

Provence Alpes Côte d'Azur - France





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970 agents

17 UR + 4 UE



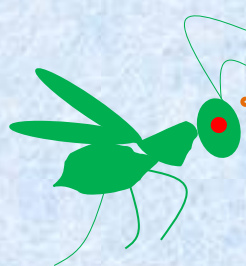
**Plant Protection Center
Biological Control Unit (UEL B)**

Working group

Biological control against Lepidoptera pests

Team leader : Dr Elisabeth TABONE

Improvement of integrated management against *Tuta absoluta* by using new egg parasitoids



IPM



Agadir, Morocco, November 16-18, 2011

Hong DO THI KHANH, Marion TIRADON, Ety COLOMBEL, Anaïs CHAILLEUX,
Nicolas DESNEUX, Yannie TROTTIN-CAUDAL, Elisabeth TABONE

Damage caused by *T. absoluta*



If without control:

Loss up to 60 to 100%

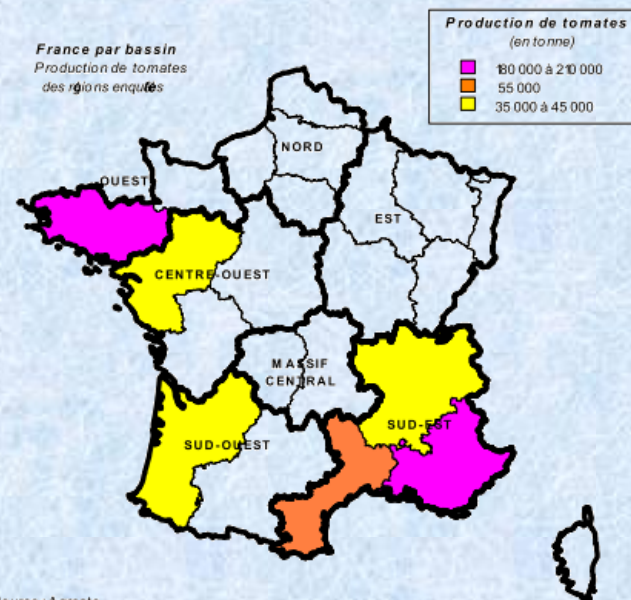
(Gonzales-Cabrera, 2011)

Risk of disrupting IPM system

In France : Developed IPM on tomato

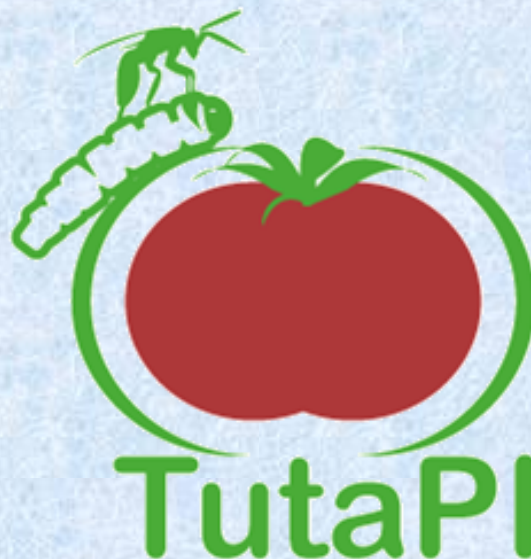
- 80 to 90 % in greenhouse
- 56 % of protected cultivation (Jeunes Agriculteurs, 2003)

Production areas



CasDar TutaPI project

French Funding CASDAR (2011-2013) : 465 K€



This project is also supported by : RMT DévAB, pôle de compétitivité PEIFL et GisPIClég

Main objectives



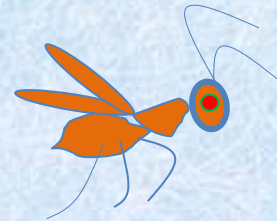
Search for new beneficial and methods of biological control against *Tuta absoluta*

1

Evaluate the efficacy of available methods

2

Research and test new beneficial and methods



3

Integrate these new beneficial and methods in IPM strategies

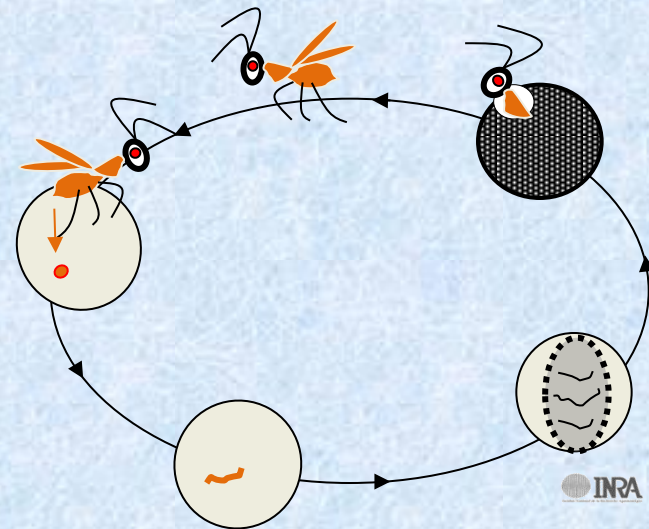


Communication and publication

Many available methods

but

Egg parasitoids are interesting



Attack the egg stage

suppress the pest before damage

« No larvae, no holes »

Easier export

+

Advantages of Trichogramma

- Expertise confirmed
- Successful transfer INRA - biomanufacturing
- Good example on biocontrol against the European corn borer
- Successful marketing in the world



Scientific approaches

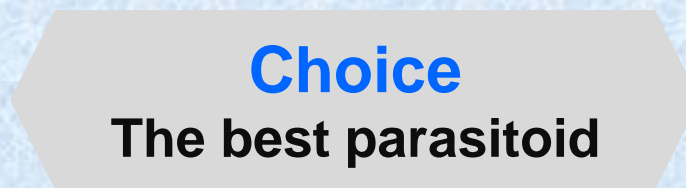




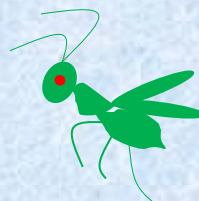
1. In laboratory



2. In mesocosm



3. In greenhouse



1. Real field context

Wide variety of field conditions

2. Many potential strains

Important differences between
Trichogramma strains

To obtain the best efficacy in the field

Scientific study of screening
before field release

3. Advantage of screening in laboratory

It is difficult and costly to test directly all strains in greenhouse

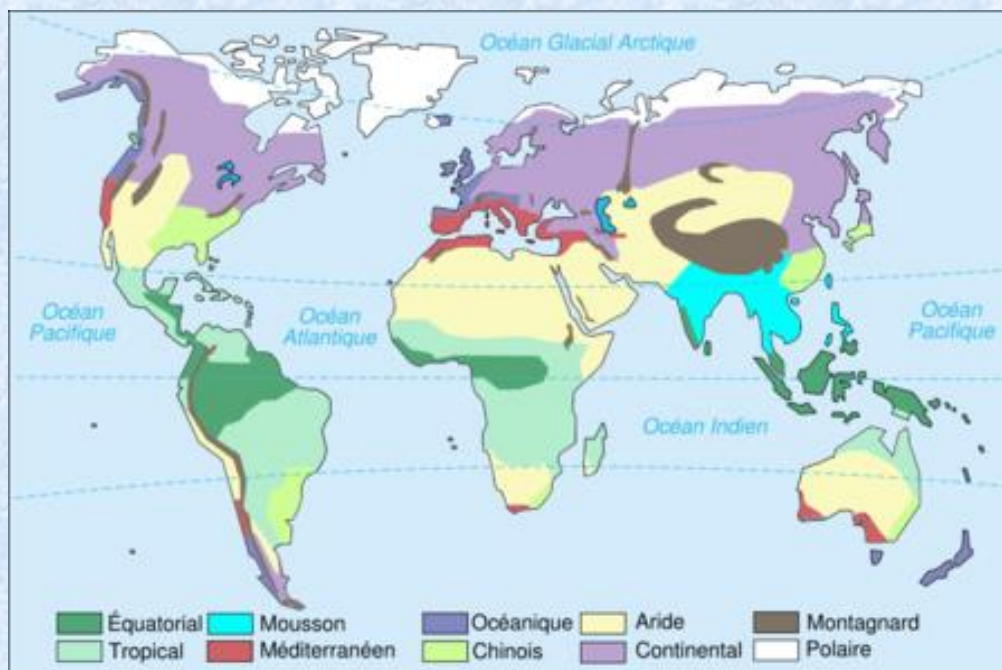
→ screening in tube = interesting first step

Because it is easier, cheaper and faster than in mesocosm or greenhouse

First screening in laboratory



Study of 64 *Trichogramma* strains (20 species) from the whole world

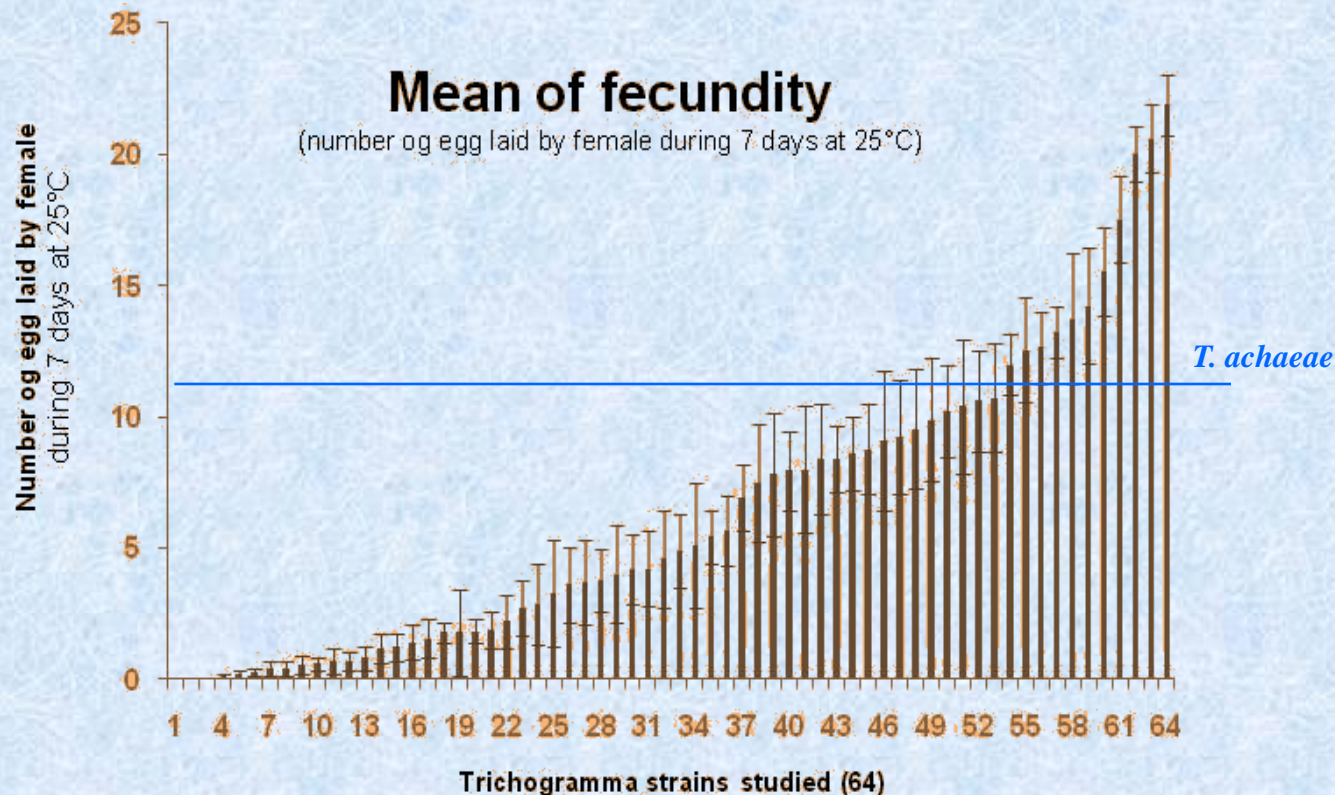


| Species | Authors |
|-------------------------------------|----------------------|
| 1) <i>Trichogramma achaeae</i> | Nagaraja |
| 2) <i>Trichogramma brassicae</i> | Bezdenko |
| 3) (<i>Trichogramma maidis</i>) | Pintureau & Voegelé |
| 4) <i>Trichogramma bourarachae</i> | Pintureau & Balbaut |
| 5) <i>Trichogramma buesi</i> | Voegelé |
| 6) <i>Trichogramma cacaoeciae</i> | Marchal |
| 7) <i>Trichogramma chilonis</i> | Ishii |
| 8) <i>Trichogramma cordubensis</i> | Vargas & Cabello |
| 9) <i>Trichogramma daumalae</i> | Dugast & Voegelé |
| 10) <i>Trichogramma dendrolimi</i> | Matsumura |
| 11) <i>Trichogramma euproctidis</i> | Girault |
| 12) <i>Trichogramma evanescens</i> | Westwood |
| 13) <i>Trichogramma exiguan</i> | Pinto & Platner |
| 14) <i>Trichogramma japonicum</i> | Ashmead |
| 15) <i>Trichogramma nerudai</i> | Pintureau & Gerding |
| 16) <i>Trichogramma oleae</i> | Voegele & Poitale |
| 17) <i>Trichogramma ostriniae</i> | Pang & Chen |
| 18) <i>Trichogramma pretiosum</i> | Riley |
| 19) <i>Trichogramma principium</i> | Sugonjaev & Sorokina |
| 20) <i>Trichogramma semblidis</i> | Aurivillius |

Master 2 training of Marion TIRADON
PhD thesis of Anaïs CHAILLEUX

Trichogramma parasitized *Tuta* eggs on tomato leaf inside a tube

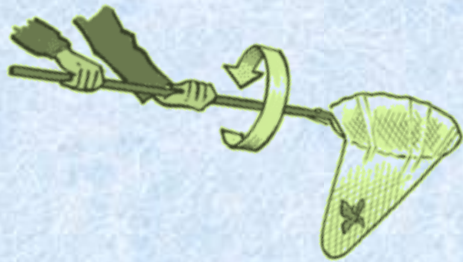
64 strains (20 species)



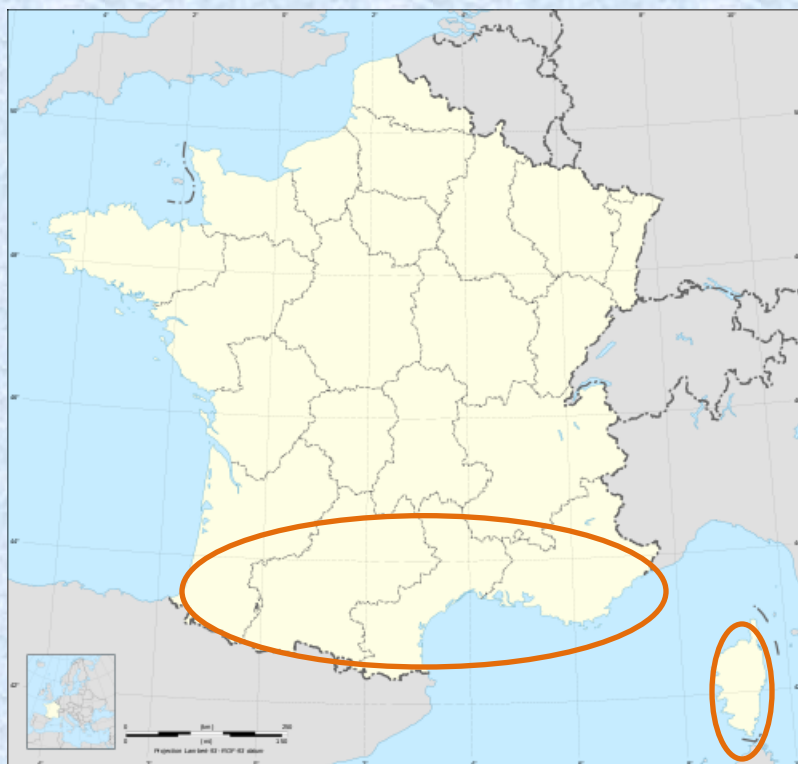
Interesting strains were firstly obtained.

The next step : screening of strains collected on tomato system

Field collection of new strains



In the South of France



| Date of receipt | Reference | Provenance |
|-----------------|--------------|------------------------------------|
| 26-juil-11 | 34-Va-p-1-30 | Hérault (Lunel) |
| 26-juil-11 | 34-Va-p-1-30 | Hérault (Lunel) |
| 18-juil-11 | 84-Ta-a-1-29 | Vaucluse (Pernes les fontaines) |
| 25-juil-11 | 34-Va-a-1-30 | Hérault (Lunel) |
| 28-juil-11 | 2B-Ge-p-1-30 | Corse (Folleli) |
| 13-juil-11 | 2B-Cr-a-5-1 | Corse (San Giuliano) |
| 13-juil-11 | 2B-Cr-a-5-1 | Corse (San Giuliano) |
| 17-août-11 | 34-Va-p-1-33 | Hérault (Lunel) |
| 17-août-11 | 34-Va-a-1-33 | Hérault (Lunel) |
| 07-sept-11 | 34-Va-p-1-36 | Hérault (Lunel) |
| 07-sept-11 | 34-Va-a-1-36 | Hérault (Lunel) |
| 07-sept-11 | 34-Me-a-1-36 | Hérault (Mauguio) |



Promising strains collected on tomato system

Inside cages in greenhouse conditions

T° between 18 and 32°C

HR between 30 and 80%, L16 : D8

- On tomato plants
- Artificial infestation by *T. absoluta*
- Introduction of *Trichogramma* adults
- Parasitism of *Trichogramma*

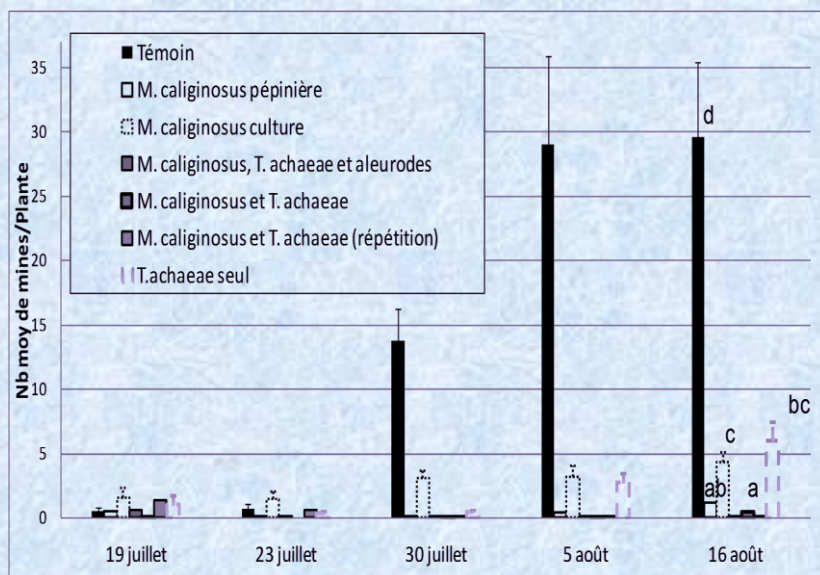


**Important simplifications of experimental design
to study many strains reared and collected**



Field tests before TutaPI (2010)

Mean number of mines per plant (random sample of 30 plants)
1st part of the trial (on the left)



1. Efficacy of beneficial use compared to control
2. Interest of early releases of *Trichogramma*
3. Interest of the combination *T. achaeae* / *Macrolophus*

In the case of massive infestation by *T. absoluta*



Confirmation of the efficacy of the combination
Trichogramma + *Macrolophus*

Interesting potential strains
Collected strains will be tested
In laboratory

Simplifications of experimental design
(number of plants, insects, ...)
In mesocosm + greenhouse

Acquired important results

Improvements of study methods

Field collection
Promising strains
directly collected on tomato

Field tests
Efficacy of the combination
Trichogramma + Macrolophus

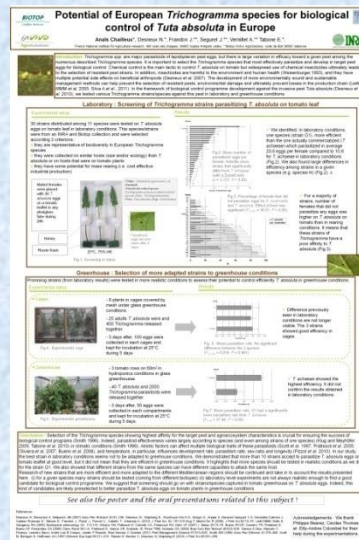
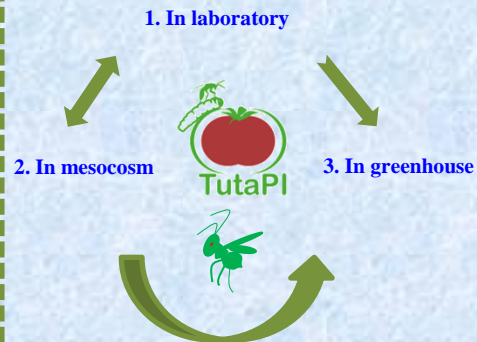
The best conditions to search new parasitoids

Associated posters

Poster 1

Potential of European *Trichogramma* species for biological control of *Tuta absoluta* in Europe

Anaïs Chailleux, Desneux N., Frandon J., Séguret J., Vernillet A., E.Tabone



First interesting results and many strains are studying

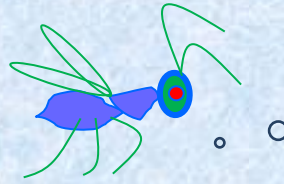
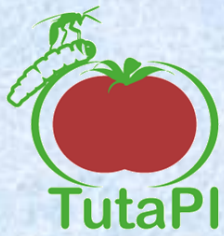
Poster 2

Efficacy of the combination of two beneficials to control *Tuta absoluta* in tomato greenhouses in southern France

Julien Séguret, P. Maignet, G. Ridray



Confirmation of the efficacy of the combination *Trichogramma* + *Macrolophus*



thanks !



This project is also supported by : RMT DévAB, pôle de compétitivité PEIFL and GisPIClég

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Trichogramma collects on *Tuta absoluta*

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