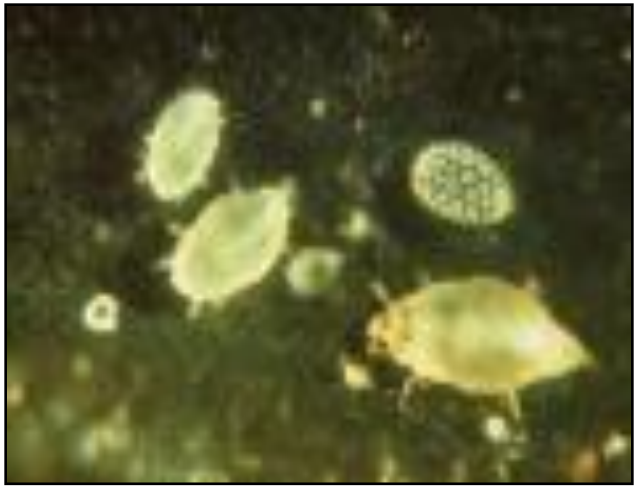
Químico

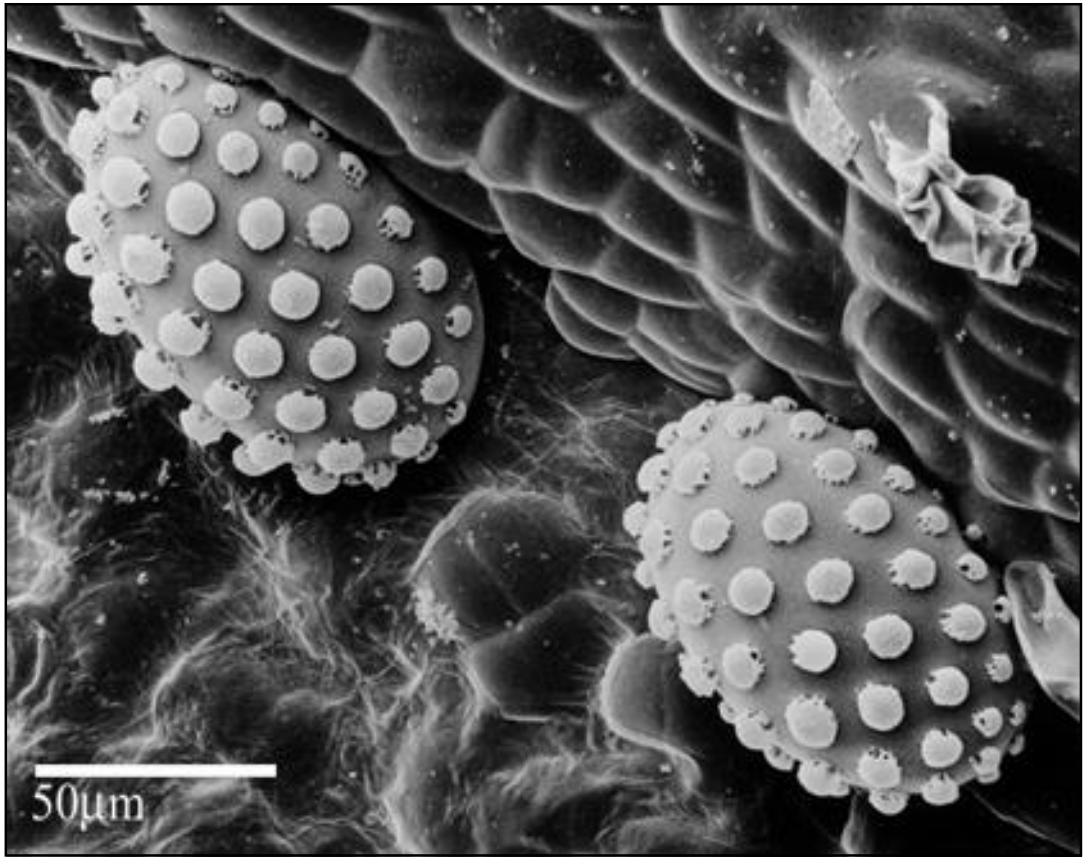
Biológico

AGROTÓXICOS COMPATÍVEIS
(*Neoseiulus californicus*)

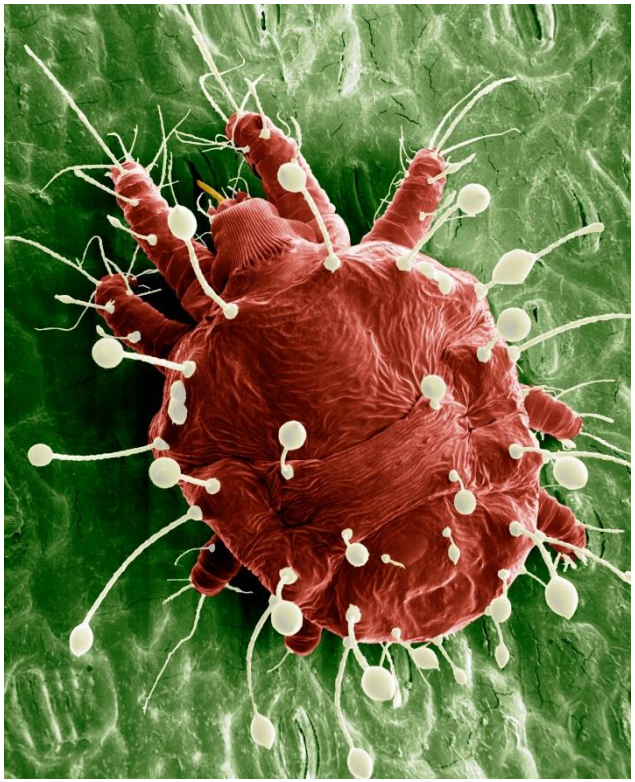
Acaricidas	Inseticidas	Fungicidas
•propargite	•tiametoxam	•azoxistrobina
•flufenoxurom	•deltametrina	•tebuconazol
•fenpropatrina	•fenpropatrina	•clorotalonil
•cihexatin	•buprofezina	•imibenconazol
•diafentiurom	•espiromesifeno	•iprodiona
	•espinosade	•triforina
	•ciromazina	•metiram+piraclostrobina
		•boscalida

Polyphagotarsonemus latus
ÁCARO BRANCO





Phytonemus pallidus
ÁCARO DO ENFEZAMENTO



Raoiella indica

Ácaro vermelho das palmeiras

Neoseiulus barkeri

Mosca branca

Amblyseius swirskii

NÃO TEM NO BRASIL

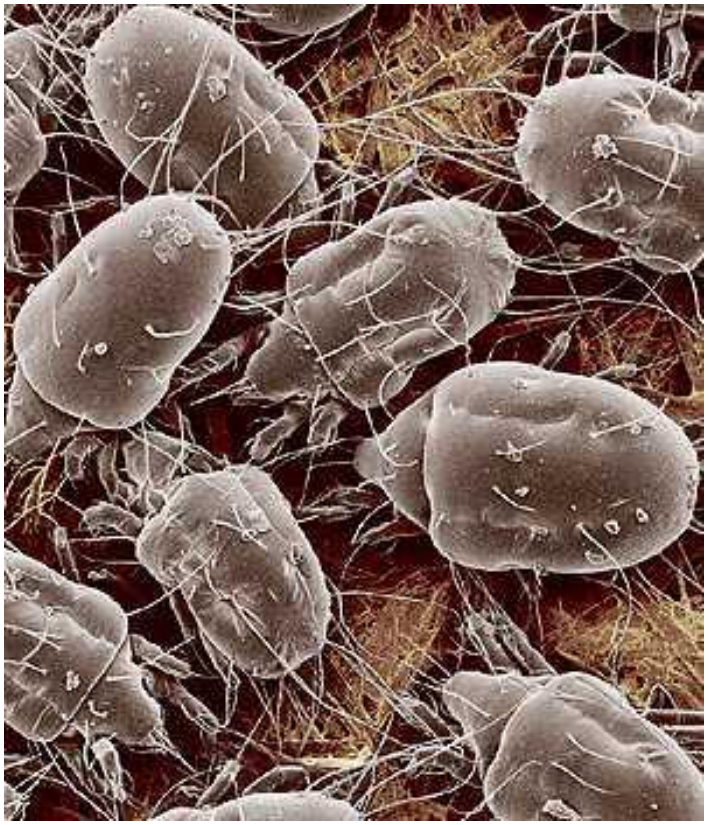
Amblydromalus limonicus

Amblyseius tamatavensis

Comercializado no Brasil

Produção mais simples

vermiculita

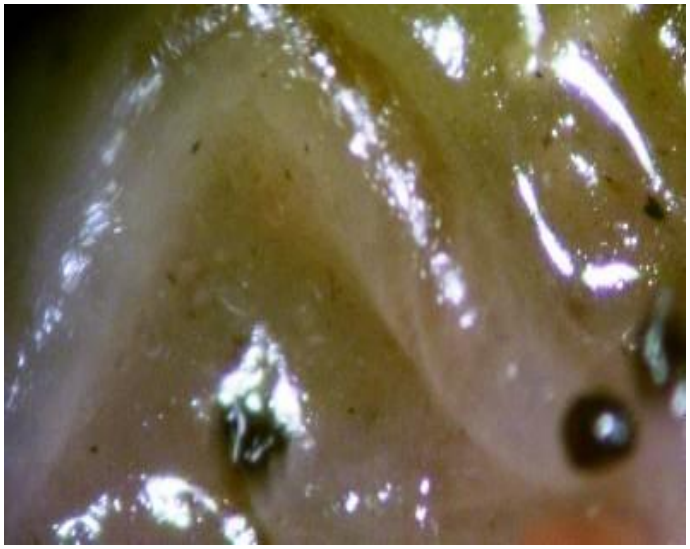


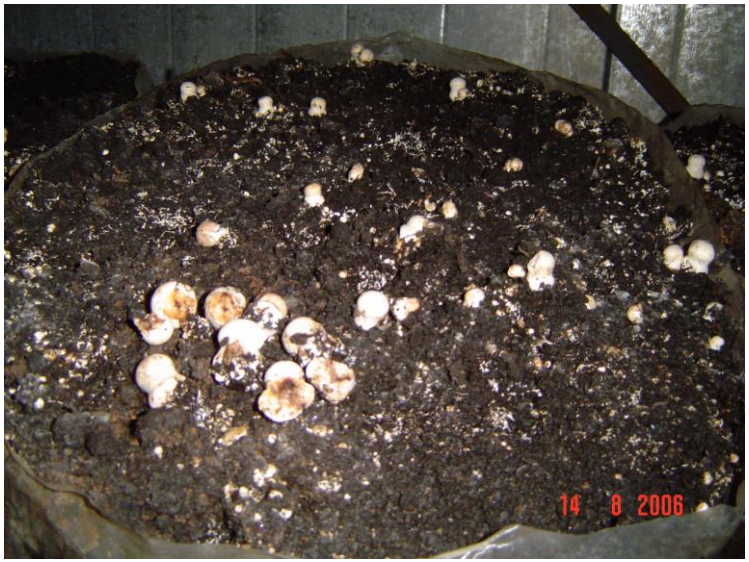
Acaridae

Tripes

Ácaros predadores
Mesostigmata
Cultivos agrícolas ????

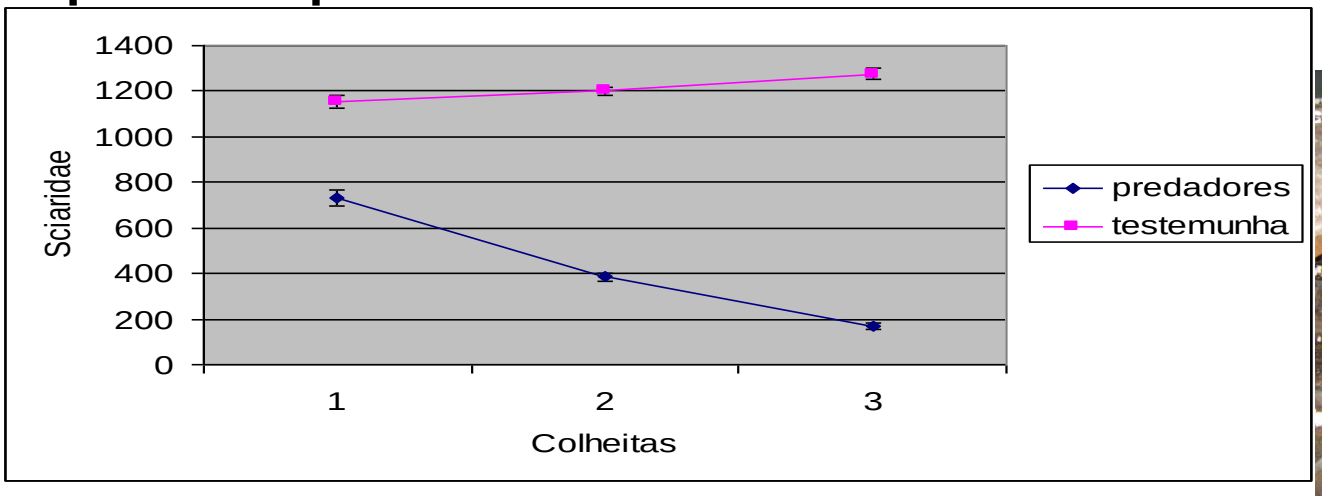
Fungus gnat





Stratiolaelaps scimitus

Número de *B. matogrossensis* adultos capturados por armadilha



Produção de cogumelos (em gramas)

Tratamentos	Categoria de danos			
	Nenhum	Leves	Médios	Severos
Liberação *S. scimitus*	11.794	408	483	159
Testemunha	5.465	1.787	945	445

Produtividade

Testes	Tratamentos	Produtividade
1	Duas liberações de *S. scimitus*	11.272
	Testemunha	8.165
2	Uma liberação de *S. scimitus*	12.844
	Testemunha	8.642

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The predatory mite Stratiolaelaps scimitus as a control agent of the fungus gnat Bradysia matogrossensis in commercial production of the mushroom Agaricus bisporus

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Online Publication Date: 01 July 2009

Resultado

S. scimitus - comercializado

NEMATOIDE
Pratylenchus brachyurus
SOJA

1000 formas ativas
de *P. brachyurus* por vaso

100 *Protogamasellopsis zaheri*
por vaso

70 dias após a infestação e liberação	***Pratylenchus brachyurus* / raiz de soja**
Controle	**66**
Protogamasellopsis zaheri	**25** **- 63%**

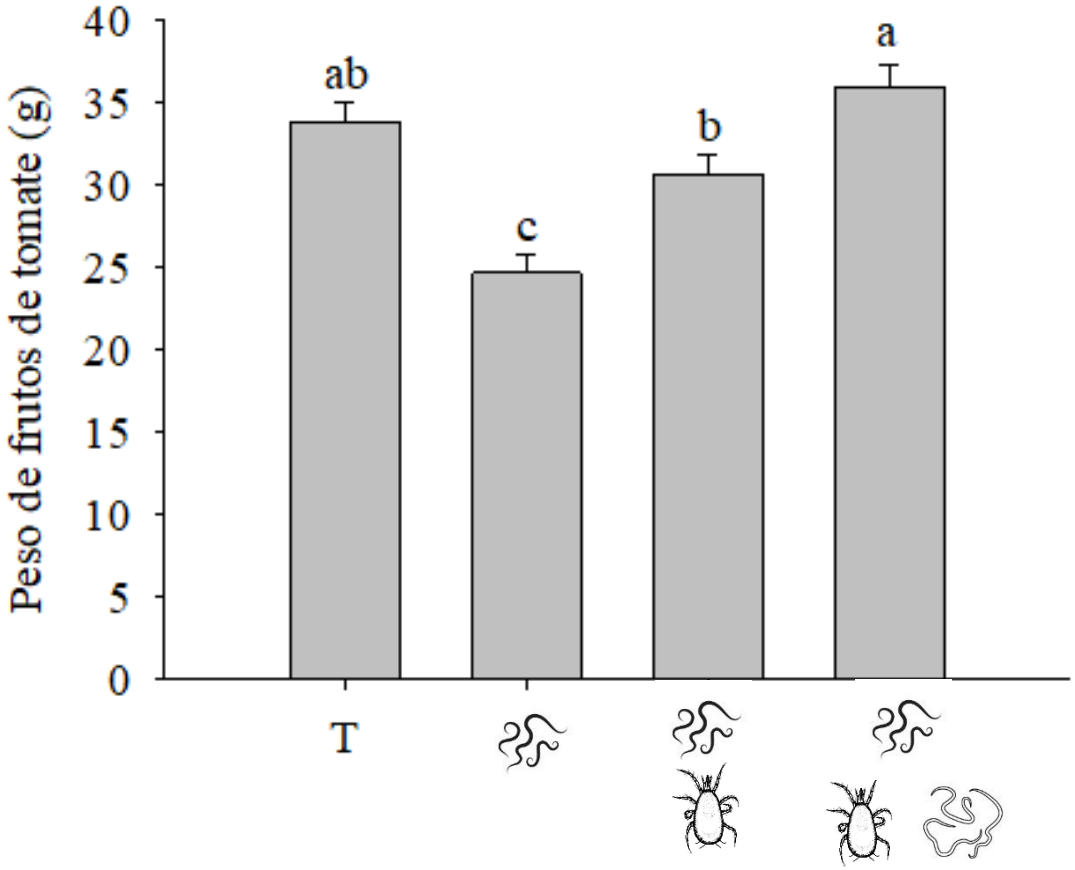
NEMATOIDE DE GALHA
Meloidogyne

1000 formas ativas de *M*. *incognita* por vaso
15 adultos de *Protogamasellopsis zaheri*

68% diminuição na população do nematoide

RESULTADOS

Peso médio de frutos por planta de tomateiro Micro-Tom, cultivado em vaso, com e sem a inoculação de *Meloidogyne incognita*, *Protogamasellopsis zaheri* e *Rhabditella axei*.



Teste de Tukey a 5% de probabilidade. Médias com a mesma letra não diferem significativamente

NEMATOIDE DE CISTO
Heterodera glycines

N°	Descrição	Ovos/predador/dias	Sobrevivência (%)
1	Testemunha absoluta (água)	0,713 ± 0,02 g[1,2]	40,00 ± 9,09 c[1]
2	Cisto de *Heterodera glycines*	0,801 ± 0,07 f	63,33 ± 8,94 b
3	Fêmea de *Heterodera glycines*	1,176 ± 0,130 e	100,00 a
4	Ovo de Cisto de *Heterodera glycines*	1,749 ± 0,066 c	100,00 a
5	Juvenil de Cisto de *Heterodera glycines*	1,563 ± 0,072 d	100,00 a
6	*Tyrophagus putrescentiae*	2,087 ± 0,059 a	100,00 a
7	*R. axei*	2,022 ± 0,087 b	100,00 a
8	Cisto + fêmea + ovos + juvenile de *Heterodera glycines*	1,781 ± 0,083 c	100,00 a
9	Cisto + fêmea + ovos + juvenile de *Heterodera glycines* + *R. axei*	2,022 ± 0,067 b	100,00 a
	F	1369,59	26,99
	Pr > F	<0,0001	<0,0001

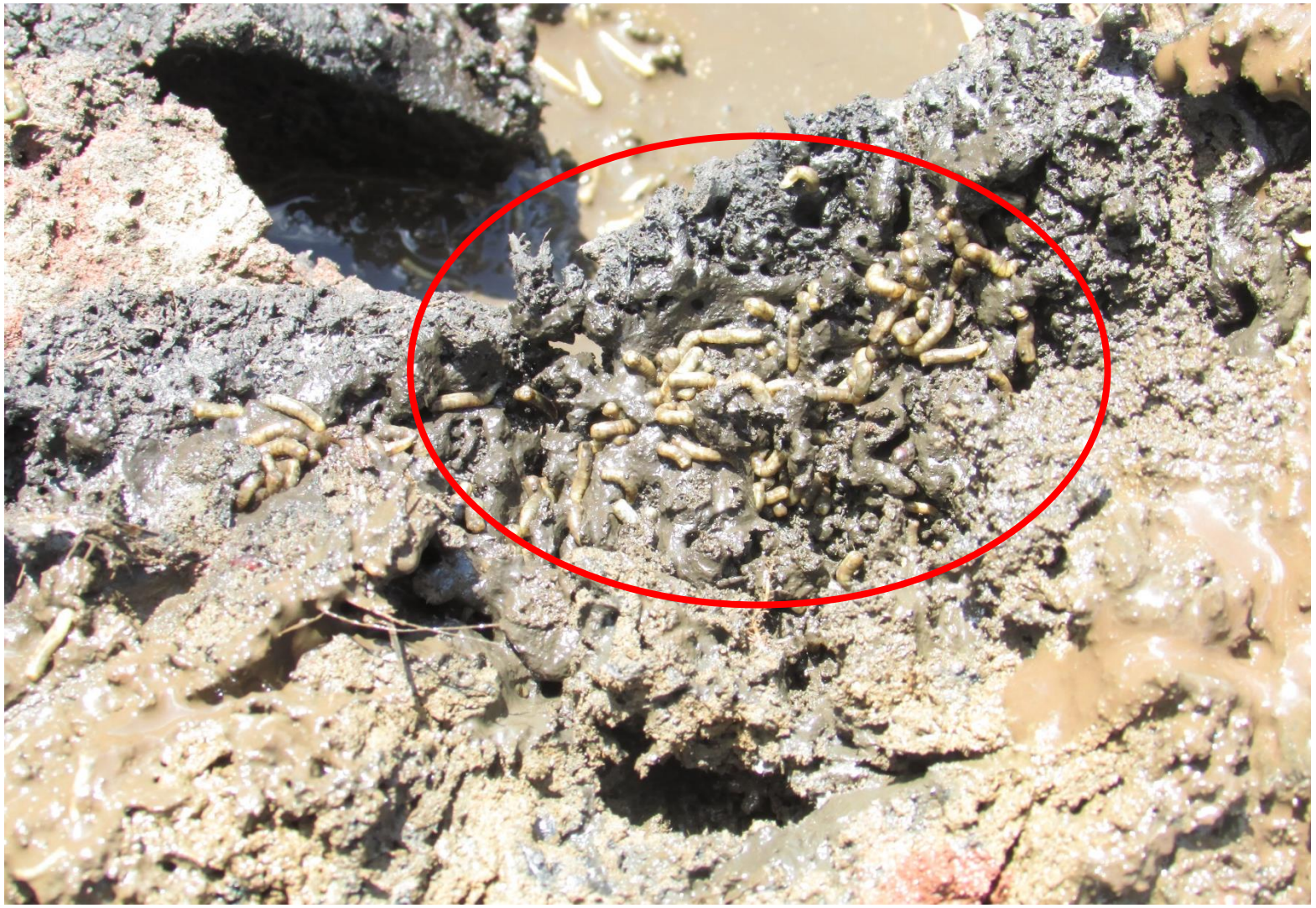
Diminuição de cistos viáveis no solo - 30%

Musca domestica

Mosca dos estábulos

Stomoxys calcitrans

Stomoxys calcitrans



Stomoxys calcitrans

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Potential of *Macrocheles* species (Acari: Mesostigmata: Macrochelidae) as control agents of harmful flies (Diptera) and biology of *Macrocheles embersoni* Azevedo, Castilho and Berto on *Stomoxys calcitrans* (L.) and *Musca domestica* L. (Diptera: Muscidae)

Letícia Henrique Azevedo[a,*], Murilo Prudente Ferreira[a], Raphael de Campos Castilho[b], Paulo Henrique Duarte Cançado[c], Gilberto José de Moraes[a]

Potencial de predação

Presa	Predador		
	Macrocheles embersoni	*Macrocheles muscaedomesticae*	*Macrocheles robustulus*
Stomoxys calcitrans (ovos)	12,5 ± 0,6a	8,7 ± 0,9b	3,5 ± 0,5c
Stomoxys calcitrans (L1)	23,8 ± 1,0a	7,2 ± 1,0c	15,1 ± 1,0b
Musca domestica (ovos)	12,4 ± 0,7a	11,0 ± 1,2a	4,4 ± 0,6b
Musca domestica (L1)	8,9 ± 1,7a	2,5 ± 0,1b	3,5 ± 0,5b
Haematobia irritans (ovos)	5,5 ± 0,4a	4,3 ± 0,4a	-
Bradysia matogrossensis	6,4 ± 0,2a	0,4 ± 0,2b	4,1 ± 0,5a
Rhizoglyphus sp.	0,9 ± 0,2b	<0,1b	2,6 ± 0,4a

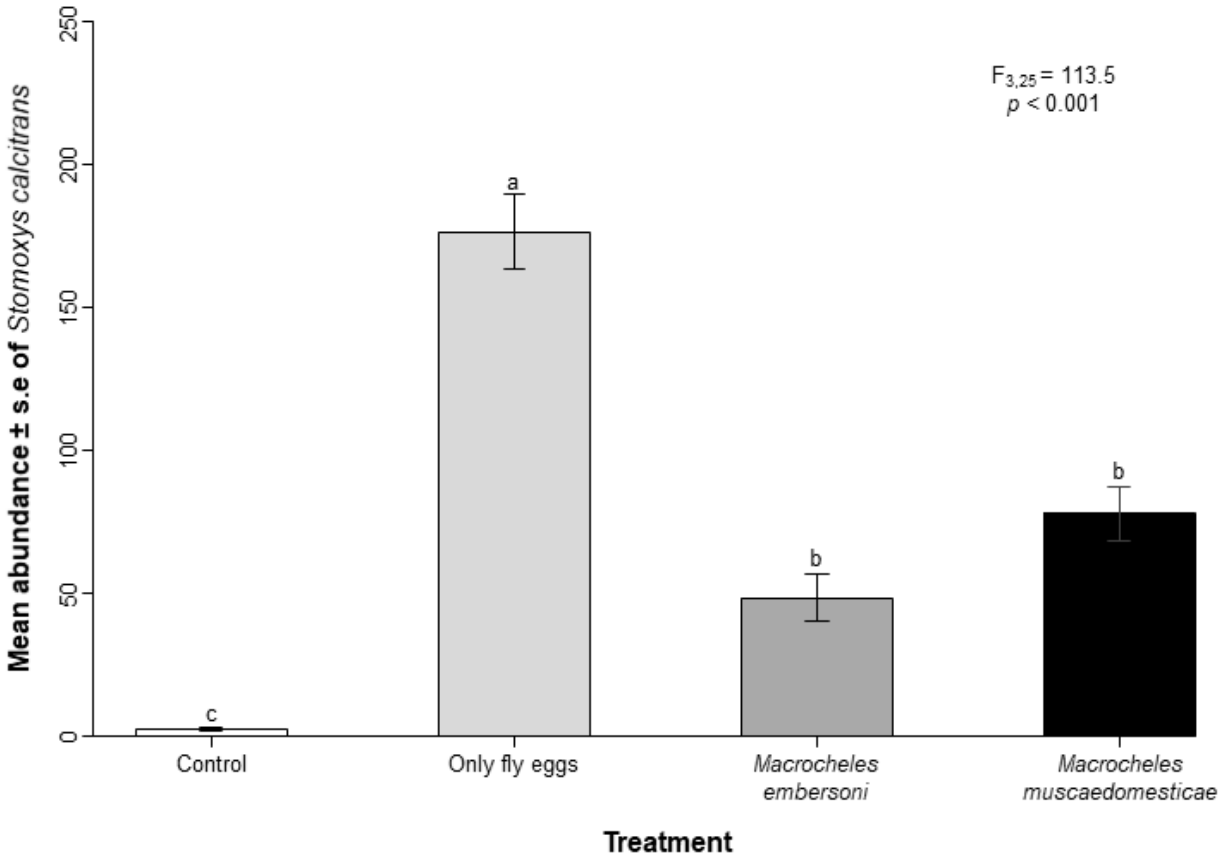
(-) Teste não realizado

Table 3
Duration of different developmental stages (days ± SE); survivorship (%, in parentheses) and mean duration (days ± SE) of pre-oviposition, oviposition and post-oviposition periods of *Macrocheles embersoni* fed all stages of *Rhabditella axei* and eggs of *Stomoxys calcitrans* and *Musca domestica* at 30 ± 2 °C, 95 ± 10% RH and in the dark.

Stages	Prey		
	R. axei	*S. calcitrans*	*M. domestica*
Egg	0.3 ± 0.04a (86.0)	0.3 ± 0.02a (96.0)	0.3 ± 0.02a (96.0)
Larva	0.2 ± 0.02a (91.0)	0.2 ± 0.01a (94.2)	0.2 ± 0.01a (98.0)
Protonymph	0.3 ± 0.03a (95.0)	0.4 ± 0.03a (92.0)	0.4 ± 0.03a (1 0 0)
Deutonymph	0.7 ± 0.06b (97.3)	0.4 ± 0.03a (93.3)	0.4 ± 0.02a (1 0 0)
Egg-adult	1.5 ± 0.03b (72.0)	1.3 ± 0.01a (78.0)	1.3 ± 0.01a (94.0)
Pre-oviposition	1.3 ± 0.08a	2.9 ± 1.1b	2.9 ± 0.18b
Oviposition	19.5 ± 1.1b	14.1 ± 1.1a	16.2 ± 0.59a
Post-oviposition	2.9 ± 0.6a	17.6 ± 1.8b	14.9 ± 1.60b
Female longevity	23.5 ± 1.4a	30.1 ± 2.1b	29.3 ± 2.10b
Male longevity	13.6 ± 1.3b	8.8 ± 0.9a	17.4 ± 0.71b
Sex ratio (♀, ♂)	25, 7 (= 78%)	27, 17 (= 61%)	35, 12 (= 74%)

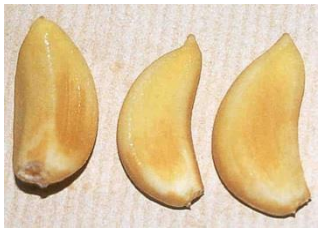
Stomoxys calcitrans

Experimentos realizados com *Stomoxys calcitrans*
Número de *Stomoxys calcitrans* capturadas nas armadilhas.



Dermanyssus gallinae

Aceria tulipae



Carrapatos

Sphenophorus levis

Moscas-das-frutas

PROFISSIONAL DO FUTURO

- **Agricultura 4.0**
- Ciência dos dados
- Interdisciplinaridade
- Planejamento
- Inovação/criatividade
- “Leitura do mundo”