Uni ct AGRICOLTURA, ALIMENTAZIONE E AMBIENTE

Giuseppe
Massimino Cocuzza

FOCUS SULL'AGRUMICOLTURA BIOLOGICA NEL MEDITERRANEO
CREA OFA Acireale
18 ottobre 2024

Strategie di contenimento di vecchi e nuovi fitofagi nell'agrumeto e impatto dei cambiamenti climatici

Parassiti degli agrumi in Italia dal 1970 in poi

Pezothrips kellyanus
Aleurothrixus floccosus
Dialeurodes citri
Parabemisia myricae
Paraleirodes minei
Aleurocanthus spiniferus
Pseudococcus longispinus
Coccus pseudomagnoliarum
Protopulvinaria pyriformis
Pseudococcus calceolarie
Unaspis yanonensis
Chrysomphalus aonidium
Aonidiella citrina
Phyllocnistis citrella
Halyomorpha halys
Anoplophora chinensis
Solenopsis invicta
Eutetranychus orientalis

In Spagna sono già presenti…

Eutetranychus banksii
Chaetanaphothrips orchidii
Scirtothrips aurantii
Scirtothrips dorsalis
Trioza erytreae
Delottococcus aberiae
Pulvinaria polygonata

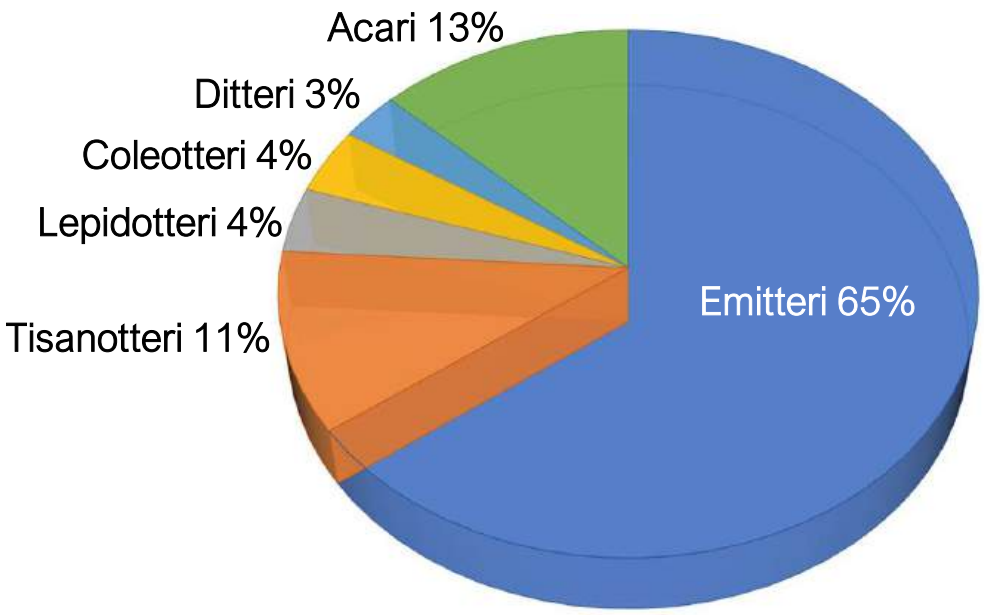
Mentre nel Mediterraneo…

Diaphorina citri

Aleirodidi (28%) e cocciniglie (39%) rappresentano il 67% delle specie infestanti gli agrumi introdotte in Italia

Gli agrumi e gli artropodi

Sugli agrumi coltivati nel bacino del Mediterraneo possono vivere oltre 70 specie tra insetti e acari



Perché questa numerosità?

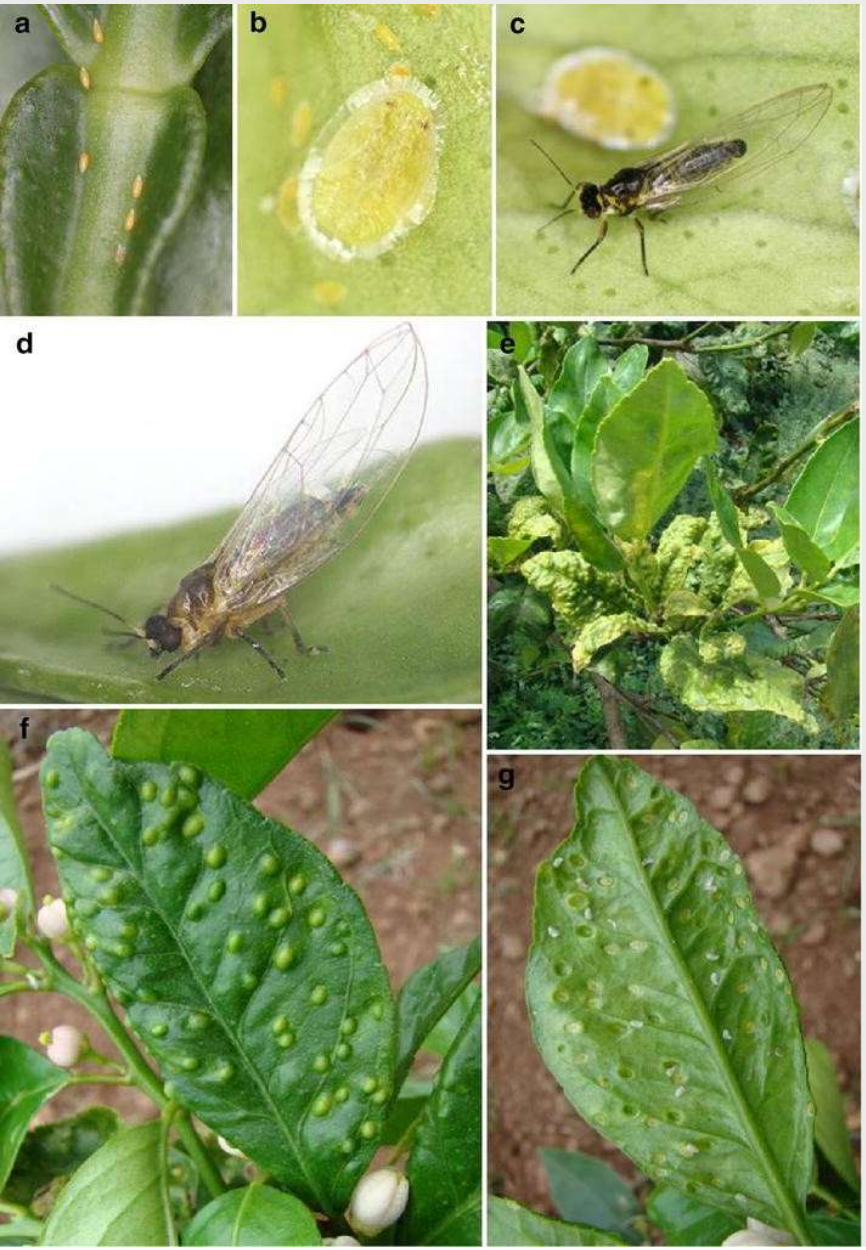
Piante sempreverdi
Clima temperato-caldo favorevole
Numerosità delle specie di agrumi
Frequenti introduzioni di specie esotiche

Il ruolo del controllo biologico

Chi ricorda *Aleurotryxus floccosus*? *Dialeurodes citri*? *Parabemisia myricae*? *Paraleirodes minei*?

Grazie a parassitoidi e antagonisti indigeni e introdotti, la dannosità di questi aleirodidi è oggi trascurabile

Il ruolo del controllo biologico



J Pest Sci (2017) 90:1–17
DOI 10.1007/s10340-016-0804-1

REVIEW

A review on *Trioza erytreae* (African citrus psyllid), now in mainland Europe, and its potential risk as vector of huanglongbing (HLB) in citrus

Giuseppe E. Massimino Cocuzza[1] · Urbaneja Alberto[2] · Estrella Hernández-Felipe Siverio[3] · Silvia Di Silvestro[4] · Alejandro Tena[2] · Rapisarda Carmelo[1]

Biological Control 188 (2024) 105431

Contents lists available at ScienceDirect

Biological Control

journal homepage: www.elsevier.com/locate/ybcon

Implementation and assessment of the classical biological control program against the huanglongbing vector, *Trioza erytreae*, in the Canary islands

J. Pérez-Rodríguez[a,b,*], L. Suárez-Méndez[c], A. Urbaneja[a], E. Hernández-Suárez[c], A. Tena[a]

[a] Instituto Valenciano de Investigaciones Agrarias (IVIA). Centro de Protección Vegetal y Biotecnología. Unidad de Entomología, Carretera CV-315, Km 10'7. 46113 Moncada, Valencia. Spain
[b] Department of Zoology, University Institute of Biotechnology and Biomedicine (BIOTECMED), Universitat de València, Unidad Mixta Gestión Biotecnológica de Plagas UV-IVIA, Dr Moliner 50, 46100 Burjassot, Valencia, Spain
[c] Unidad de Protección Vegetal. Instituto Canario de Investigaciones Agrarias (ICIA). Ctra. El Boquerón, s/n - Valle Guerra 38270 San Cristóbal de La Laguna, Tenerife. Spain

SCIENTIFIC REPORTS

OPEN

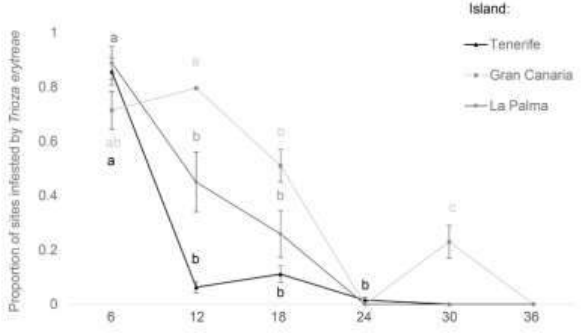
Classical biological control of the African citrus psyllid *Trioza erytreae*, a major threat to the European citrus industry

J. Pérez-Rodríguez[1,2], K. Krüger[3], M. Pérez-Hedo[2], O. Ruiz-Rivero[1], A. Urbaneja[1] & A. Tena[1]

Citrus greening or huanglongbing (HLB) is the main threat to the European citrus industry since one of its vectors, the African citrus psyllid, *Trioza erytreae*, has recently become established in mainland Europe. In this context, classical biological control programmes should be implemented to reduce the spread of the psyllid. The aims of this study were to: i) disentangle the parasitoid complex of *T. erytreae* combining morphological and molecular characterization; and ii) to study the biology of its main parasitoids in its area of origin in South Africa for their future importation into Europe. The main citrus producing areas of South Africa were surveyed during 2017. In contrast to previous studies, the parasitoid complex of *T. erytreae* included three species of primary parasitoids: *Tamarixia dryi*, *Psyllaephagus pulvinatus* and another parasitoid of the genus *Tamarixia*. Molecular analysis showed that it is a new species closely related to *T. dryi*. *Tamarixia dryi* was the most abundant parasitoid but its relative abundance varied among sampling sites. The sex ratio (males/females) of *T. dryi* and *Tamarixia* sp. decreased with *T. erytreae* size and became female biased when psyllid nymphs were larger than 0.6 and 1.2 mm², respectively. These parasitoids were attacked by three species of hyperparasitoids, *Aphidencyrtus cassatus*, *Marietta javensis* and a species of the genus *Aphanogmus*. *Aphidencyrtus cassatus*, the most abundant hyperparasitoid, tended to emerge from large nymphs, and adult females lived as long as those of *T. dryi*. The implications of these results are discussed within the framework of the introduction of *T. dryi* into Europe.

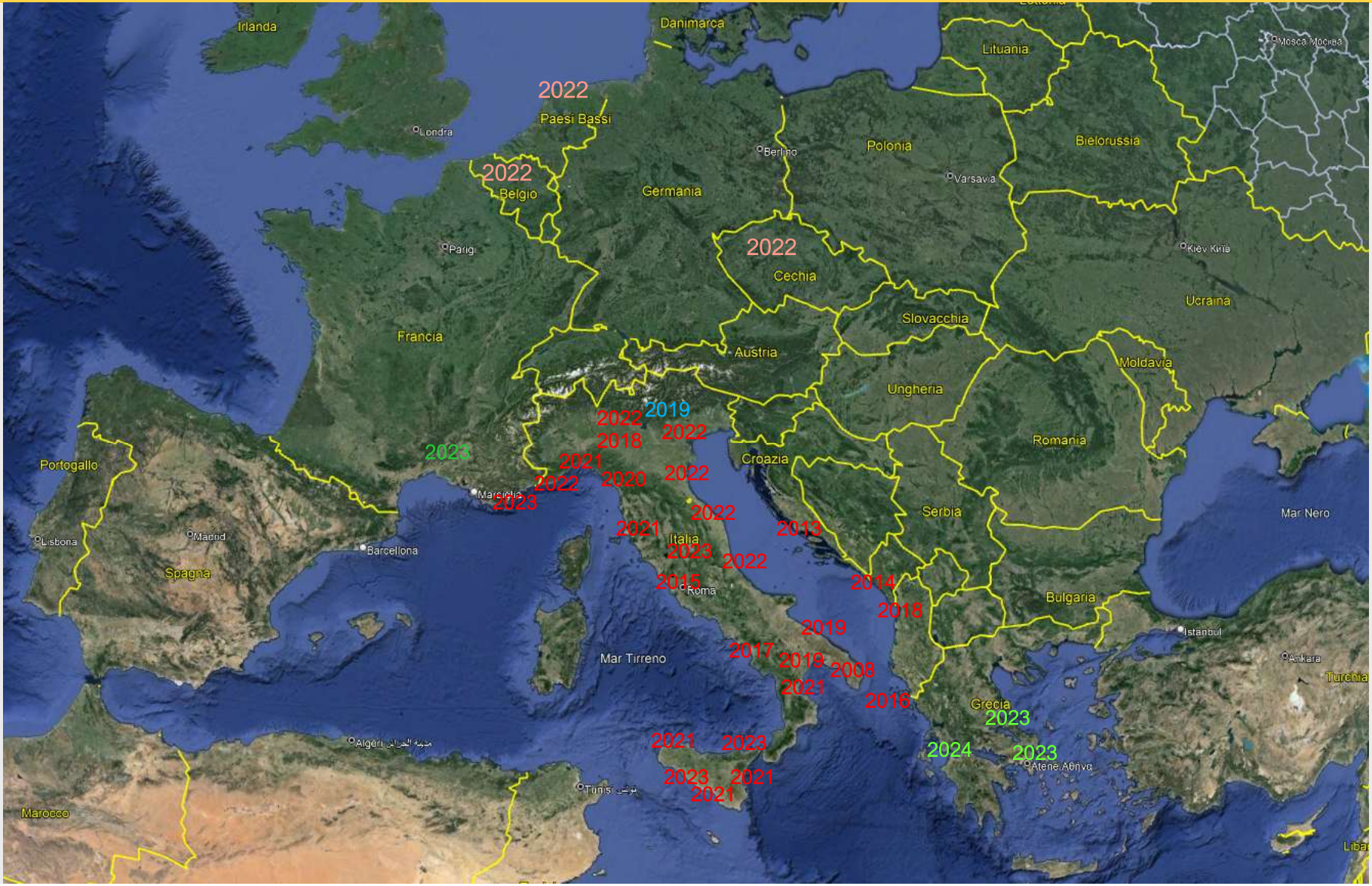
(2019) 9:9440 | https://doi.org/10.1038/s41598-019-45294-w

The primary parasitoid *Tamarixia dryi* parasitizes the HLB vector, *Trioza erytreae*



Months after *Tamarixia dryi* was released in the island of Tenerife

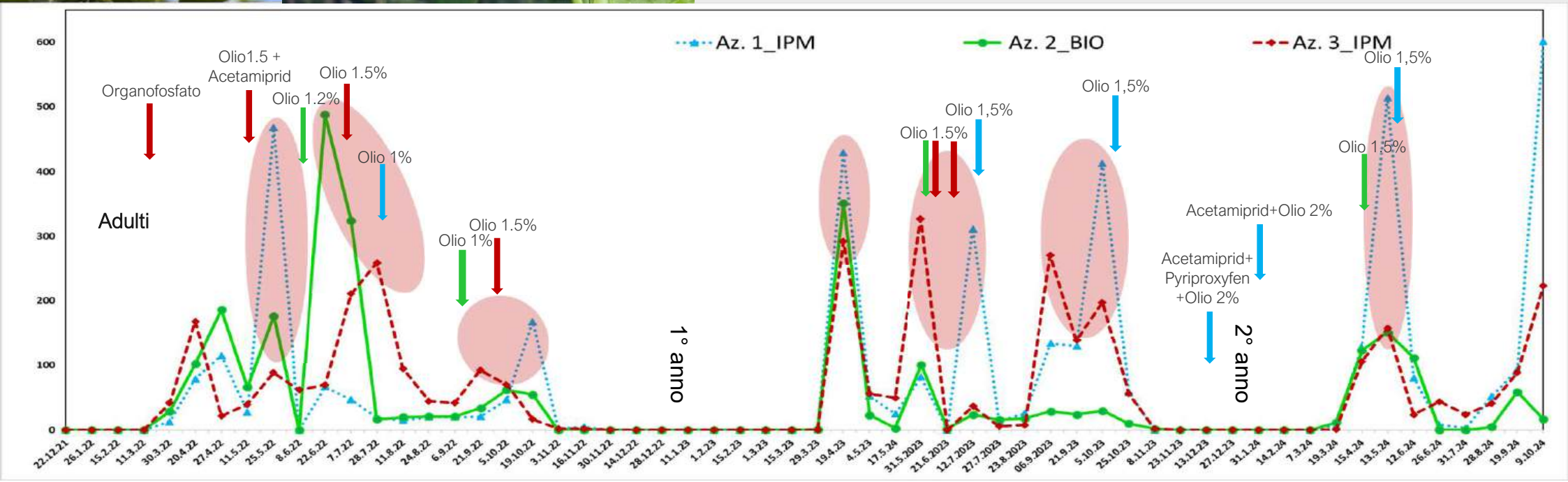
Dopo l'Italia…l'Europa

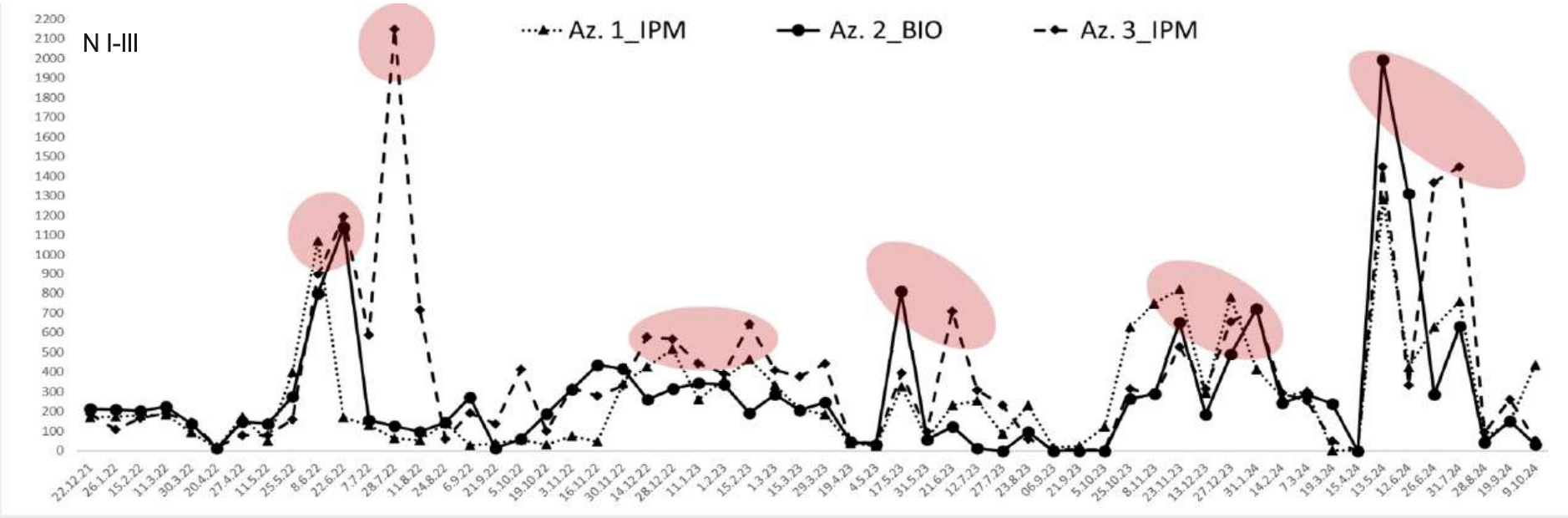


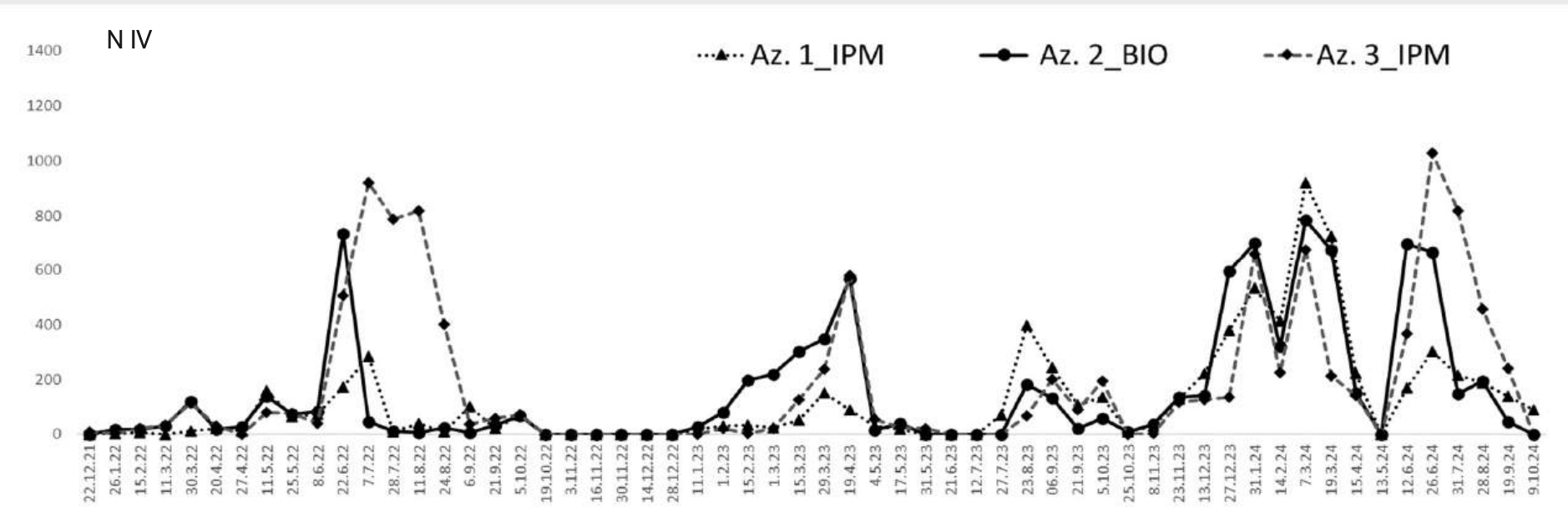
Aleurocanthus spiniferus negli agrumeti siciliani

Aleurocanthus spiniferus sverna da neanide di II e III stadio.
I primi adulti si osservano nell'ultima decade di marzo.

La generazione più dannosa è quella tardo primaverile-estiva.
La specie svolge 3 generazioni annue.

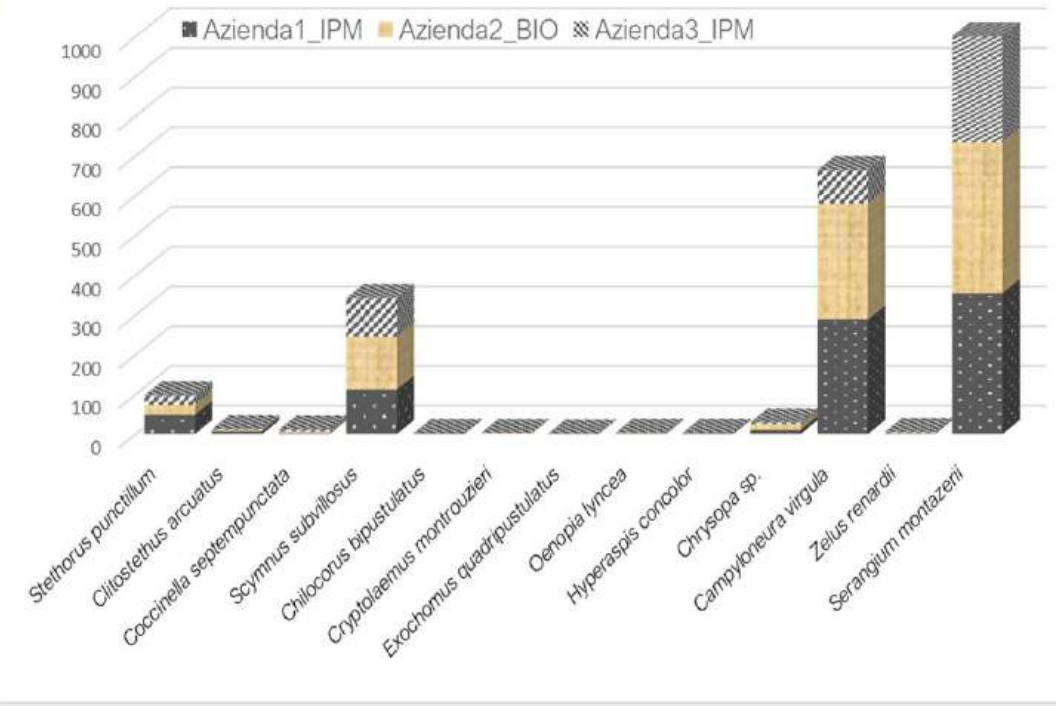


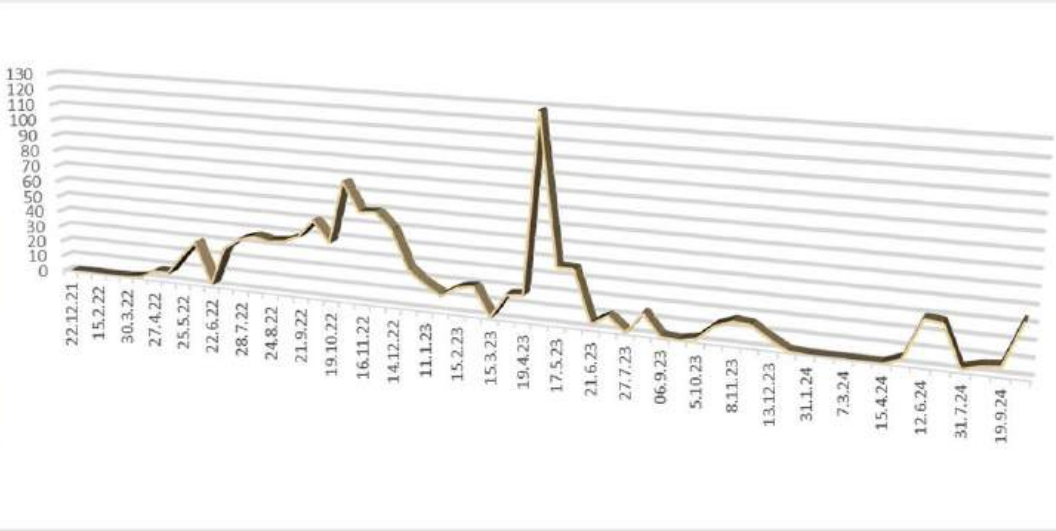

N I-III
Az. 1_IPM
Az. 2_BIO
Az. 3_IPM


N IV
Az. 1_IPM
Az. 2_BIO
Az. 3_IPM

Serangium montazerii Fürsch

Coleoptera, Coccinellidae, Microweiseinae, Seranginii





Presenza **costante.** La sua numerosità è strettamente connessa alla densità di popolazione di *Aleurocanthus*

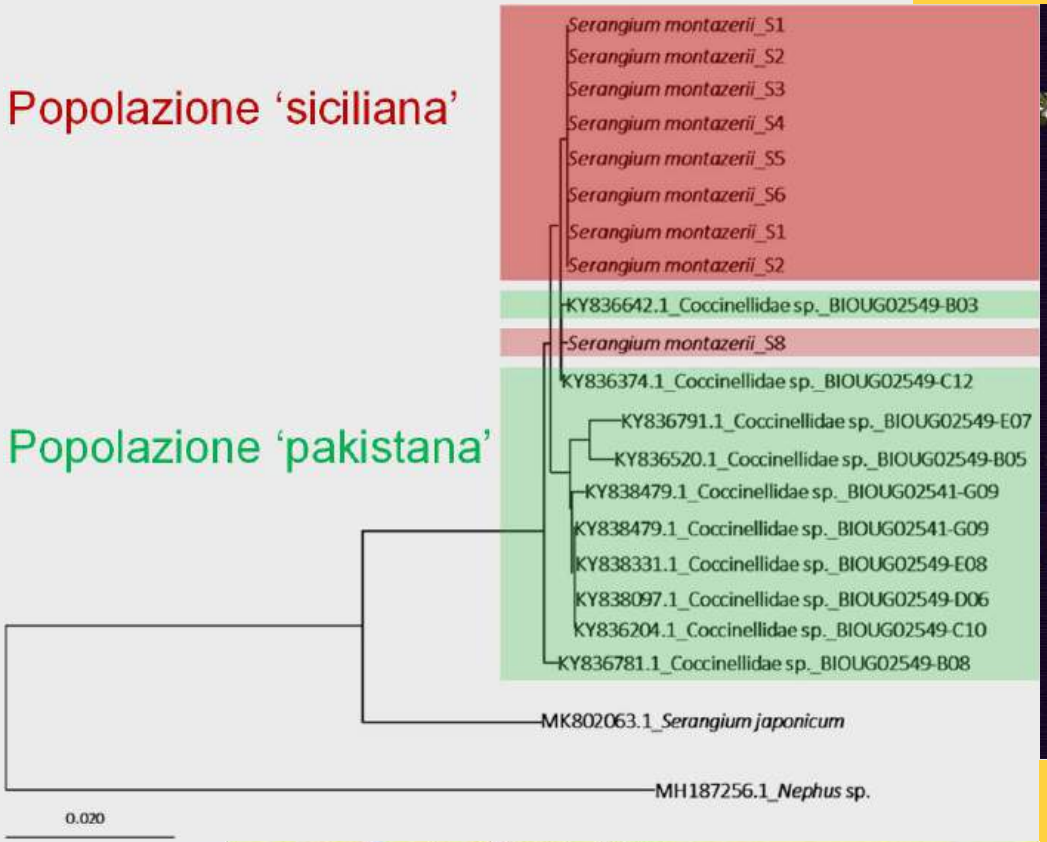
Non è risolutivo, ma contribuisce al contenimento dell'aleirode

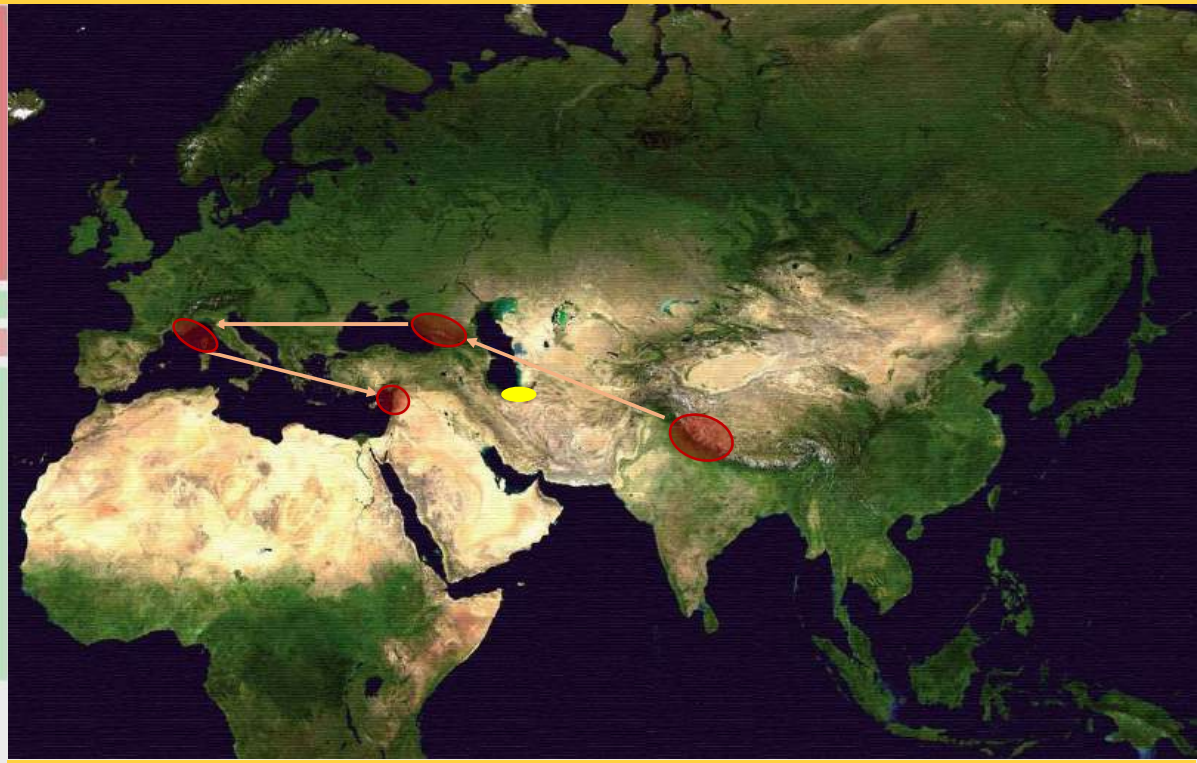
E' possibile l'allevamento di *Serangium* in biofabbrica

La storia di *Serangium montazerii*

Popolazione ‘siciliana’

Popolazione ‘pakistana’





Introdotto, come *Serangium parcesetosum*, rispettivamente in Georgia nel 1978, Francia (Costa Azzurra e Corsica) nel 1985 e Israele (1989) per il controllo di *Dialeurodes citri*. Si è diffuso spontaneamente in Turchia e Siria. Introdotto nel 1993 anche in Texas (USA) dall’India per il controllo di *Bemisia tabaci*.

E i parassitoidi?

The drastic reduction of host populations is probably attributable to the activity impact of aphelinids, testified by numerous nymphs with the typical exit hole known for the species of the genus *Eretmocerus*, as well as to the predation activities by *S. montazerii*, *C. arcuatus*, and *D. catalinae*. Population trends of *Eretmocerus* sp. gr. *serius* indicate that even slight

sustainability

Attualmente, nelle **principali aree di rinvenimento**, si registra una percentuale di parassitizzazione del **35-40%.**

Article

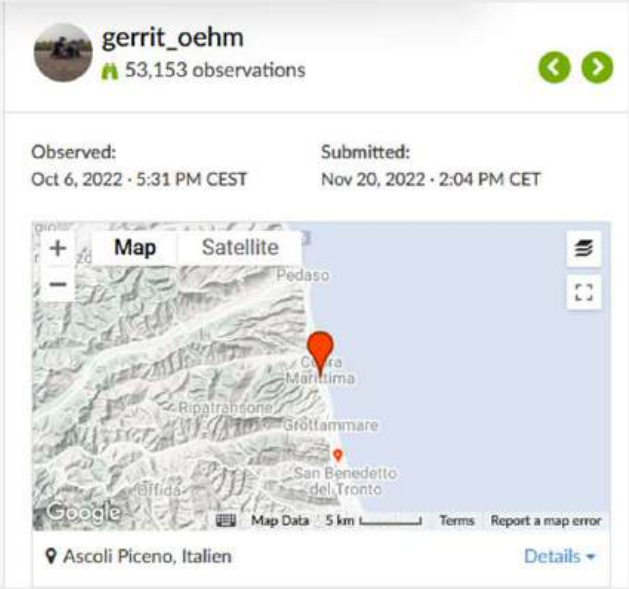
An *Eretmocerus* Species, Parasitoid of *Aleurocanthus spiniferus*, Was Found in Europe: The Secret Savior of Threatened Plants

Gianluca Melone [1], Roberta Ascolese [2,3], Francesco Nugnes [2,*], Francesco Porcelli [4], Carmelo Rapisarda [5], Alessia Farina [5], Ugo Picciotti [4], Francesca Garganese [4] and Stefania Laudonia [1,6]

Citizen Science

iNaturalist

https://www.inaturalist.org/observations/142448049

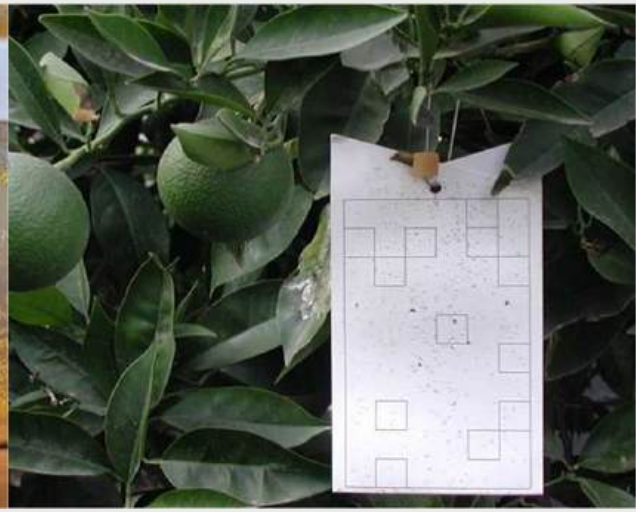


Intraguild predation

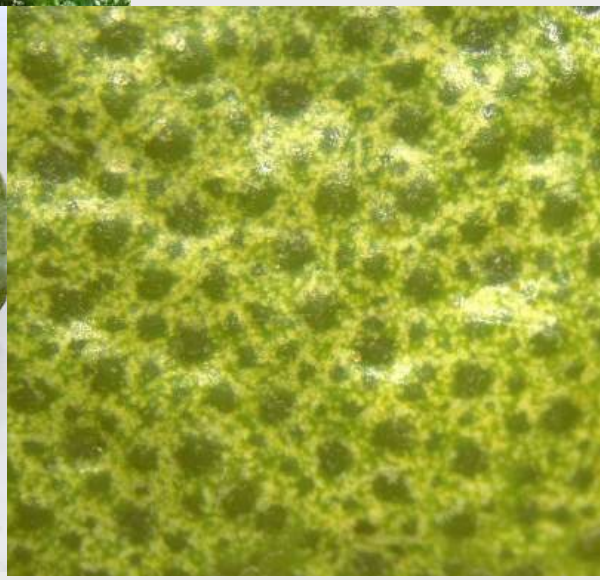
Più antagonisti naturali condividono una stessa preda o ospite e contribuiscono insieme al controllo delle sue popolazioni

Vecchi fitofagi

Nell’azienda storica nel territorio di Mineo, i rilasci annuali sono iniziati nel 1992 e sospesi nel 2021…per carenza di cocciniglie (catture di maschi bassissime)!



Il nuovo acaro *Eutetranychus orientalis*



Il nuovo acaro *Eutetranychus orientalis*

- Morfologia simile a *Eutetranychus banksi* e *E. africanus*
- Quanto è diffuso?
- Come è arrivata in Sicilia?
- Dannosità
- Strategie (?) di controllo

Il ruolo degli insetticidi

Nel 1990 le sostanze attive registrate sugli agrumi: 46 (solo 1BIO)

Meccanismi d'azione: 6

Nel 2024 le sostanze attive registrate sugli agrumi : 22 (13 no BIO / 9 BIO)

Meccanismi d'azione: 9

Acaricidi: 6

BIO: 4 (Beauveria bassiana, maltodestrine, olio paraffinico, sali potassici)

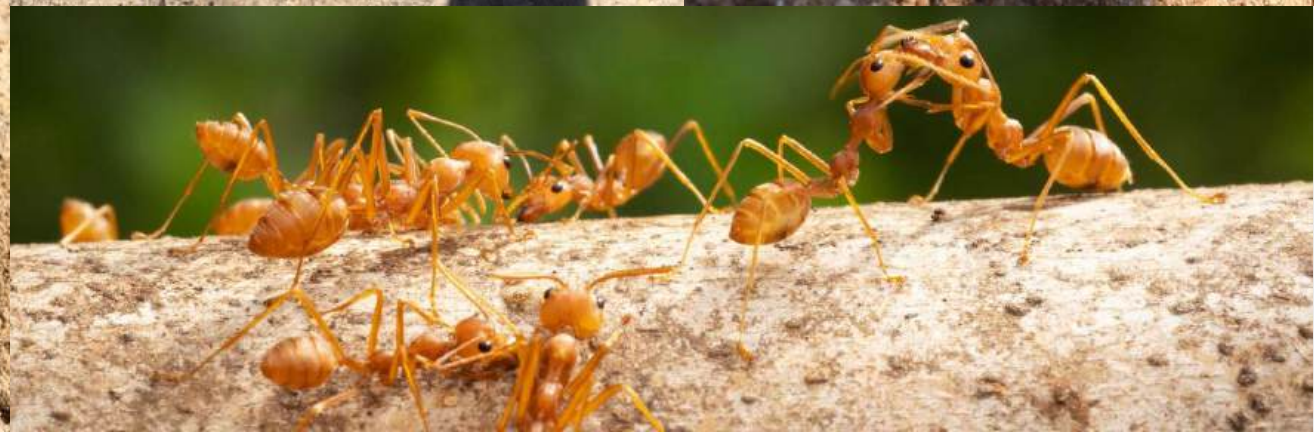
No BIO: 2 (cyflumetofen, spirotetramat fino al 10.2025)

Al 2024 risultano disponibili sul mercato 65 '**prodotti ad azione specifica – biostimolanti**' utilizzabili sugli agrumi

La formica di fuoco

Solenopsis invicta

Solenopsis invicta è un insetto onnivoro. Negli agrumeti ad alte densità di popolazione, potrebbe causare danni diretti e indiretti alle soprattutto alle giovani piante.



La formica di fuoco

Solenopsis invicta

I nidi sono uno tipici, riconoscibili e rinvenibili ovunque

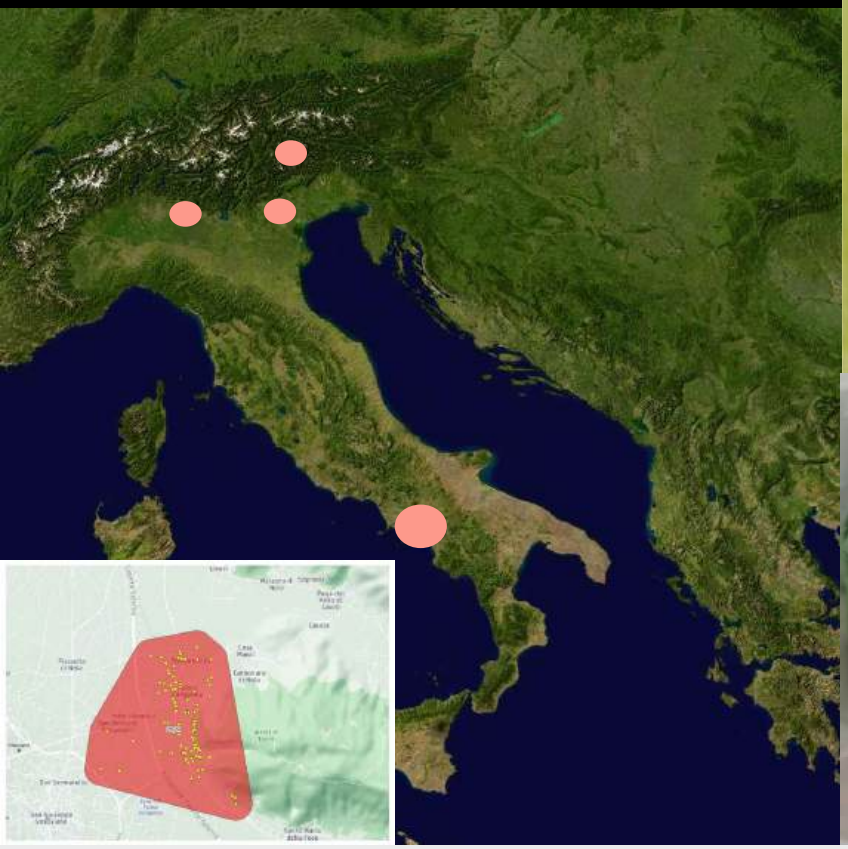
La formica di fuoco

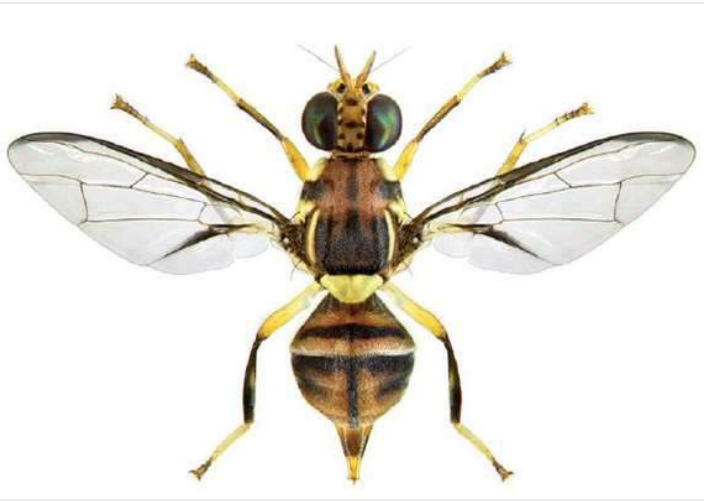
Solenopsis invicta

Solenopsis invicta è considerata tra le 10 specie di insetti più dannosi del mondo

Mosca orientale della frutta

Bactrocera dorsalis





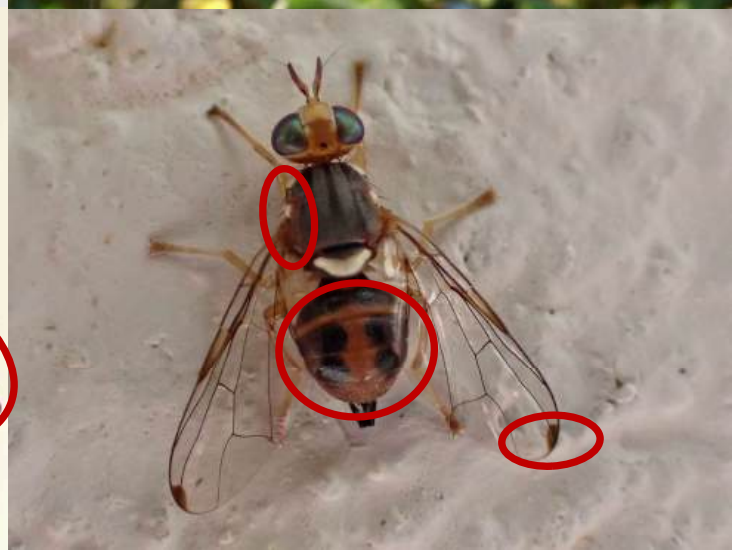
Attualmente presente in Campania (area di Palma Campania e San Giuseppe Vesuviano). Individuata in Emilia Romagna (Bologna), Lombardia (mercato ortofrutticolo di Milano), Alto Adige (Merano) e Veneto (mercato ortofrutticolo di Mestre). Tutti i rinvenimenti sono avvenuti con le trappole. Più volte intercettata in vari aeroporti.

Mosca orientale della frutta

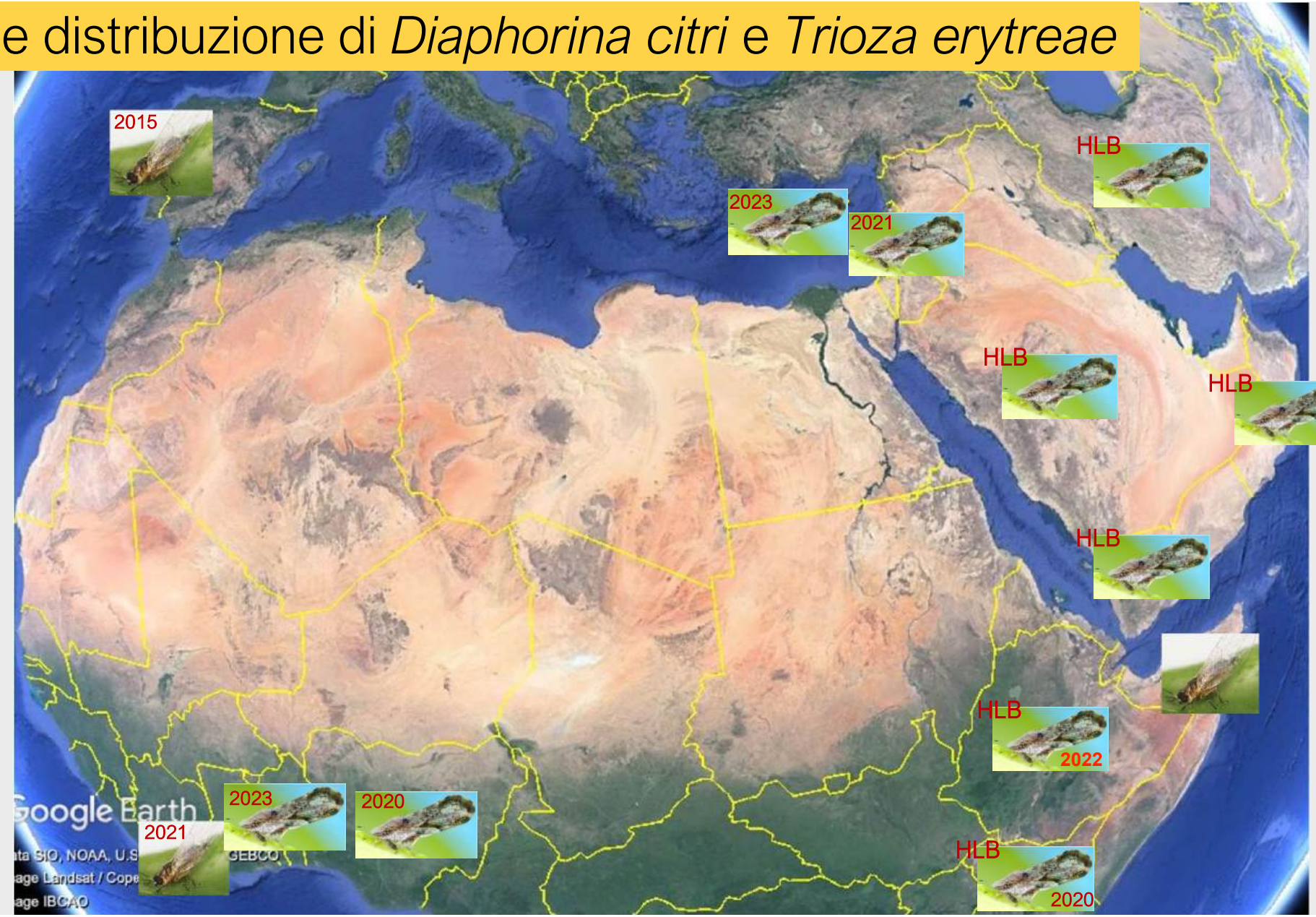
Bactrocera dorsalis

Attacca oltre 300 specie vegetali: frutta tropicale (avocado, mango), frutticole (drupacee, pomacee) e agrumi

Come distinguerla da *Ceratitis capitata* e *Bactrocera oleae*?



Attuale distribuzione di *Diaphorina citri* e *Trioza erytreae*



Come riconoscere i due insetti?

Psilla africana degli agrumi

ADULTI

Trioza erytreae (Triozidae)

Psilla asiatica degli agrumi

Diaphorina citri (Liviidae)

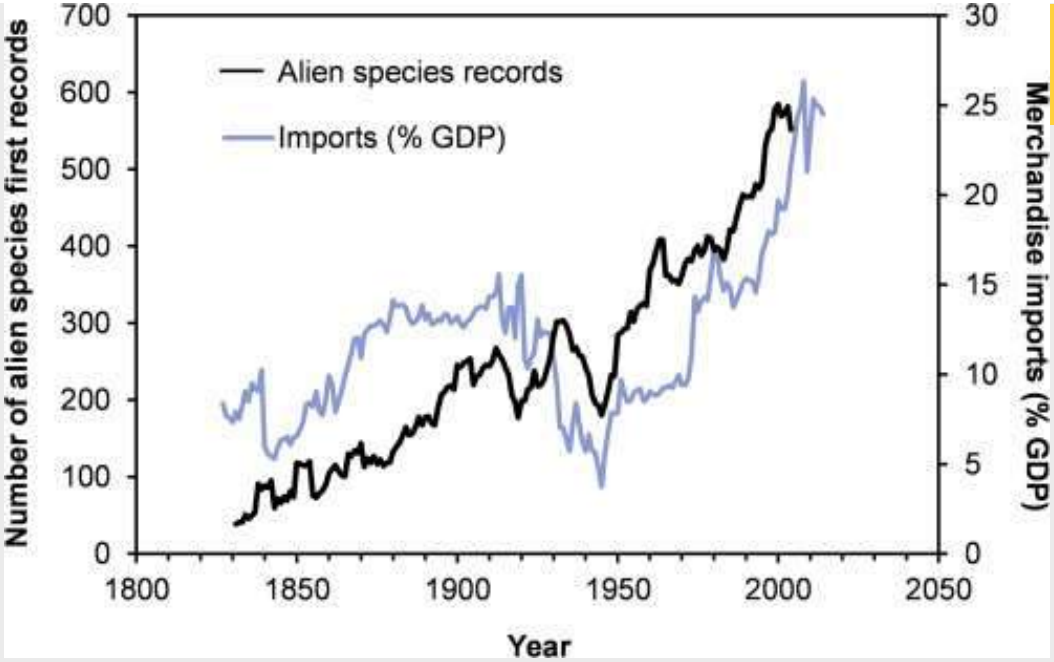
Se si osservano questi sintomi SEGNALARLO SUBITO

Trioza erytreae

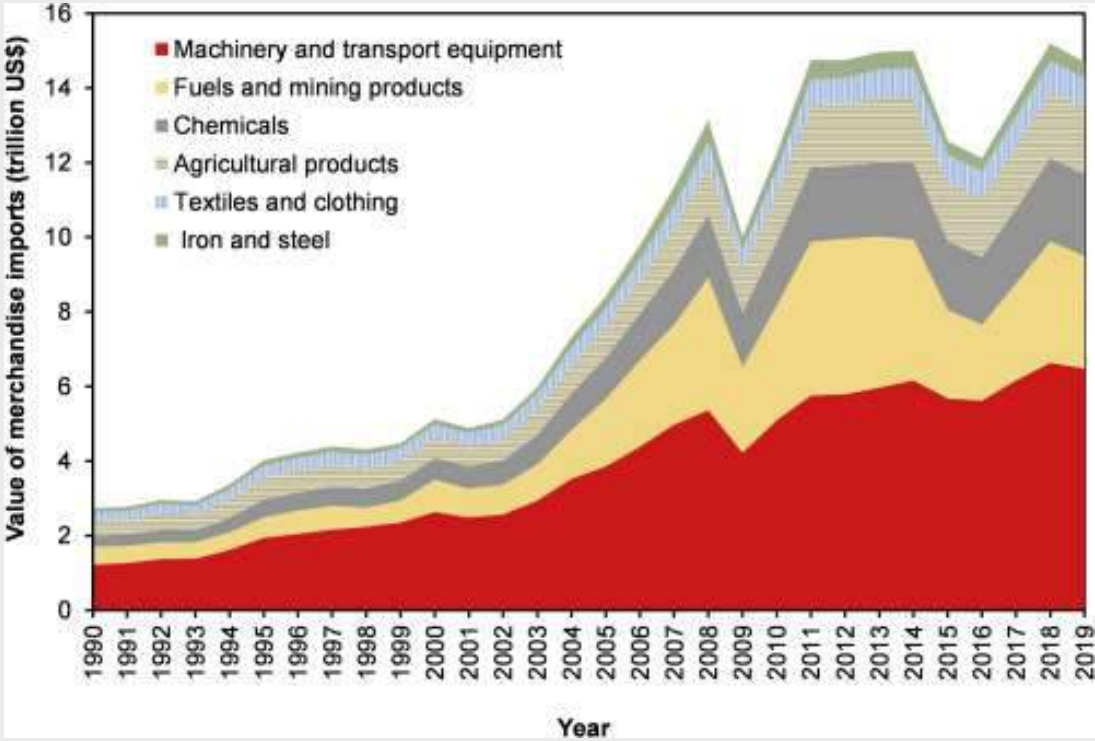
Diaphorina citri

Come arrivano insetti e acari?

Come arrivano insetti e acari?



Variazione temporale della percentuale del PIL costituita dalle importazioni e del numero di prime registrazioni di specie esotiche in tutto il mondo.



PNAS RESEARCH ARTICLE | ECOLOGY

Historical plant introductions predict current insect invasions

Aymeric Bonnamour[a,1], Rachael E. Blake[b], Andrew M. Liebhold[c,d], Helen F. Nahrung[e], Alain Roques[f], Rebecca M. Turner[g], Takehiko Yamanaka[h], and Cleo Bertelsmeier[a,1]

Edited by Daniel Simberloff, University of Tennessee at Knoxville, Knoxville, TN; received December 23, 2022; accepted April 20, 2023

Overall, our results highlight the strong link between plant and insect invasions and show that limiting the spread of nonnative plants might be key to preventing future invasions of both plants and insects.

Lo studio evidenziano il forte legame tra piante esotiche e insetti. Limitare la diffusione di piante non autoctone è fondamentale per prevenire future invasioni sia di piante che di insetti.

Cambiamenti climatici

Complex responses of global insect pests to climate warming

Philipp Lehmann[1,2,3*], Tea Ammunét[4†], Madeleine Barton[3†], Andrea Battisti[5†], Sanford D Eigenbrode[6†], Jane Uhd Jepsen[7†], Gregor Kalinkat[8†], Seppo Neuvonen[9†], Pekka Niemelä[10†], John S Terblanche[3†], Bjørn Økland[11†], and Christer Björkman[4]

Although it is well known that insects are sensitive to temperature, how they will be affected by ongoing global warming remains uncertain because these responses are multifaceted and ecologically complex. We reviewed the effects of climate warming on 31 globally important phytophagous (plant-eating) insect pests to determine whether general trends in their responses to warming were detectable. We included four response categories (range expansion, life history, population dynamics, and trophic interactions) in this assessment. For the majority of these species, we identified at least one response to warming that affects the severity of the threat they pose as pests. Among these insect species, 41% showed responses expected to lead to increased pest damage, whereas only 4% exhibited responses consistent with reduced effects; notably, most of these species (55%) demonstrated mixed responses. This means that the severity of a given insect pest may both increase and decrease with ongoing climate warming. Overall, our analysis indicated that anticipating the effects of climate warming on phytophagous insect pests is far from straightforward. Rather, efforts to mitigate the undesirable effects of warming on insect pests must include a better understanding of how individual species will respond, and the complex ecological mechanisms underlying their responses.

Front Ecol Environ 2020; 18(3): 141–150, doi:10.1002/fee.2160

insects MDPI

Review

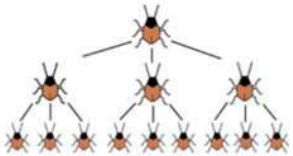
The Impact of Climate Change on Agricultural Insect Pests

Sandra Skendžić [1,2,*], Monika Zovko [2], Ivana Pajač Živković [1], Vinko Lešić [3] and Darija Lemić [1]

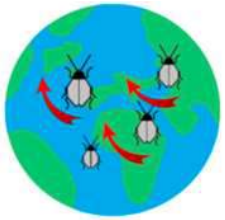
Insects **2021**, *12*, 440. https://doi.org/10.3390/ insects12050440

Abstract: Climate change and global warming are of great concern to agriculture worldwide and are among the most discussed issues in today's society. Climate parameters such as increased temperatures, rising atmospheric CO_2 levels, and changing precipitation patterns have significant impacts on agricultural production and on agricultural insect pests. Changes in climate can affect insect pests in several ways. They can result in an expansion of their geographic distribution, increased survival during overwintering, increased number of generations, altered synchrony between plants and pests, altered interspecific interaction, increased risk of invasion by migratory pests, increased incidence of insect-transmitted plant diseases, and reduced effectiveness of biological control, especially natural enemies. As a result, there is a serious risk of crop economic losses, as well as a challenge to human food security. As a major driver of pest population dynamics, climate change will require adaptive management strategies to deal with the changing status of pests. Several priorities can be identified for future research on the effects of climatic changes on agricultural insect pests. These include modified integrated pest management tactics, monitoring climate and pest populations, and the use of modelling prediction tools.

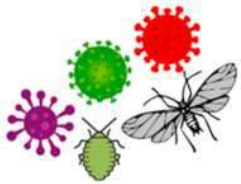
In che modo l'aumento della temperatura può influire sugli insetti?



Incremento del numero di generazioni

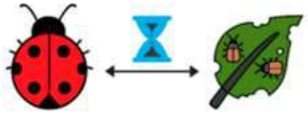


Espansione delle aree di diffusione



Maggiore diffusione delle malattie trasmesse dagli inset

Incremento della sopravvivenza invernale



Desincronizzazione del ciclo pest/beneficial

Desincronizzazione del ciclo pest/pianta ospite

Grazie per l’attenzione

giuseppe.massiminococuzza@unict.it