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Croatian Agency for Agriculture and Food | L'Agence Croate pour l'Agriculture et l'Alimentation

EMERGING PLANT DISEASES AND ADAPTATION OF INSECT PESTS IN A CHANGING CLIMATE – SOME RECENT CROATIAN EXPERIENCES

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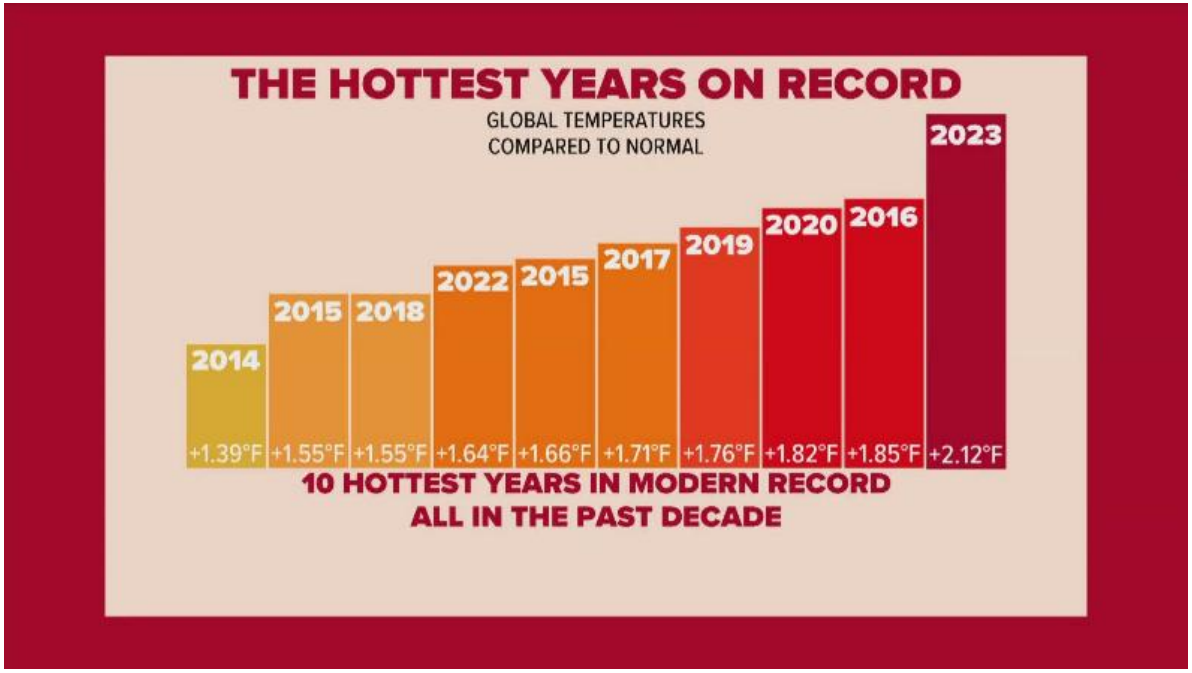
CHANGING CLIMATE

CHANGING CLIMATE

Five warmest years since global measurements are available: 2023, 2016, 2020, 2019, 2017

2023 was the warmest year in the modern temperature record



CHANGING CLIMATE

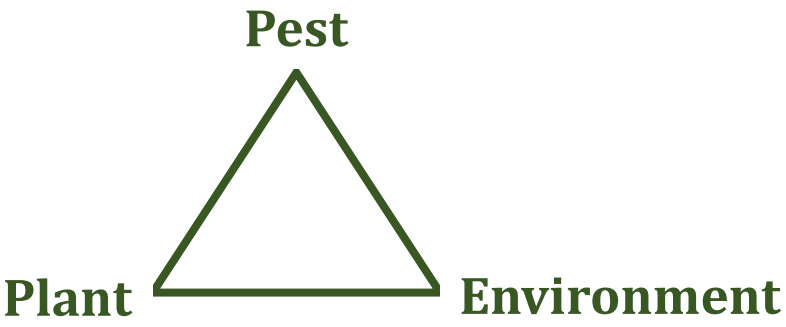
Adaptation – one of the main drivers of evolution

Plant pests and pathogens – adapting to changes in environmental conditions

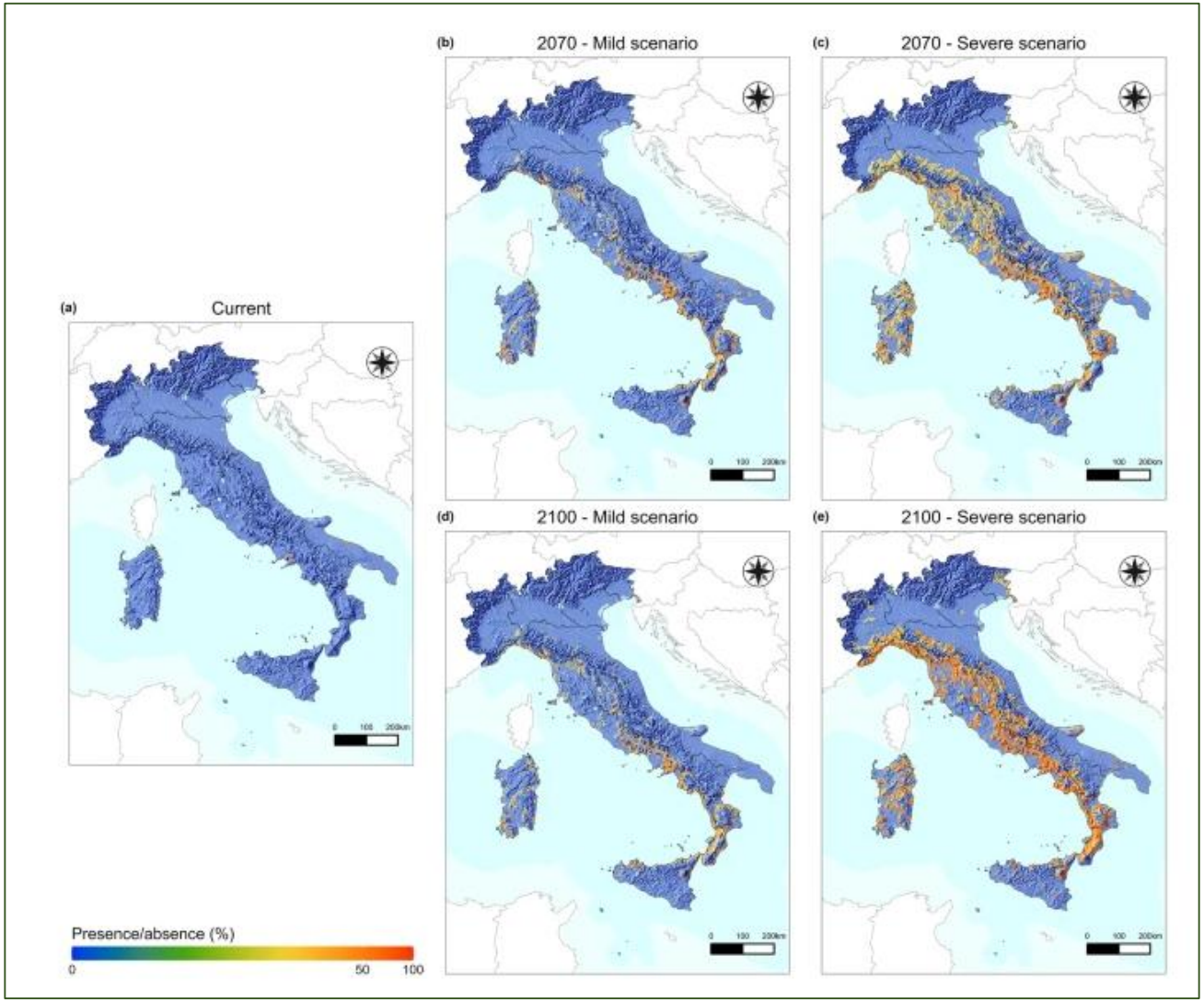
Changes driven by multiple factors – demanding analysis

Measurements / Observations

Scientifically supported data / Observed appearance

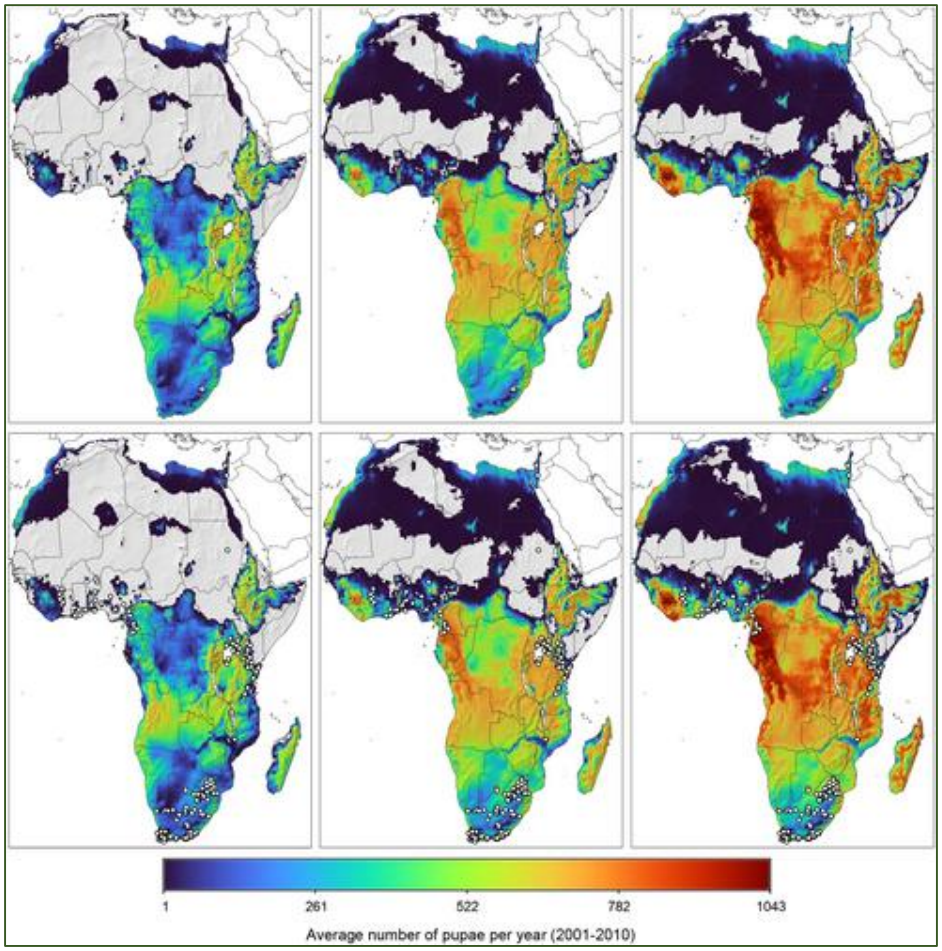


CHANGING CLIMATE



Bernardo, U., Nugnes, F., Ascolese R., Carbone, C., Miele, F., Innangi, M., Di Febbraro, M. (2025). Predicting the invasion risk of Bactrocera dorsalis in Italy under climate and land cover change. Scientific Reports 15, 35096.

CHANGING CLIMATE



Thaumatotibia leucotreta average number of pupae as projected, shown for three scenarios of larval temperature-dependent mortality

EFSA Journal, Volume: 21, Issue: 10, First published: 19 October 2023, DOI: (10.2903/j.efsa.2023.8107)

PLANT PATHOGENS

Microorganisms

More rapid adaptation

More complex to investigate

In relation to host plant – interactions

<u>‘Classical’ criteria:</u>
Minimal temperature for growth
Optimal temperature for growth
Maximal temperature for growth

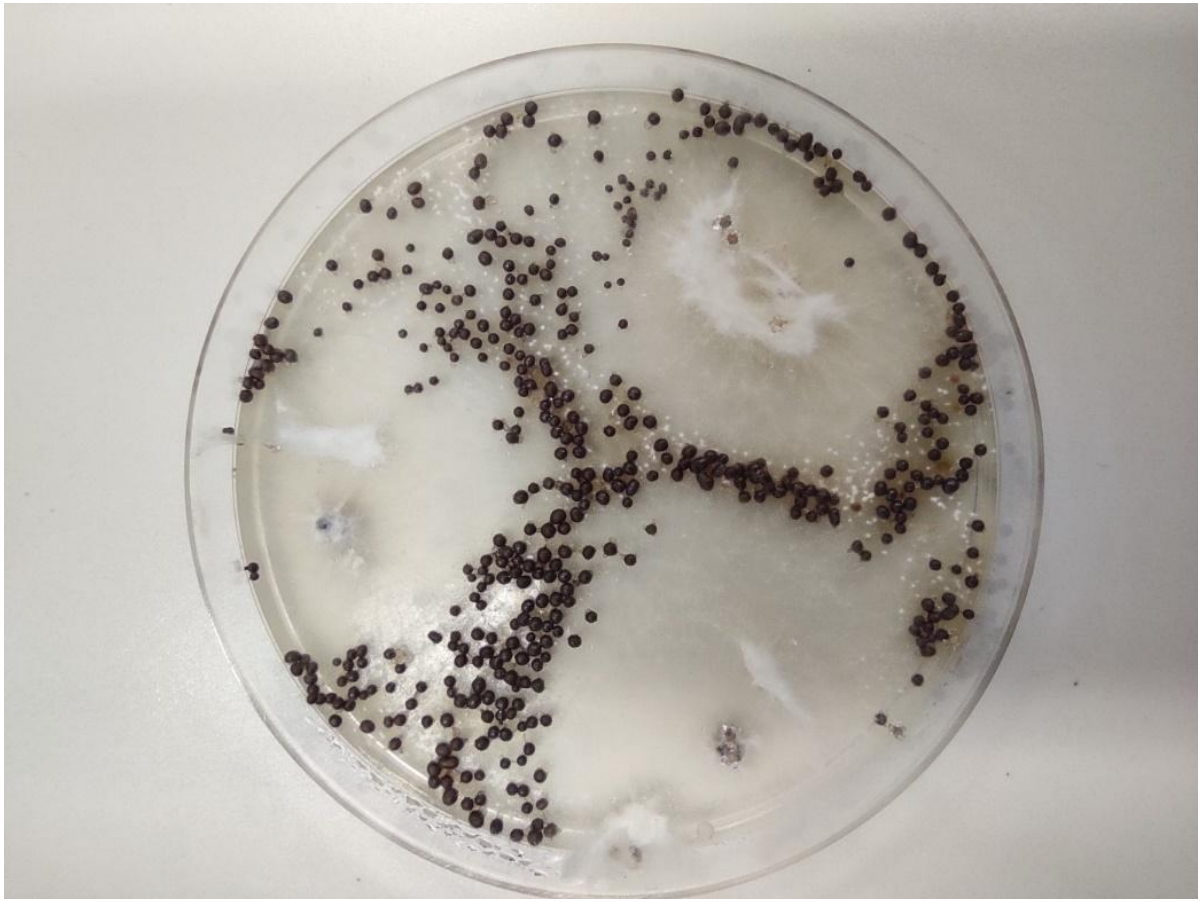
Changes in the occurrence of plant diseases
Changes in the impact (severity) of plant diseases
Changes in the distribution of plant diseases

PLANT PATHOGENS

Sclerotium rolfsii

‘Pathogen of warm climates’ – optimal range for growth 25 – 35 °C

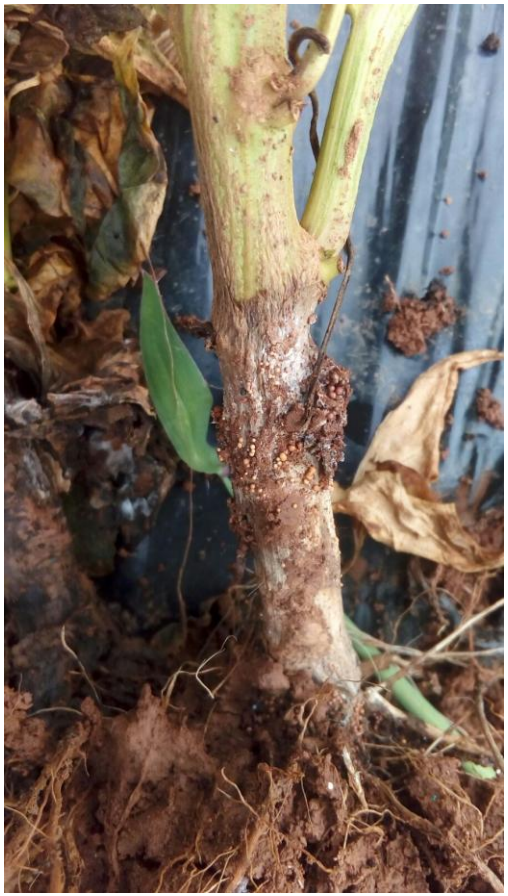
PLANT PATHOGENS



Sclerotium rolfsii

Until 2019, only one report in Croatia (2005)

PLANT PATHOGENS



Sclerotium rolfsii

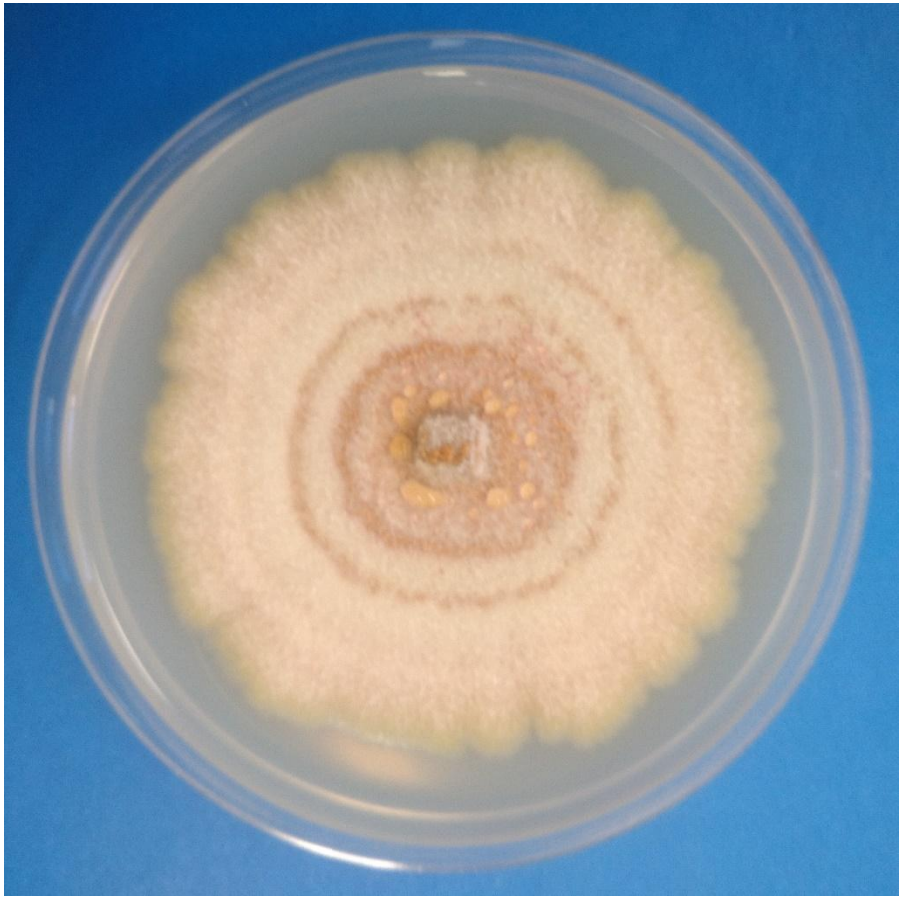
2019: Severe occurrence on pepper and tomato in Istria
2020: Severe occurrence on tomato in Istria
2023: Severe occurrence on potato near Dubrovnik

PLANT PATHOGENS

***Colletotrichum* spp.**

‘Pathogens of warmer climates’ – optimal range for growth 25 – 38 °C (for many species…)

PLANT PATHOGENS



***Colletotrichum* spp.**

Until 2015, sporadic on pepper, apple and mandarines

PLANT PATHOGENS







***Colletotrichum* spp.**

2015 - now: Economically important pathogen of apples
2017 – now: First findings on pear, plum, almond, olives
2018 - now: Severe occurrence on mandarins, each year

PLANT PATHOGENS

Botryosphaeriaceae

‘Stress-related pathogens’

PLANT PATHOGENS

Botryosphaeriaceae

The incidence of wood and canker diseases is increasing

PLANT PATHOGENS

Botryosphaeriaceae

2015 – now: Findings in declining fruit and forest plants
2020 – now: Increased occurrence on fruits

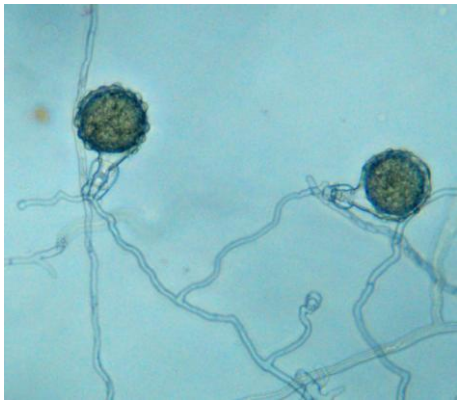
PLANT PATHOGENS

***Phytophthora* species**

Different ranges, host plants and requirements

PLANT PATHOGENS




Phytophthora palmivora **– more and more findings**
Phytophthora cinnamomi **– good adaptation to 'cold' winters**
Phytophthora austrocedri **– good adaptation to warm summers**

PLANT PATHOGENS

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Impact of a drier climate on the exotic pathogen *Phytophthora cinnamomi* in Mediterranean forests differing in soil properties and species composition

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Oak forests
Olea europaea var. *sylvestris*
Quercus suber
Quercus canariensis
Soil-borne pathogens

ABSTRACT

As climate becomes drier, plant disease dynamics will change. However, there is a lack of experimental data exploring how climate change scenarios will modify the abundance of aggressive pathogens threating forest ecosystems. In this study, we aimed to fill this gap by analysing the effect of a drier climate on the population dynamics of *Phytophthora cinnamomi*, one of the 100 worst invasive alien species on earth. The study was conducted over 5 years (2016–2020) in two Mediterranean mixed forests of Southern Spain invaded by the pathogen. The two forests varied in soil properties (texture) and species composition (closed forest of *Quercus suber* and *Quercus canariensis* vs. open woodland of *Quercus suber* and *Olea europaea*). The abundance of *P. cinnamomi* resistance spores in the forest soil was analysed every spring taking advantage of rainfall exclusion infrastructures that removed 30 % of the rainfall, simulating predicted climate change scenarios for the Mediterranean basin. Results showed that *P. cinnamomi* abundance in the forest soil was influenced by both soil texture and tree species composition, being lower in sandy soils and under *Olea europaea* compared to *Quercus* species. More importantly, we found a general negative effect of the rainfall exclusion treatment on pathogen abundance across soils and species. The longitudinal assessment of *P. cinnamomi* abundance in the soil also revealed that the pathogen had the capacity to survive at low density during dry years and increase its population in response to subsequent wet years. Overall, our findings suggest that the aridification of the Mediterranean climate might imply a reduction in average pathogen abundance, but that it would not be enough to preclude peaks of high pathogen abundance in response to the extreme heavy rains and floods also predicted by climate change models.

INSECT PESTS

Changes in incidence and severity

Changes in the relevance of particular species

Warm summers – higher numbers of generations

Mild summers – lower mortality

In relation to natural enemies and agronomic practices – complex analysis

Reduction of active substances available – impact?

Increased incidence of aphids and scale insects
Increased incidence of cicadas
Increased incidence of mites
Spread of particular species into new areas

INSECT PESTS

2024: Emergence of *Tuta absoluta* in northern Croatia
2023, 2025: High incidence of stolbur in sugar beet and potato
2022 – now: High incidence of stink bugs in hazelnuts and vegetables

INSECT PESTS

Higher incidence in vector-borne diseases

Aphid-borne viruses
Phytoplasmas and other phloem-bacteria

INSECT PESTS

Ceratitis capitata **in Neretva Valley**

Sterile Insect Technique (SIT)

From April to November

Integrated approach in the management of the Mediterranean fruit fly

INSECT PESTS

6 – 26 % of females and 6 – 10 % of males may survive as adults in the open field from October to April

Higher percentages in urban environments – 42 % of females and 33 % of males

Survival of pupae: 15 – 45 %, adults may survive until August

Bjeliš, M., Popović, L., Moraiti, C.A., Papadopoulos, N.T. (2020). Overwintering dynamics of the Mediterranean fruit fly in Central Dalmatia of Croatia. Book of Abstracts of 4th International TEAM Meeting

CHANGING CLIMATE

Climate change leads to changes in the occurrence, severity and distribution of plant diseases and pests

Pests and diseases – 'indicators' of climate change?

Interaction with other factors

Pest risk assessments may include 'changing climate' scenarios

Assumptions

Scientific research – a base for the improvement of models


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