Naturalis®

(a.s. *Beauveria bassiana* strain ATCC 74040):

effective against Tetranychid mites and harmless to predatory Phytoseiid mites

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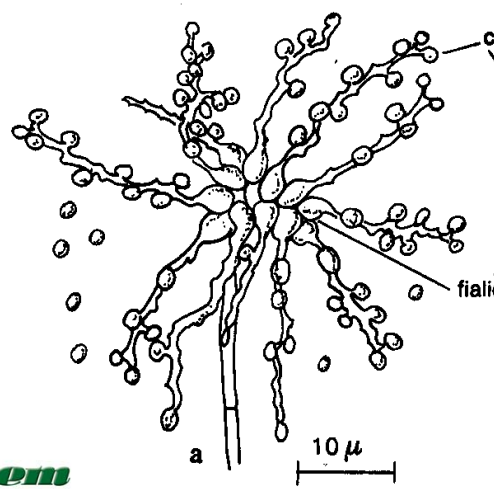
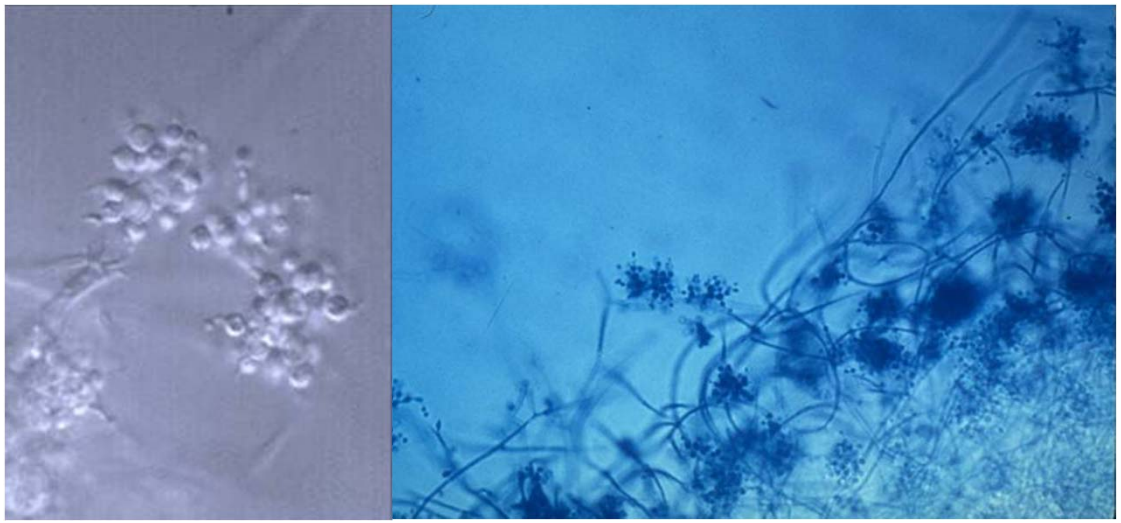
Naturalis®

- **Naturalis** is a bioinsecticide containing at least 2.3 x 10^7 viable conidiospores / ml of *B. bassiana* **strain ATCC 74040**.
- **ATCC 74040** was obtained from the cotton boll weevil, *Anthonomus grandis*, at the USDA-ARS Crop Insect Research Center, Lower Rio Grande Valley, Texas, USA (not genetically modified).
- In 2005 Intrachem Bio International S.A. (Geneva, Switzerland) acquired the intellectual property rights from Troy Biosciences Inc.
- Manufacturing occurs under the control of Intrachem Production S.r.l. (Bergamo, Italy).
- **Naturalis** is registered in USA, Mexico, Italy, Spain, Greece, Switzerland, Morocco, UK, Hungary, Cyprus, Slovenia, Ireland, Turkey (Dopteril), and Korea.
- Registration is pending in the Netherlands and Germany.

Beauveria bassiana

- *Beauveria bassiana* (Deuteromycetes, Moniliales) was first recognized in 1835 by Agostino Bassi as the causal agent of the white muscardine disease of the silkworm.
- *B. bassiana* can affect a wide range of arthropod pests, **mites included**, and all their developmental stages (**eggs**, immature stages, and adults).
- **Various strains differ in their host range and selectivity**.

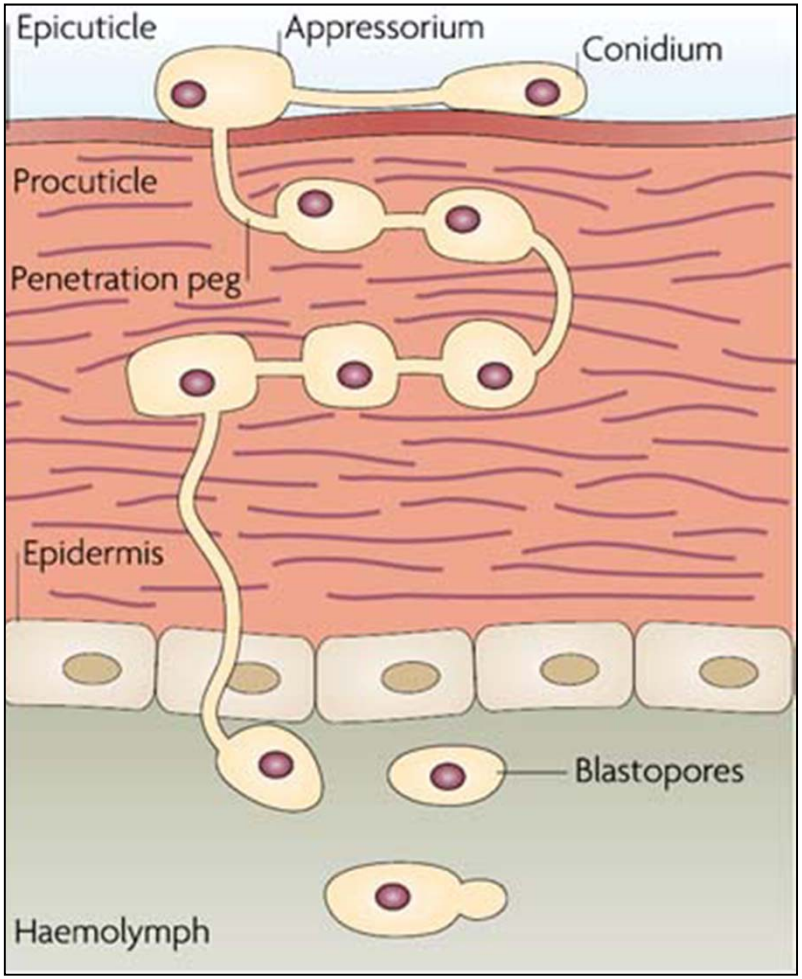




B. bassiana **ATCC 74040**

Mode of action – contact bioinsecticide

- The conidiospores, in contact with the insect's cuticle, germinate and form an appressorium.
- A fine penetration hypha perforates the cuticle, grows, and differentiates into other penetration hyphae. The fungus invades the insect's body.
- The mycelium proliferates by feeding on the host's haemolymph, and blastospores are produced.
- The host dies within a few days due to depletion of nutrients and dehydration.

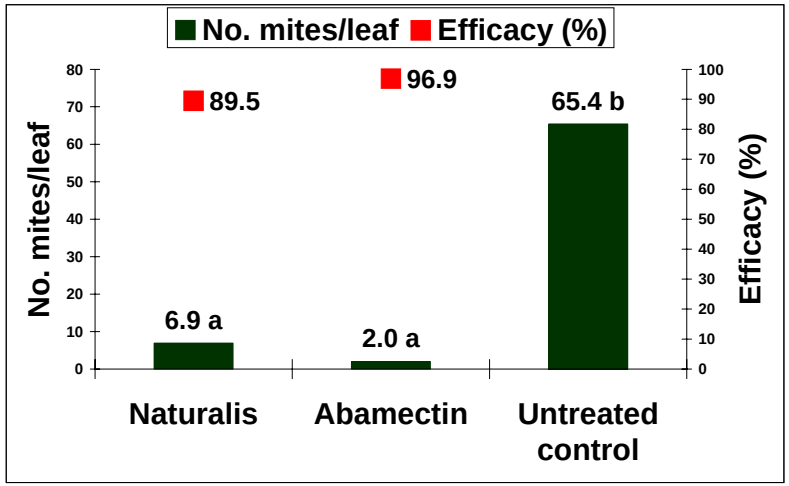


Naturalis®

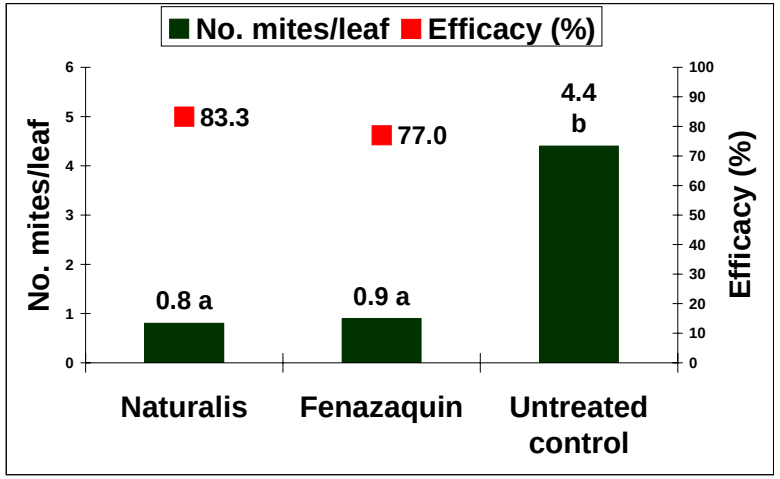
Major targets

- White flies
- Tetranychid mites
- Thrips
- Wireworms
- Fruit flies (Tephritid flies)

Tetranychid mites



Strawberry, Spain 1998 (Agrichem Bio S.A.)



Tomato, Italy 2006 (Agrigeos)

Summary of 3 recent laboratory studies on the effects of Naturalis on:

Study no.	Target mite (Prey)	Non-target mite (Predator)
1	*Tetranychus urticae*	*Phytoseiulus persimilis*
2	*Tetranychus urticae*	*Neoseiulus californicus*
3	*Eotetranychus carpini*	*Kampimodromus aberrans*




Assessments

- % corrected mortality according to Abbott on eggs and females

M (%) = (MT - MC)/(100 - MC) x 100

- fecundity (no. eggs/female/day)
- % egg hatching
- effects on generation exposed to treatment (F0) and successive generation (F1)

Exposure

- Type: direct contact (micro-immersion bioassays; leaf dip bioassays; direct spray)
- Applied rate: recommended field rate of Naturalis (80-120 ml/100 l; 0.08-0.12% v/v)

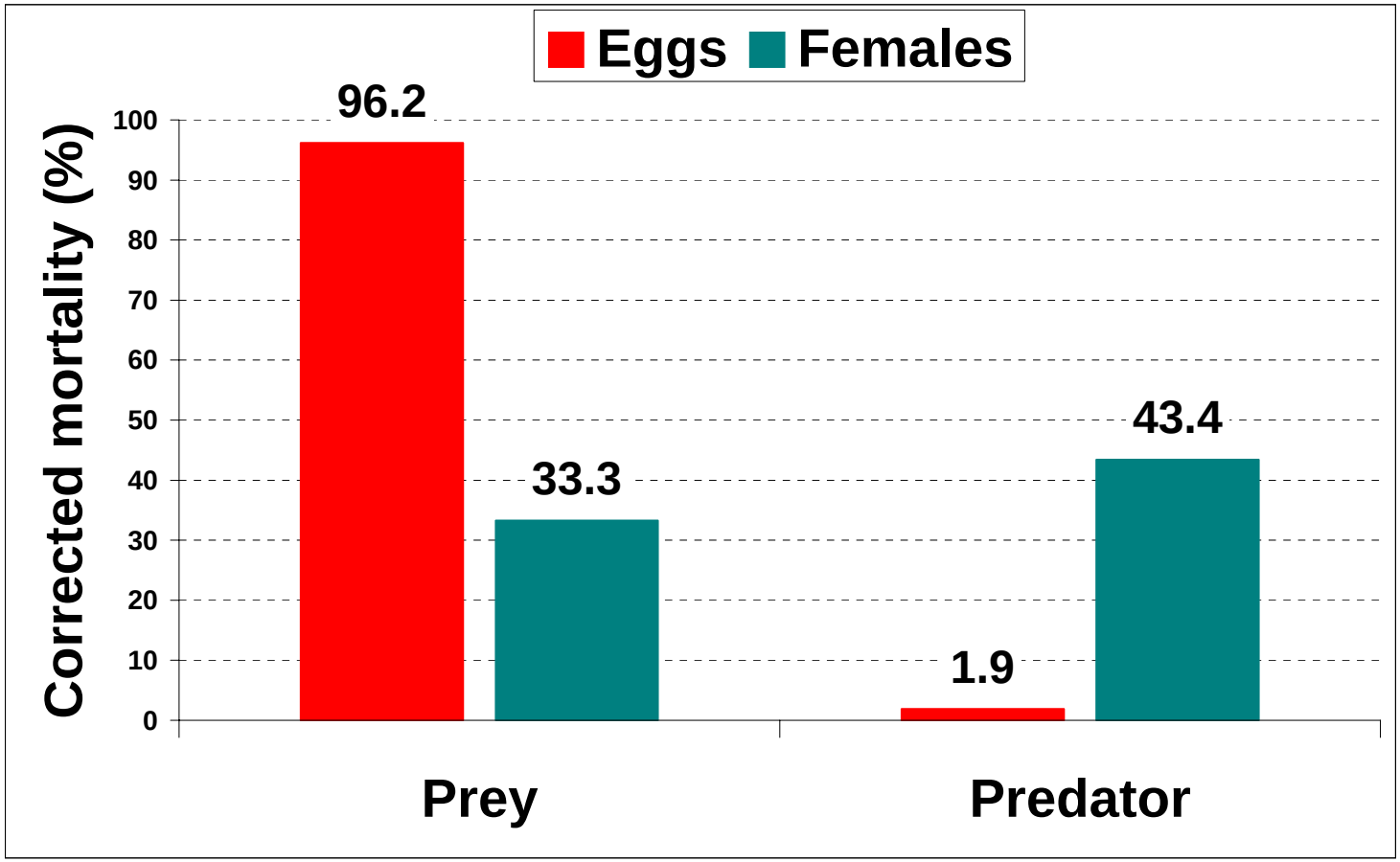
Material and Methods

- for details see cited literature

Results Study 1

Tetranychus urticae & Phytoseiulus persimilis

% corrected mortality (Abbott)



Duso et al., 2008. Comparative toxicity of botanical and reduced-risk insecticides to Mediterranean populations of *Tetranychus urticae* and *Phytoseiulus persimilis* (Acari Tetranychidae, Phytoseiidae). Biological Control 47, 16-21.

Results Study 1

Tetranychus urticae & Phytoseiulus persimilis

No. eggs/female/day (F0) and % egg hatching

Prey

Tetranychus urticae	No. eggs/female/day	% egg hatching
Naturalis	**0.04**	**0.0**
Control	**3.51**	**81.0**

Predator

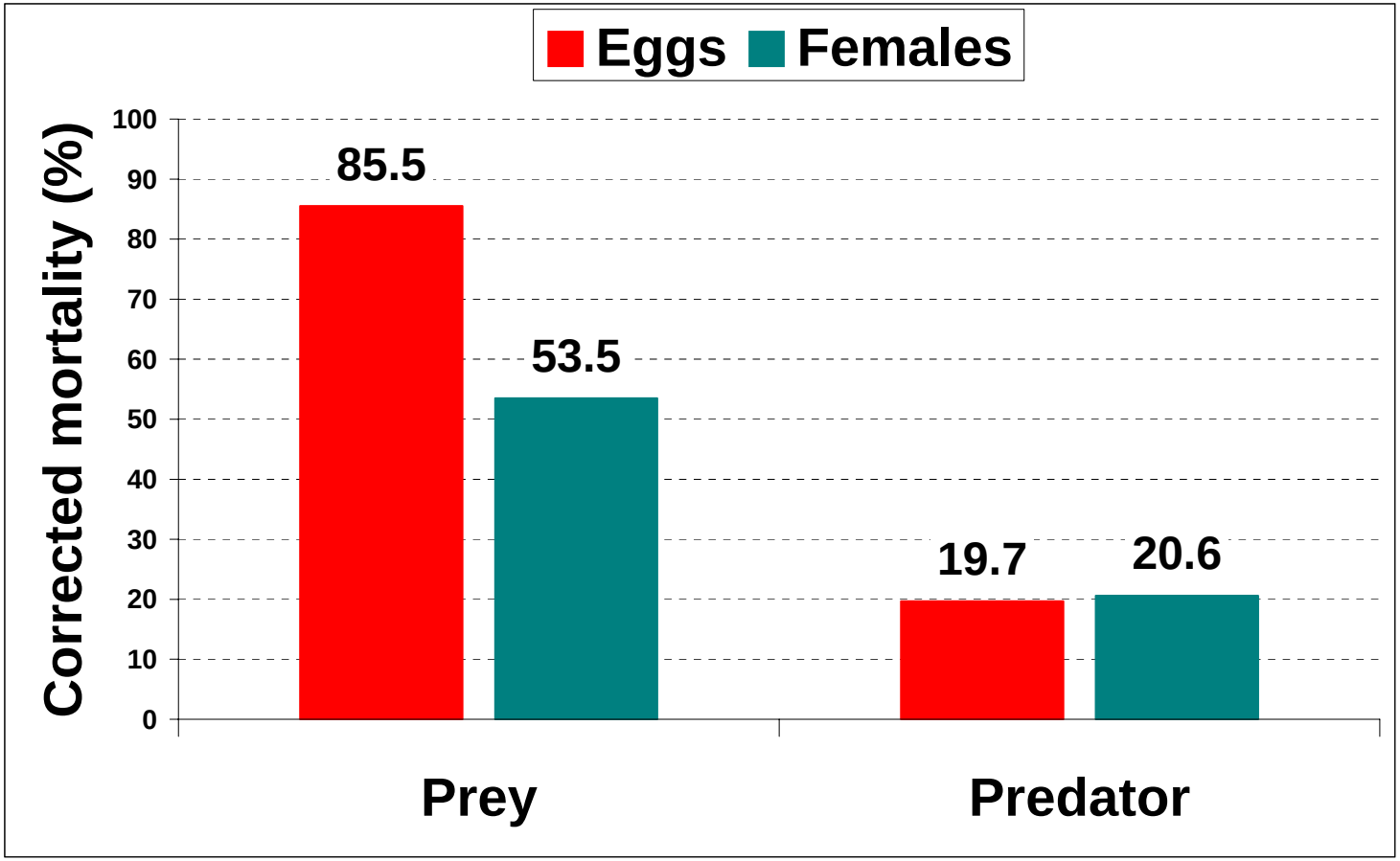
Phytoseiulus persimilis	No. eggs/female/day	% egg hatching
Naturalis	**1.6**	**82.5**
Control	**3.1**	**86.5**

Duso et al., 2008. Comparative toxicity of botanical and reduced-risk insecticides to Mediterranean populations of *Tetranychus urticae* and *Phytoseiulus persimilis* (Acari Tetranychidae, Phytoseiidae). Biological Control 47, 16-21.

Results Study 2

Tetranychus urticae & Neoseiulus californicus

% corrected mortality (Abbott)



Simoni et al., 2010. Attività di *Beauveria bassiana* sull'acaro fitofago *Tetranychus urticae* e sul fitoseide *Neoseiulus californicus*. Atti Giornate Fitopatologiche 1, 305-310.

Results Study 2

Tetranychus urticae & Neoseiulus californicus

No. eggs/female/day of females exposed to treatment (F0) and females of 1st generation after treatment exposure (F1)

Prey

Tetranychus urticae	No. eggs/female/day F0	No. eggs/female/day F1
Naturalis	2.9	3.8
Control	4.7	5.2

Predator

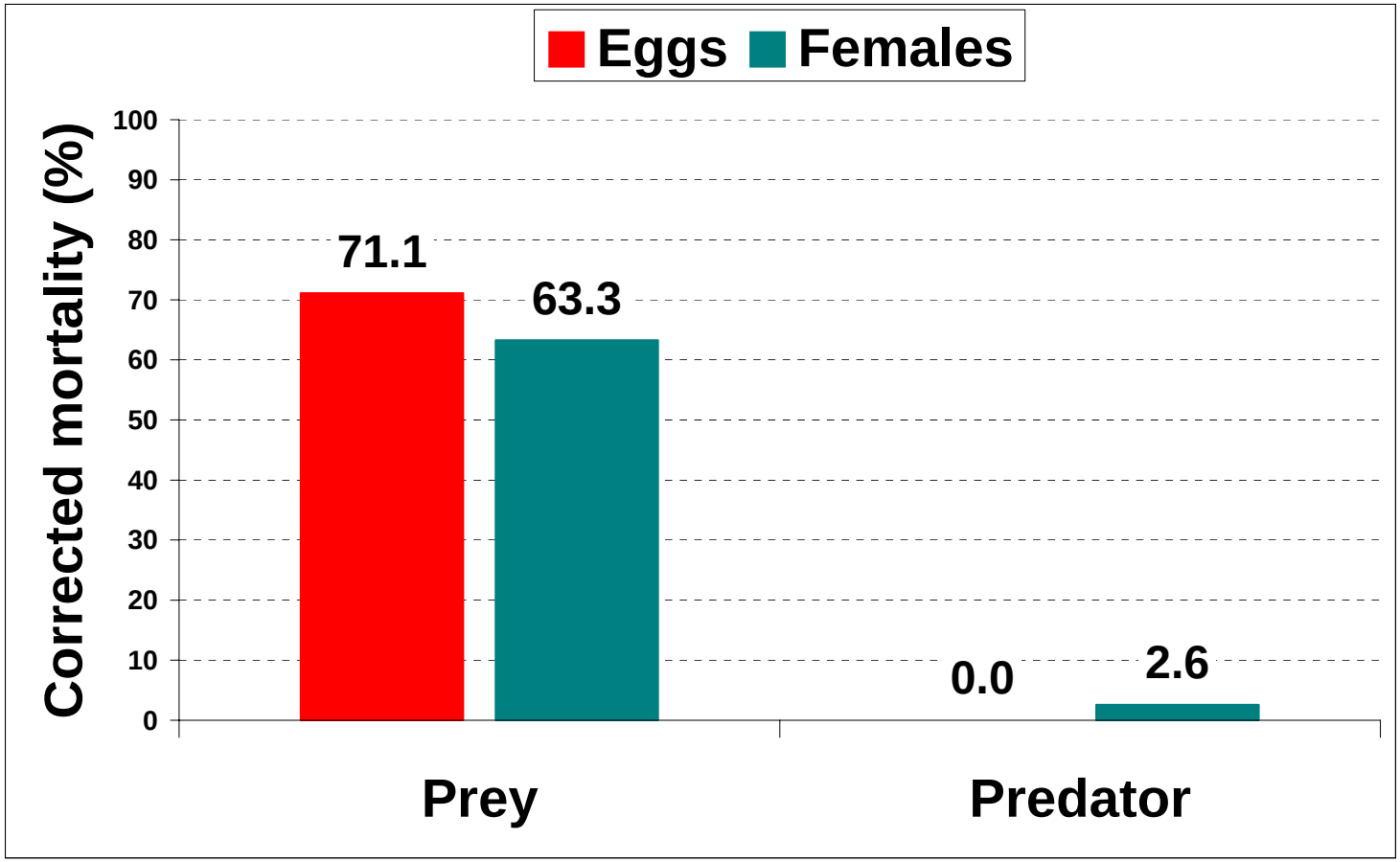
Neoseiulus californicus	No. eggs/female/day F0	No. eggs/female/day F1
Naturalis	1.3	2.5
Control	2.4	2.7

Simoni et al., 2010. Attività di *Beauveria bassiana* sull'acaro fitofago *Tetranychus urticae* e sul fitoseide *Neoseiulus californicus*. Atti Giornate Fitopatologiche 1, 305-310.

Results Study 3

Eotetranychus carpini & Kampimodromus aberrans

% corrected mortality (Abbott)



Simoni et al., 2010. Laboratory evaluation of the effects of *Beauveria bassiana* (strain ATCC 74040) on *Eotetranychus carpini* and *Kampimodromus aberrans*. XIII International Congress of Acarology, 23 – 27 August, 2010, Recife, Brazil.

… something to consider:

Example – active substances for mite control on tomato

Active substance	Status (Annex I)	Target stage	MRL (tomato)	PHI (tomato)
abamectin	**included**	**all mobile stages**	**0.02**	**7**
clofentezine	**included**	**eggs**	**0.3**	**15**
etoxazole	**included**	**eggs, larvae**	**0.02 ***	**3**
fenpyroximate	**included**	**all mobile stages**	**0.2**	**14**
tebufenpyrad	**included**	**all mobile stages**	**0.5**	**14**
B. bassiana **GHA**	**included**	**?**	**n.r. ****	**0**
B. bassiana **ATCC 74040**	**included**	**all**	**n.r. ****	**0**
hexythiazox	**voluntarily withdrawn**	**eggs, larvae**	**0.5**	**7**
fenazaquin	**voluntarily withdrawn**	**all**	**0.5**	**7**
fenbutation oxide	**voluntarily withdrawn**	**all mobile stages**	**2**	**30**
propargite	**voluntarily withdrawn**	**all mobile stages**	**2**	**15**

* indicates lower limit of analytical determination
** not requested

Source: http://ec.europa.eu/sanco_pesticides/public/index.cfm;
Win BDF, Banca dati Agrofarmaci: http://www.winbdf.it

Naturalis against Tetranychid mites - benefits:

- effective against all stages, especially eggs
- unique mode of action, different from that of any conventional chemical acaricide
- suitable for inclusion into resistance management strategies (can be tank-mixed with numerous insecticides and acaricides)
- no pre-harvest interval and no detectable MRL: useful to reduce risk of undesired residues in final produce
- safe to beneficials, humans, and environment
- suitable for any pest management strategy, Organic Farming included

In conclusion, Naturalis can be considered a valuable pest management tool for sustainable agriculture!

Thanks are due to:

- **Prof. Carlo Duso**

University of Padova, Italy

- **Dr. Sauro Simoni**

CRA - Agricultural Research Council, Florence, Italy

- **Agrichem Bio S.A.**

Madrid, Spain

- **you for your attention!**