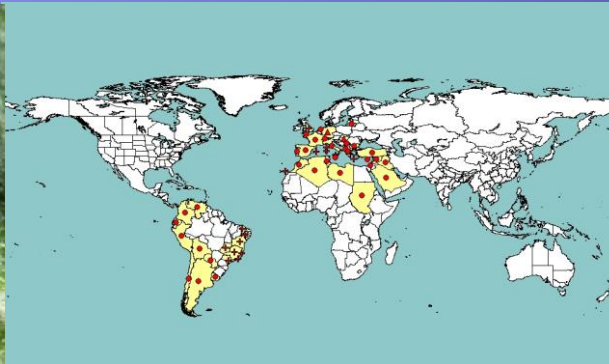


EPPO/IOBC/FAO/NEPPO

Joint International Symposium on Management of *Tuta absoluta*
Agadir, Morocco, November 16-18, 2011

BIOLOGY, DISTRIBUTION AND DAMAGE OF *TUTA ABSOLUTA*, AN EXOTIC INVASIVE PEST FROM SOUTH AMERICA



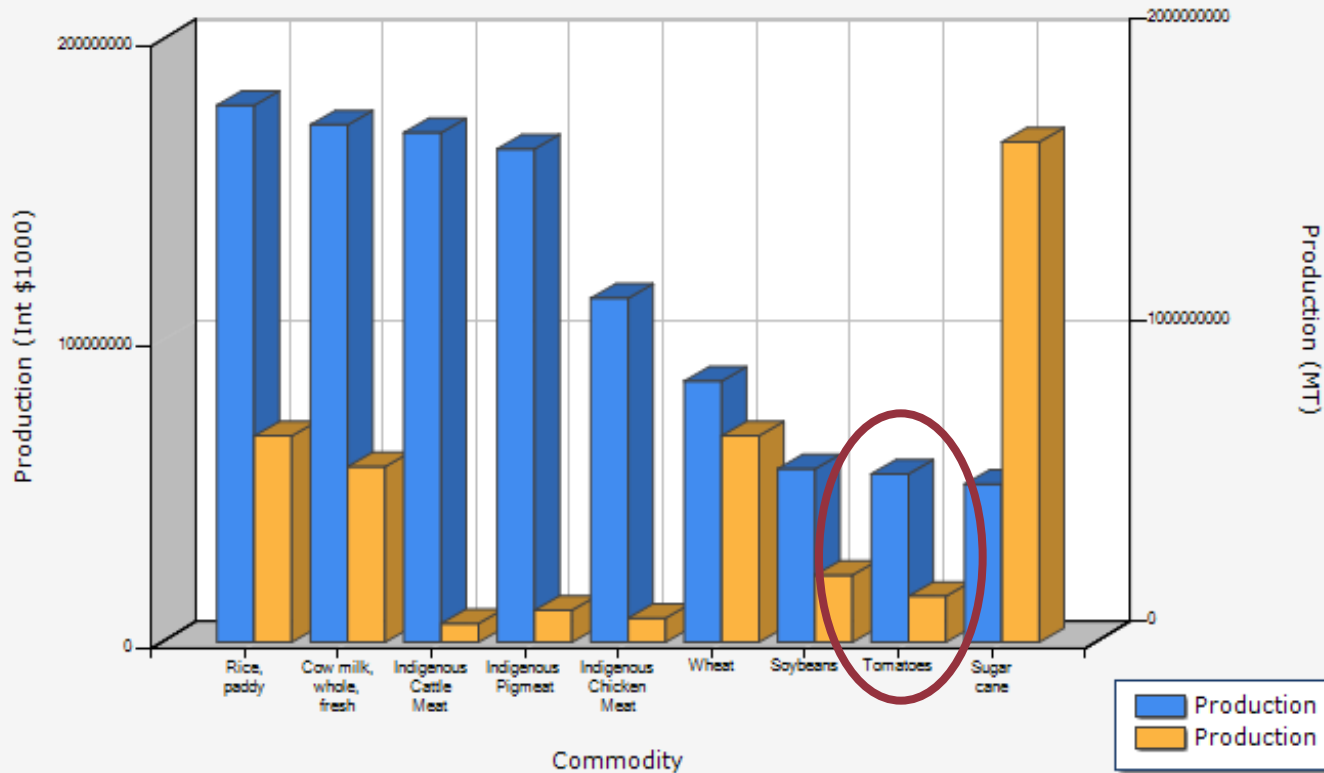
G.Tropea Garzia, G.Siscaro, A. Biondi & L. Zappalà

*Department of Agri-food and Environmental Systems Management
section Agricultural Entomology, University of Catania (Italy)*

Importance of tomato crop

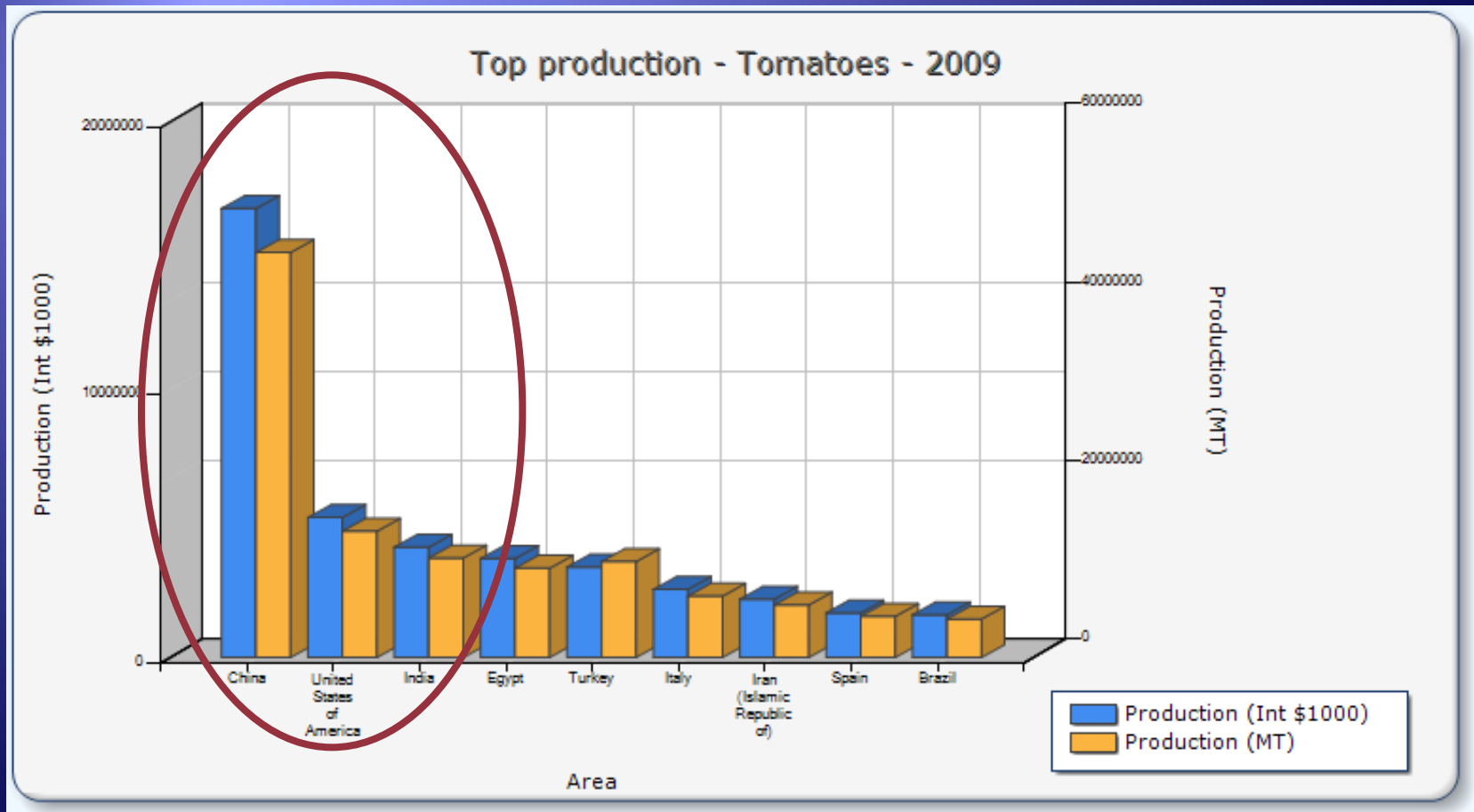
Tomato is the world's most important vegetable crop

Top production - World (Total) - 2009

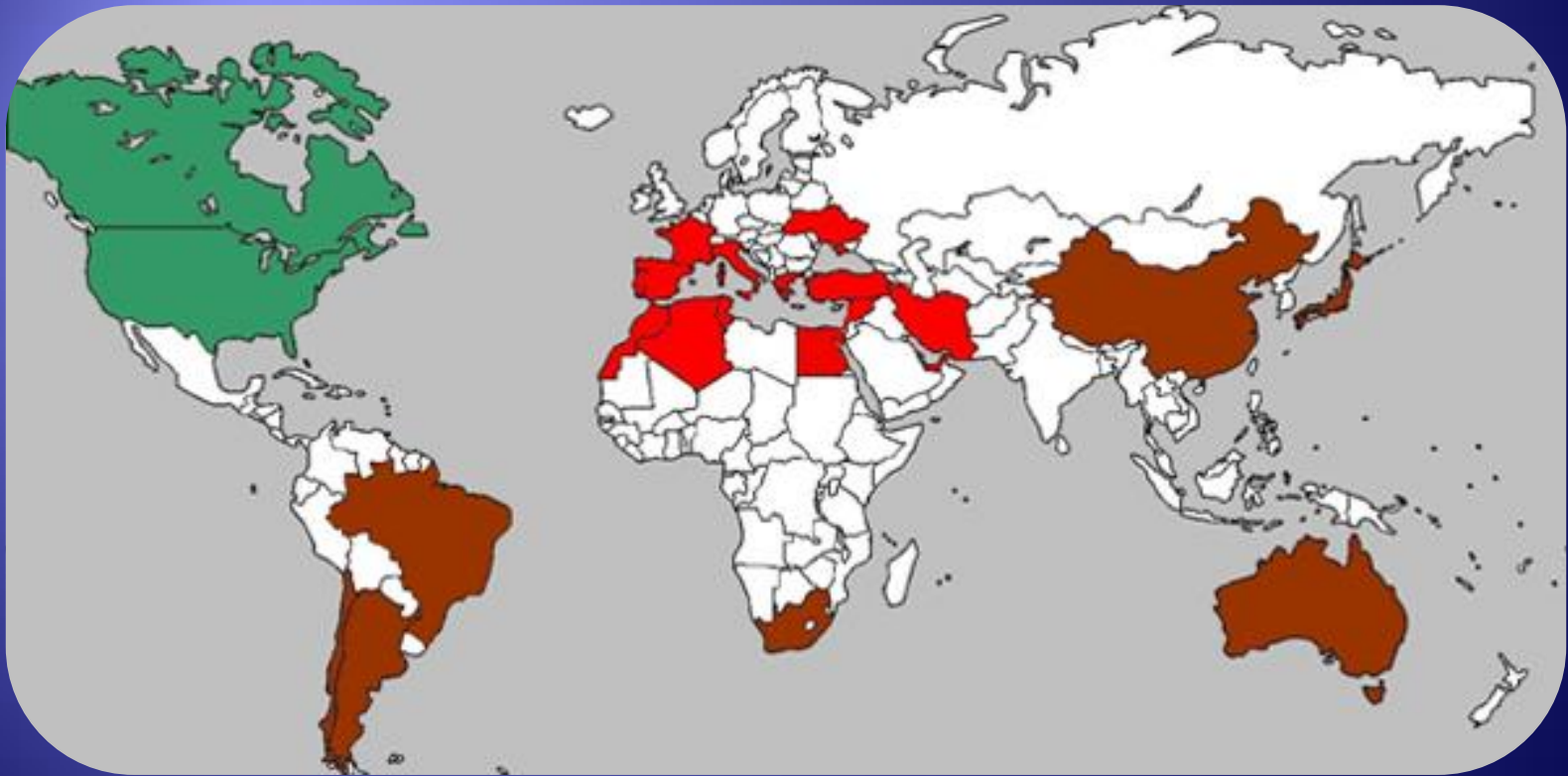


Major tomato producers

The most populous countries in the world are also the major tomato producers



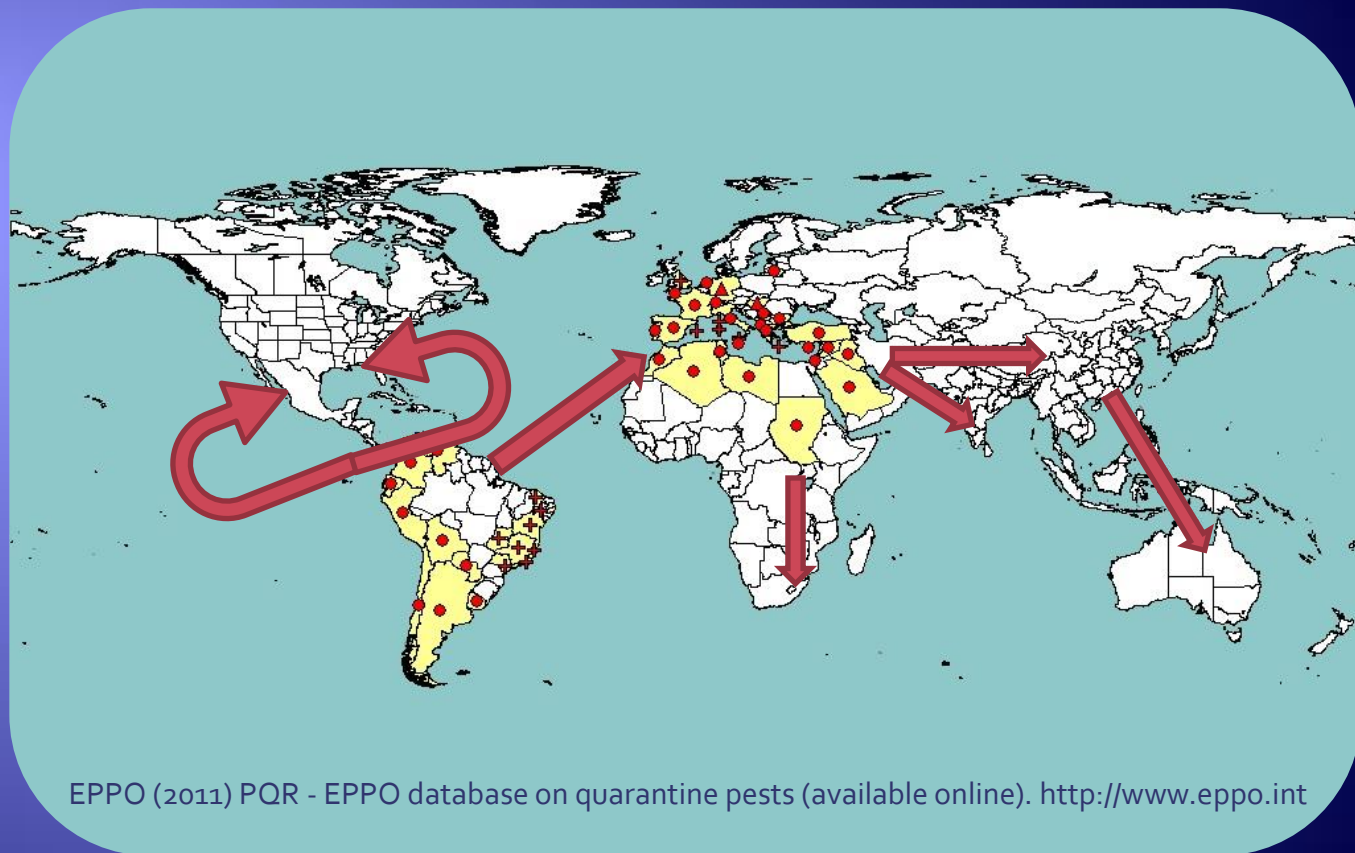
World tomato producers



World Processing Tomato Council (WPTC), 2011

Presence and expectation of Tuta distribution

Year	Reports (n.)
2006	1
2008	7
2009	13
20010	12
2011	3



EPPO Phytosanitary categorization:

Action List	Year addition	Year transfer
A1	2004	-
A2	-	2009

Mediterranean situation

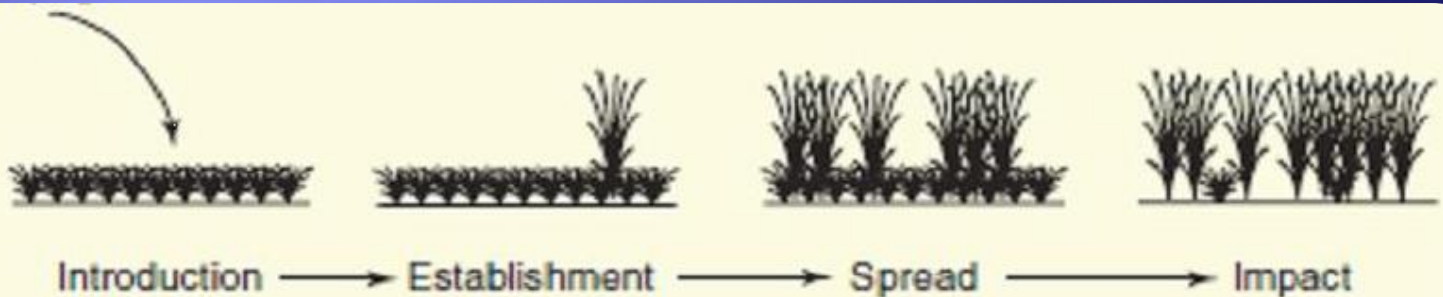


Potential distribution by Ecoclimatic Index (EI)



Stages of the invasion process

Exotic species



Different stages of the invasion process, with the tall form representing the invader.

LEVINE, 2008

The routes of invasion

- ◆ Based on genetic information; phylogenetic relationships among populations of the invasive species
- ◆ Facilitate the preventing and control strategies
 - ◆ strains of enemies coevolved with the target species
- ◆ Information about the original environment
 - ◆ choice pesticides (resistance)

Tuta absoluta case

- ◆ High genetic homogeneity both in South American and Mediterranean populations
- ◆ A single genetic type originated from South America
- ◆ Probably the more susceptible populations have been replaced by populations with higher insecticide tolerance

Future spread and establishment

- ◆ First report in Russia
 - ◆ potential subsequent spread into India and China due to:
 - ◆ Russia geographic position
 - ◆ the reduced control measures on domestic trade
- ◆ Human activity
- ◆ Outdoors crops (potato, leguminosae?) and weeds
- ◆ Active (flight) and passive (wind) diffusion

How to reduce the risk of spread

- ◆ Severe import restrictions
- ◆ Dissemination of information
- ◆ Rational application of control strategies

Systematics

Classification of <i>Tuta absoluta</i>	
Phylum	Arthropoda
Class	Insecta
Order	Lepidoptera
Suborder	Glossata
Superfamily	Gelechioidea
Family	Gelechiidae
Subfamily	Gelechiinae
Tribe	Gnorimoschemini
Genus	<i>Tuta</i>
Full Name	<i>Tuta absoluta</i> (Meyrick, 1917)

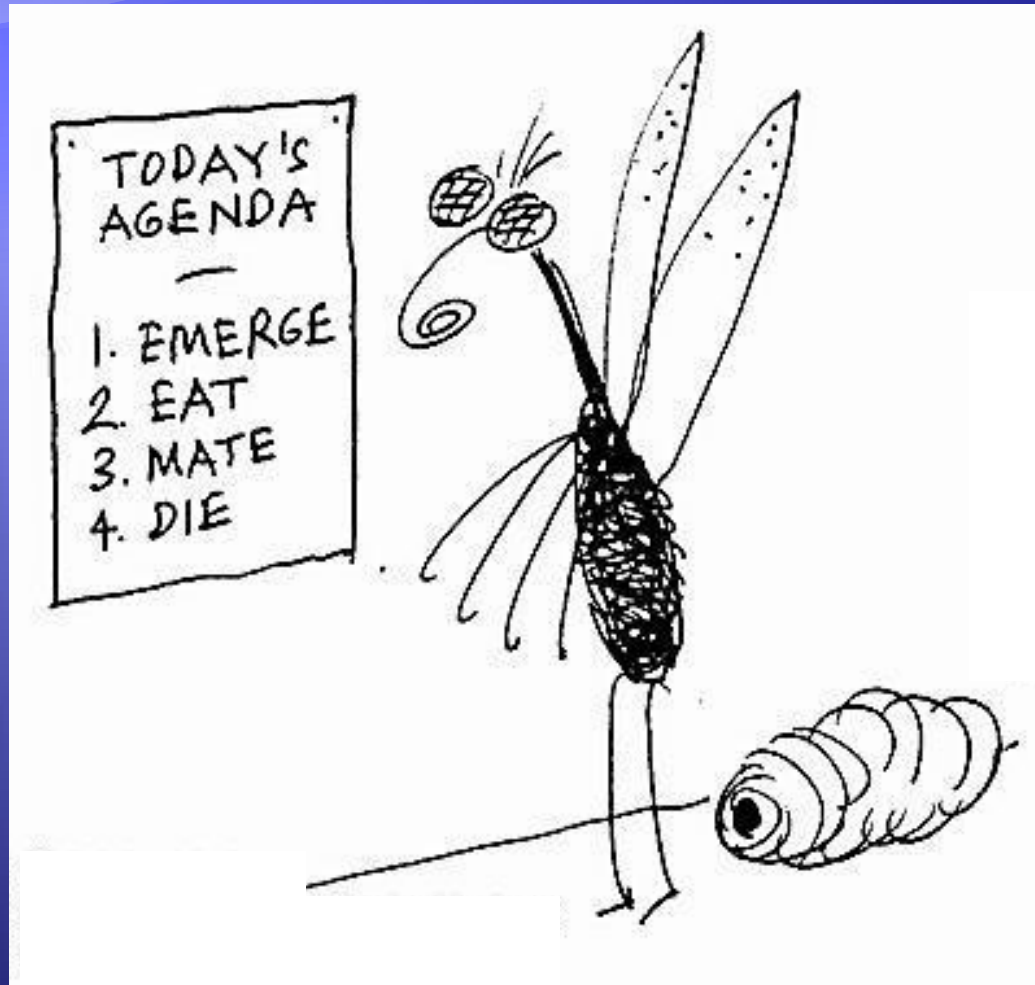
◆ Preferred Common Names

Tomato leafminer, Tomato borer

◆ Other Common Names

- lesser tomato leaf miner
- tomato leaf miner moth
- tomato moth
- South American tomato moth
- tomato fruit moth
- polilla del tomate
- tignola del pomodoro
- traca-do-tomateiro
- oruga minadora de hoja y tallo
- polilla perforadora
- cogollero del tomate
- gusano minador del tomate
- perforador de las hojas del tomate
- South American tomato pinworm
- gusano minador de la papa

Life-cycle information



Adult

- ◆ A small moth

- filiform antennae with rings of alternating dark and light scales
- anterior wings with black spots, hindwings provided with fringed edges



Adult life information

LIFESPAN (average)

- ◆ 10-15 days → female
- ◆ 6-7 days → male

MATING BEHAVIOUR

- ◆ After 1 day from emergence (early morning)
- ◆ Long-range female location
- ◆ Females mate up to 6 times, males up to 12 times
- ◆ A mating process takes 4-5 hours

OVIPOSITION

- ◆ 7 days after the first mating are the most prolific (76% eggs)
- ◆ Fecundity: 260 eggs per female (max); 40-50 (min)

Adult behaviour

- ◆ Adults are most active at dusk and sunrise
 - ◆ Catch adults just before sunrise
- ◆ Attraction by sex pheromone and light
 - ◆ Particular light frequency influences both males and females
- ◆ The adults don't fly very high
 - ◆ Correct position of traps
- ◆ Females tend to concentrate their egg laying activity on the upper third of the tomato plants after the third week of planting
 - ◆ Important for population monitoring
- ◆ Adults are attracted by tomato leaf volatiles for host finding and oviposition
 - ◆ Selection of varieties

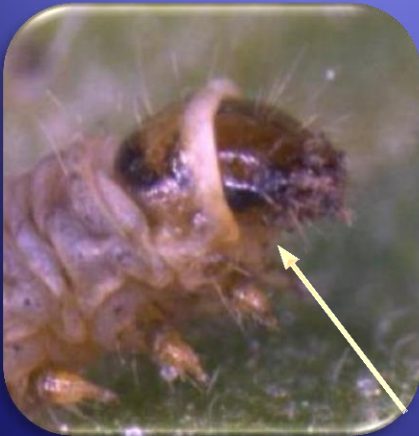
Egg

- light yellow freshly laid and dark orange at the hatching
- 0.2 to 0.4 mm
- laid singly or in small groups, mainly on young leaves (73%), followed by stems (21%), sepals (5%) and green fruits (1%)



Larva

- ◆ 0.4 to 8mm
- ◆ 4 stages
 - ◆ from light yellow to greenish
 - ◆ green with a pink dorsal band (4 th larval stage)



- ◆ prothorax plate with a dark back-end
- ◆ head with two narrow black stripes, lateral and ventral

Larval behaviour

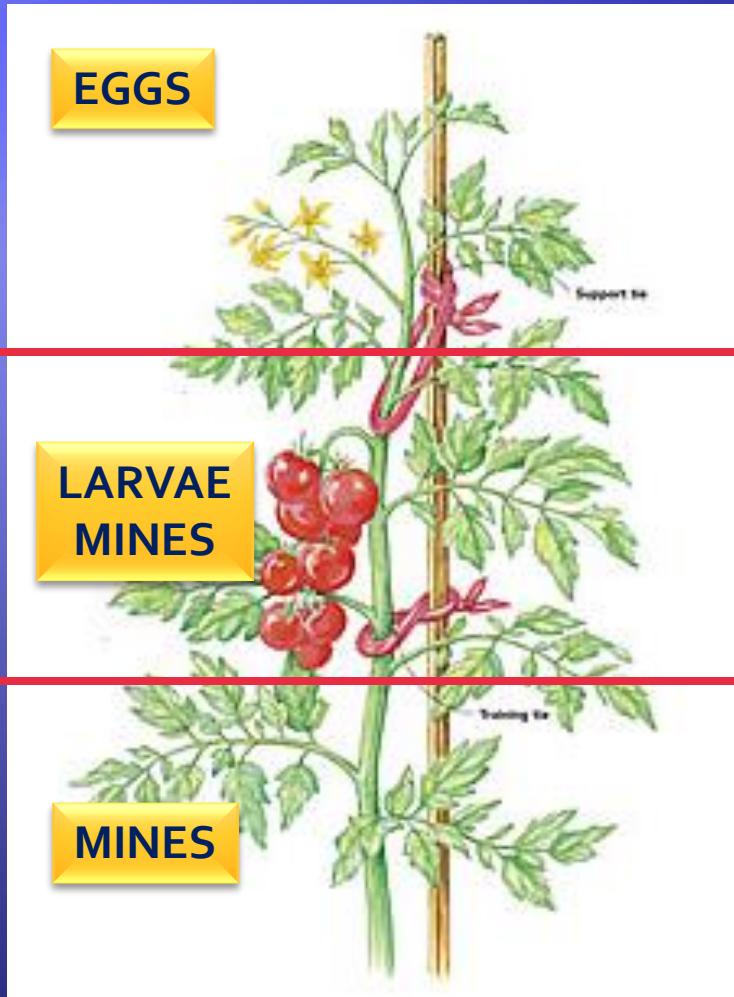
- ◆ Larvae normally hatch in the morning and wonder 5 to 40 min before starting the mine
- ◆ The second instars can leave the mine
 - ◆ **Spray the vagrant stages**
- ◆ The duration of larval stage depends on the availability of food, host plant and growing condition
 - ◆ **Cultural control and global management**
- ◆ Larvae can infest crops from the nursery to harvesting
 - ◆ **All phases need protection**

Intra-plant distribution

EGGS

LARVAE
MINES

MINES



Feeding activity and damage

L
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LEAVES



Regione Siciliana - U.O. 21 - OMP
Acireale, Sezione di Vittoria

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Other hosts



eggplant

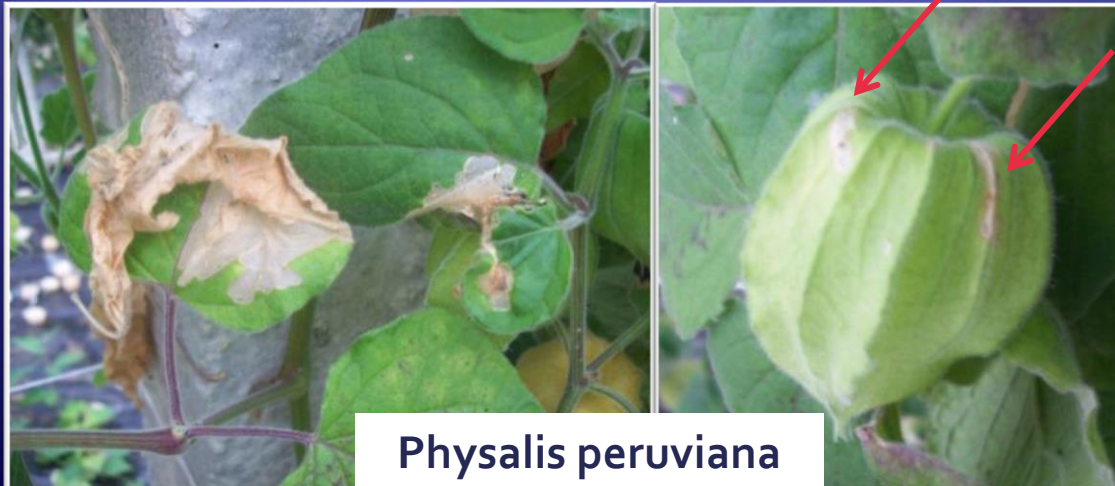


Solanum nigrum

from LAORE Sardinia



Potato



Physalis peruviana



French bean

Regione Siciliana - U.O. 21 - OMP
Acireale, Sezione di Vittoria

??????



Photos posted on Freedom-Corse.com
as potatoes damaged by Tuta



Economic Impact

- ◆ Increased cost of the tomato production process
 - ◆ additional costs for plant protection
- ◆ Yield loss
 - ◆ lower marketable production
- ◆ Rejection of the fruits for market

Pupa

- from light green to brown
- length about 4mm
- on the plant or in the soil

**Apply
Good Agricultural Practices**



Life cycle



adult
6 ÷ 7 d ♂
10 ÷ 15 d ♀



egg
4 ÷ 8 d



pupa
6 ÷ 12 d



larva
10 ÷ 20 d



Duration of developmental stages depends especially on temperature

T°C	egg	larva	pupa	adult	Cycle (days)
30	4	11	5	9	20
25	4	15	7	13	27
20	7	23	12	17	42
15	10	36	20	23	66

1 generation/month

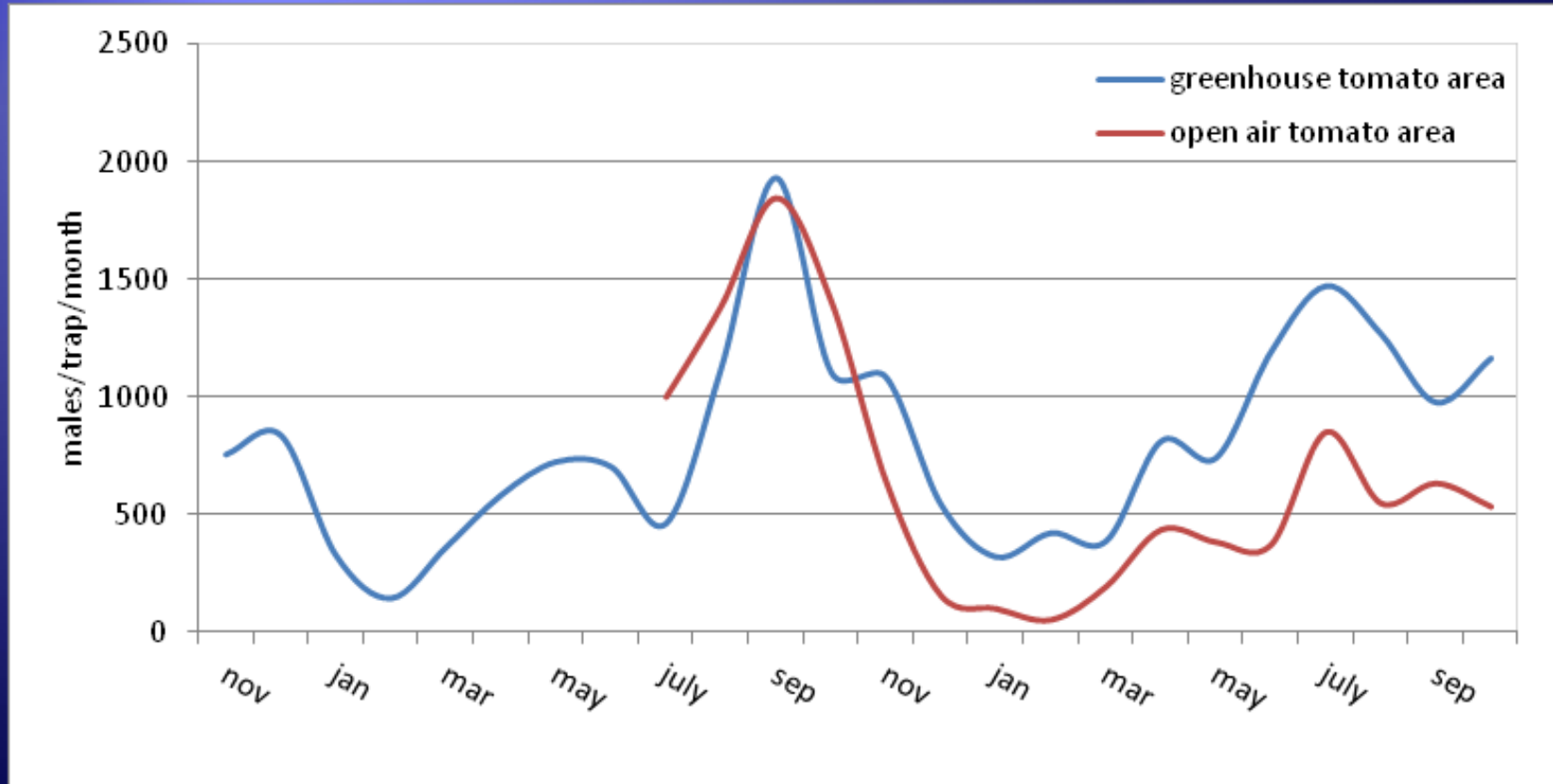
Tuta absoluta overwinters in different stages

No diapause if food is available

Growing condition	Generations/year
Open air	6-9
Greenhouse	10-12

Flight dynamics

Continuously throughout the year, greatly influenced by temperature, of transplants' calendar, presence/absence of wild hosts and seasonal trend. General reduction of the population in Sicily during the last two years.



Current situation

- ◆ *Reduction of population*
 - ◆ Use of proper insecticides
 - ◆ Activity of natural enemies
 - ◆ More attention to preventive methods
- ◆ *Better information and knowledge*
 - ◆ Extension services
 - ◆ Media communication
 - ◆ Internet network
 - ◆ Sharing of scientific data

Major points to address

- ◆ High reproductive potential
 - ◆ 10-12 generations per year
 - ◆ the female lays up to 260 eggs
- ◆ Adaptation to high temperatures
 - ◆ open air (mediterranean climate)
 - ◆ protected crop (northern climate)
- ◆ No diapause
- ◆ Different host plants
- ◆ Larval behaviour
- ◆ Pupate also in the ground
- ◆ Adults are very active early in the morning
- ◆ Monitoring

*Remember that we have no control over what happens to us,
but on what we do!*

*Bien se rappeler que nous n'avons pas de contrôle sur tout ce
qui nous arrive, mais sur ce que nous faisons!*

**Thank you very much
for your kind attention!**

*See you again in Catania on October 2012 at the IOBC WG
"Integrated Control in Protected Crops
Mediterranean Climate"*