



Broad-Range Trichoderma-Based Biocontrol to Reduce Preharvest Fruit Loss Caused by Walnut Fruit Rot Pathogens

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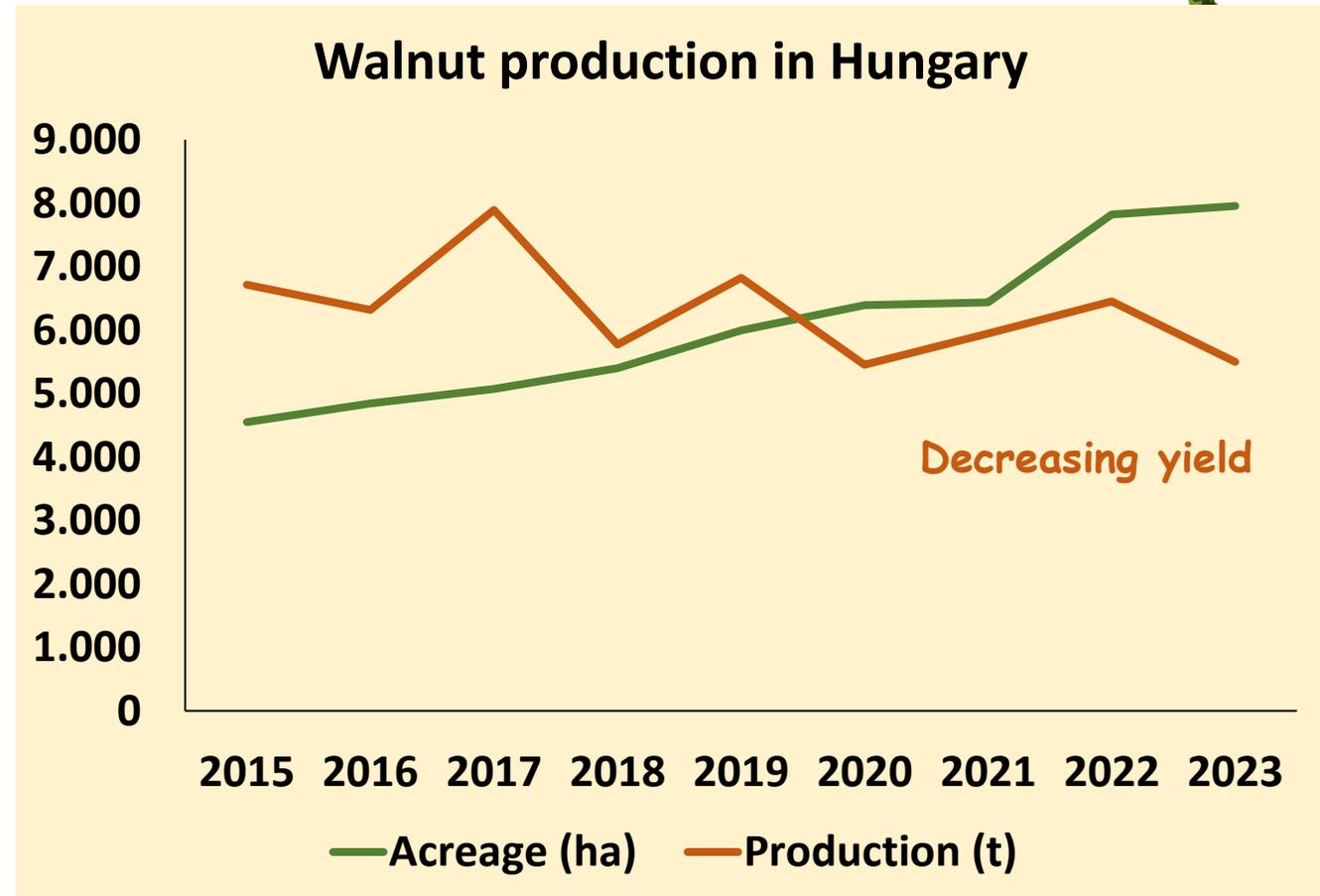
³FruitVeB Hungarian Interprofessional Organization for Fruit and Vegetable, Hungary



Walnut production



- Walnuts are the **third most produced nut crops** globally (FAO)
- The Persian (English) walnut (*Juglans regia* L.) is the **third most widely cultivated fruit species** in terms of acreage in Hungary.



Decreasing walnut production



Abiotic factors

- Cold
- Drought
- Storms
- Other Stress

Extreme weather

Biotic factors

Pests and pathogens

- Viruses
- Bacterial pathogens
- Fungal pathogens
- Insect pests

Cultivar

Decreasing walnut production



Abiotic factors

- Cold
- Drought
- Storms
- Other Stress

Biotic factors

Pests and pathogens

- Viruses
- Bacterial pathogens
- **Fungal pathogens**
- Insect pests

New pathogens

Cultivar

Recent problems in orchards



Fruit rot

Green fruit drop



Previously successful plant protection technologies!

Fruit loss

Green fruit drop (2023)

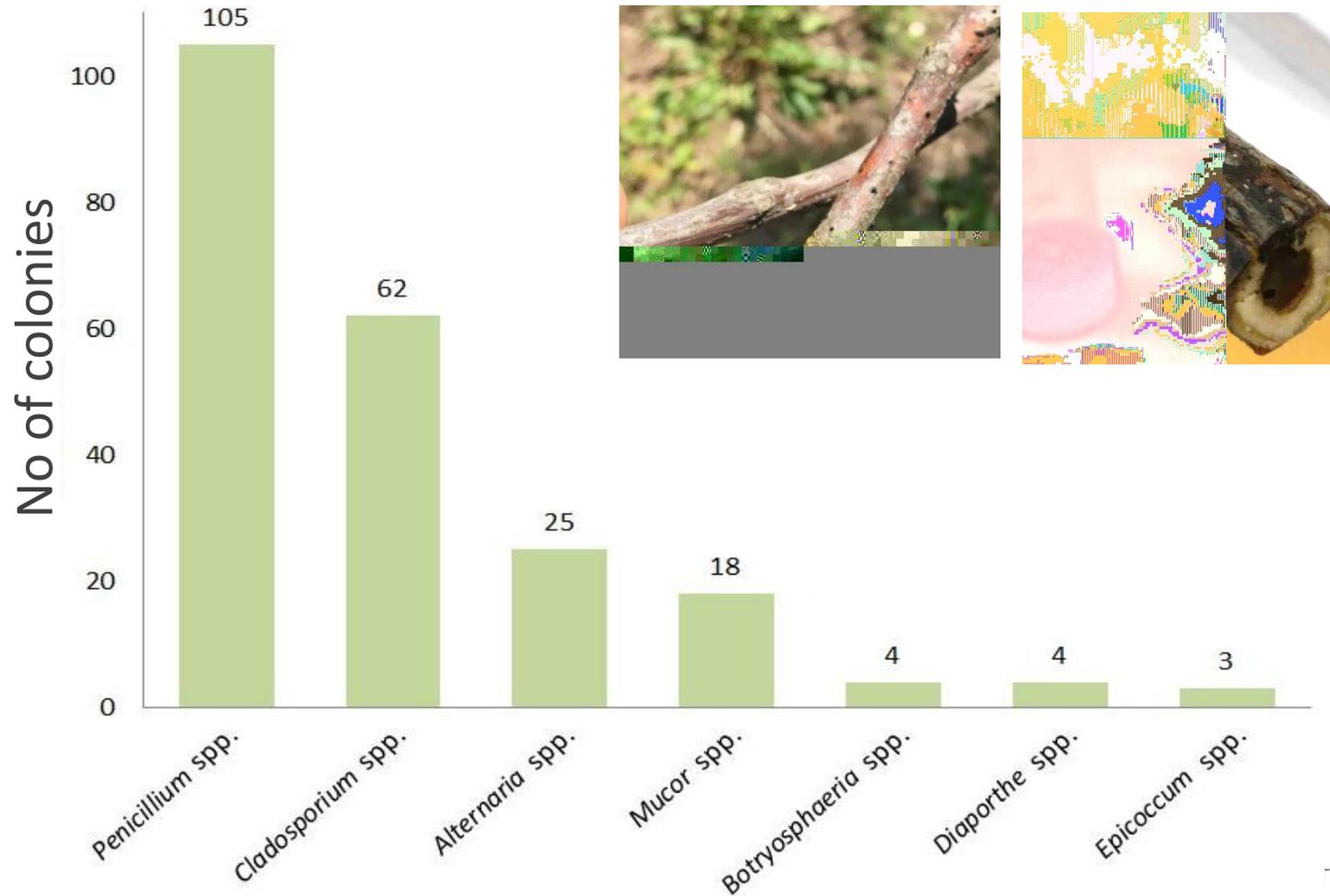
Fungal Genus	No of fruits
<i>Aspergillus</i>	19
<i>Botryosphaeria</i>	2
<i>Botrytis cinerea</i>	37
<i>Fusarium</i>	2
<i>Penicillium</i>	19
<i>Diaporthe</i>	1



Fungal Genus	Disease severity index%
<i>Alternaria</i>	53%
<i>Botryosphaeria</i>	74%
<i>Diaporthe</i>	62%
<i>Fusarium</i>	38%
<i>Penicillium</i>	48%

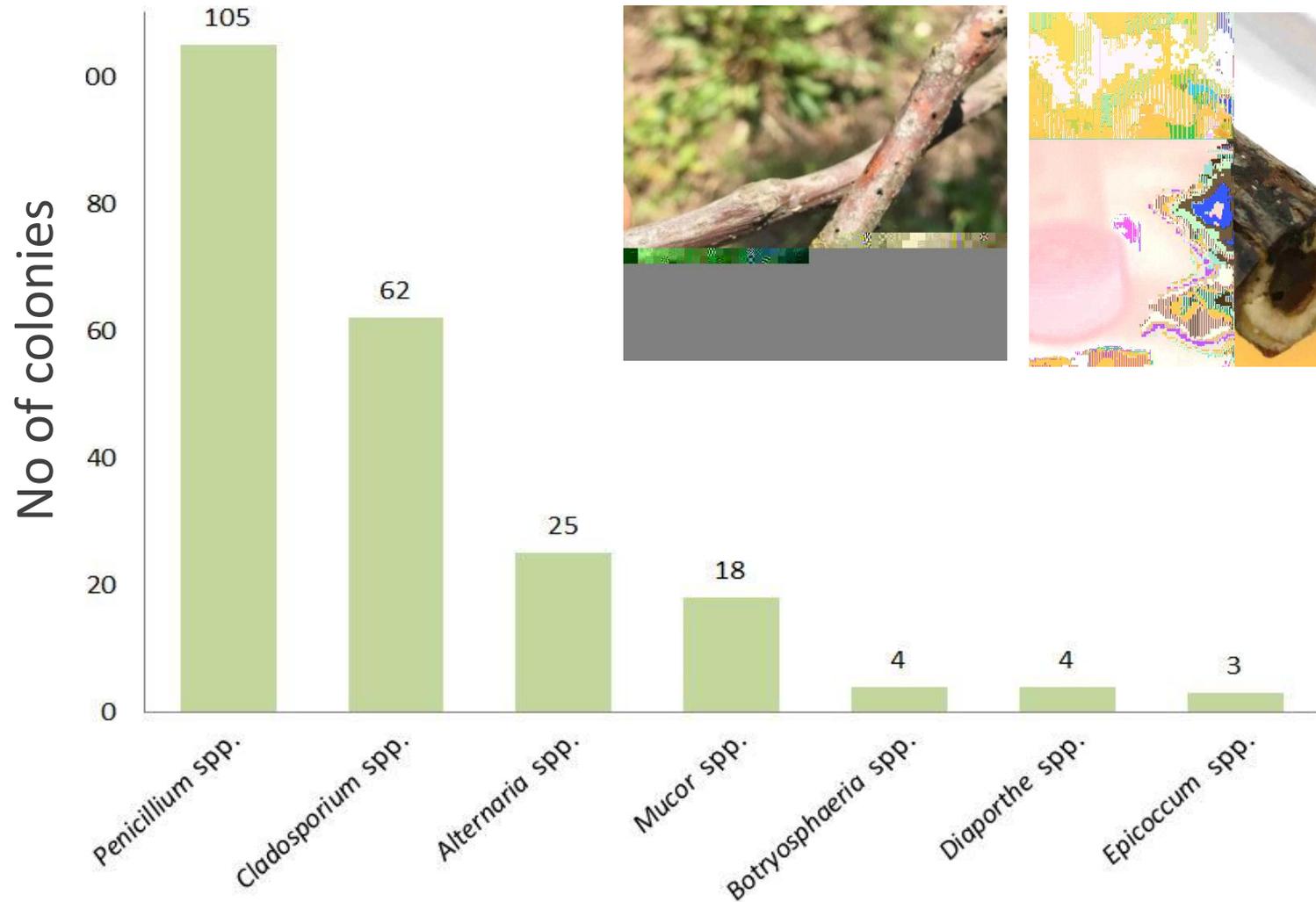


Fruit infection – inoculum sources

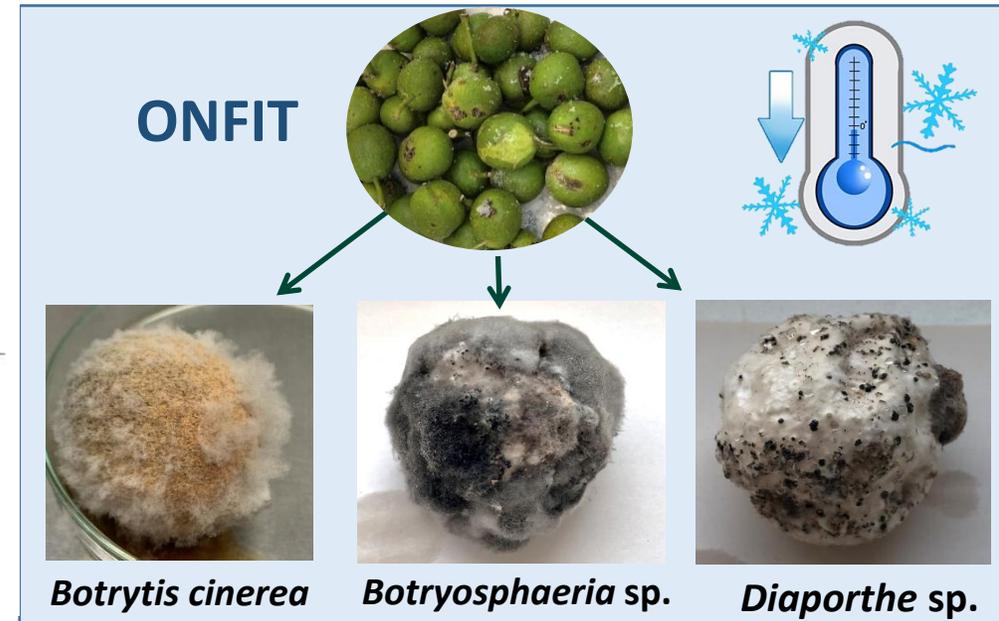


Matured fruits
Diseased wood

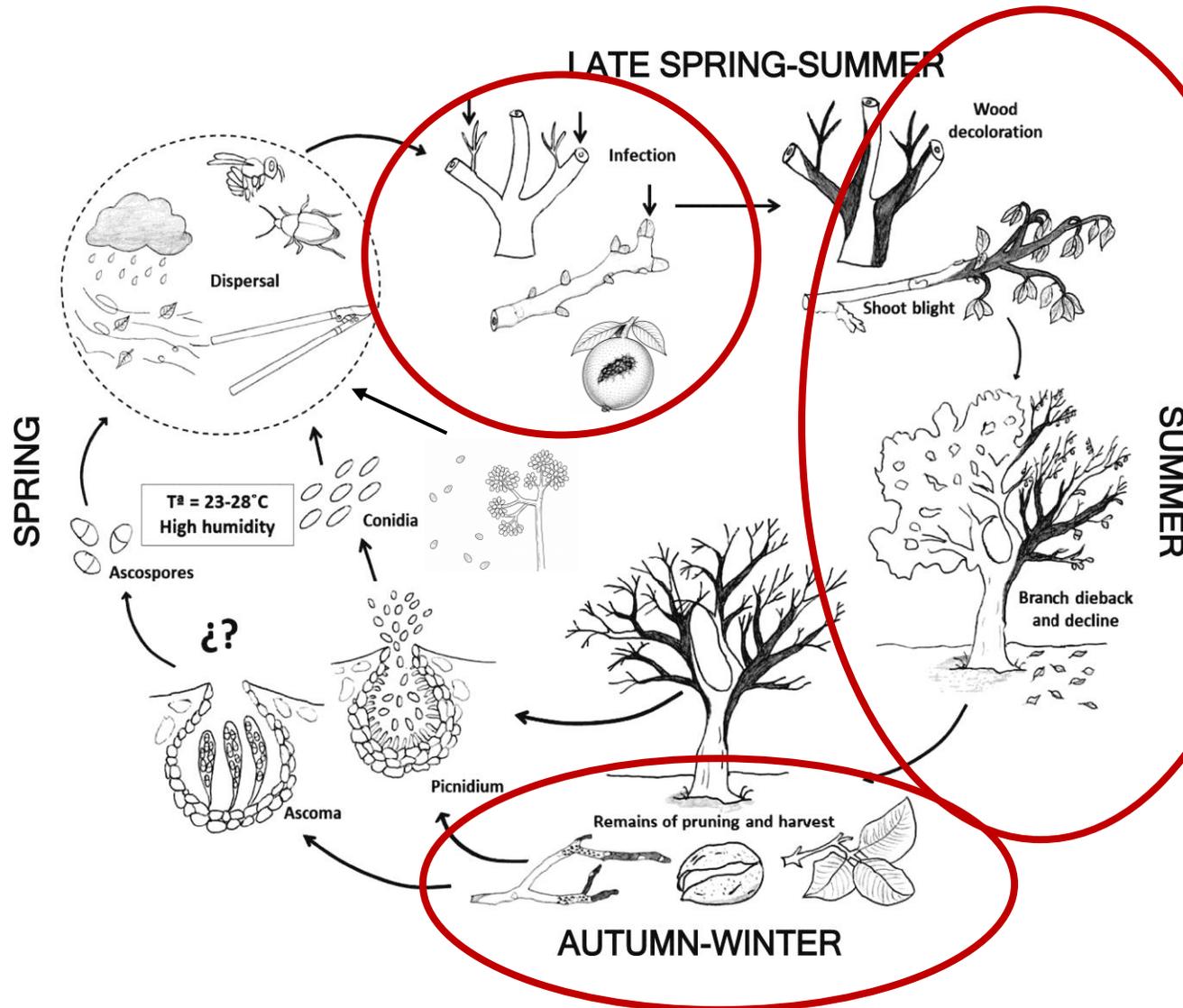
Fruit infection – inoculum sources



Matured fruits
Diseased wood
Buds
Green nuts



Biological cycle walnut fungal fruit rot



Inoculum

- ✓ Broad host range pathogens
- ✓ Diseased wood
- ✓ Diseased fruits

Infection

- ✓ Bud
 - ✓ Wounded green nuts
 - ✓ Wood wounds
 - ✓ Wounded matured fruits
- } **Latent**

Disease control



Problems

- Different fungal pathogens
- Fungal pathogens with broad host range
- Several infection routes
- Limited registered chemical pesticides
 - ! *B. cinerea* – fungicide resistance

Disease control

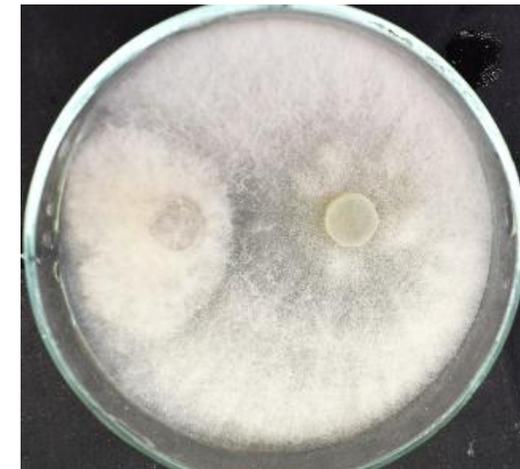
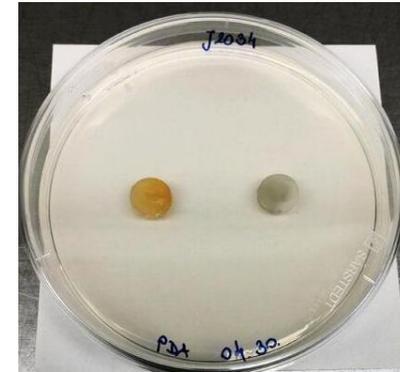


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 - ! *B. cinerea* – fungicide resistance



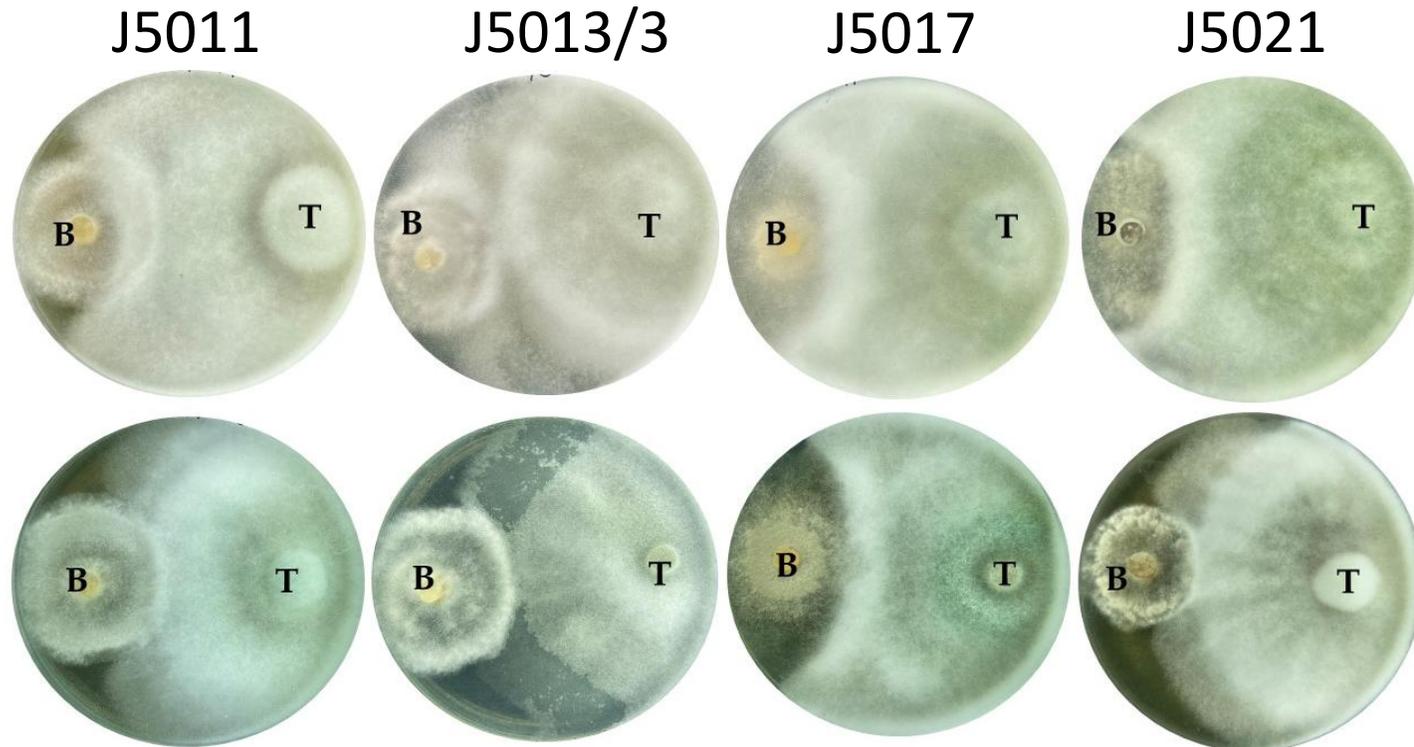
Biocontrol strains



B. dothidea

T. gamsii

Biocontrol of walnut *B. cinerea* isolates



- T. afroharzianum* (TR04),
- 8 Post inoculation days (PID)
 - 10 PID BCI: 100 %

- T. simmonsii* (TR05)
- 8 PID
 - 10 PID BCI: >80 %

Biocontrol of *Trichoderma* strains

Fungal Pathogen	Source	Biocontrol Index (BCI %)	
		TR04	TR05
Ascomycota			
<i>Botryosphaeria dothidea</i>		100	25
<i>Botrytis cinerea</i>	<i>Juglans regia</i>	100	82
<i>Diaporthe eres</i>		100	100
<i>Diplodia seriata</i>		100	100
<i>Eutypa lata</i>	<i>Vitis vinifera</i>	100	100
<i>Neofusicoccum parvum</i>		95	90

Marketed Product



Trichoderma TR04 and TR05 strains

Endophytic strains from grapevine cordon

- ✓ Treatment of whole plants
- ✓ Adapted to host and its microbiome

Isolated from healthy plants from commercial vineyard

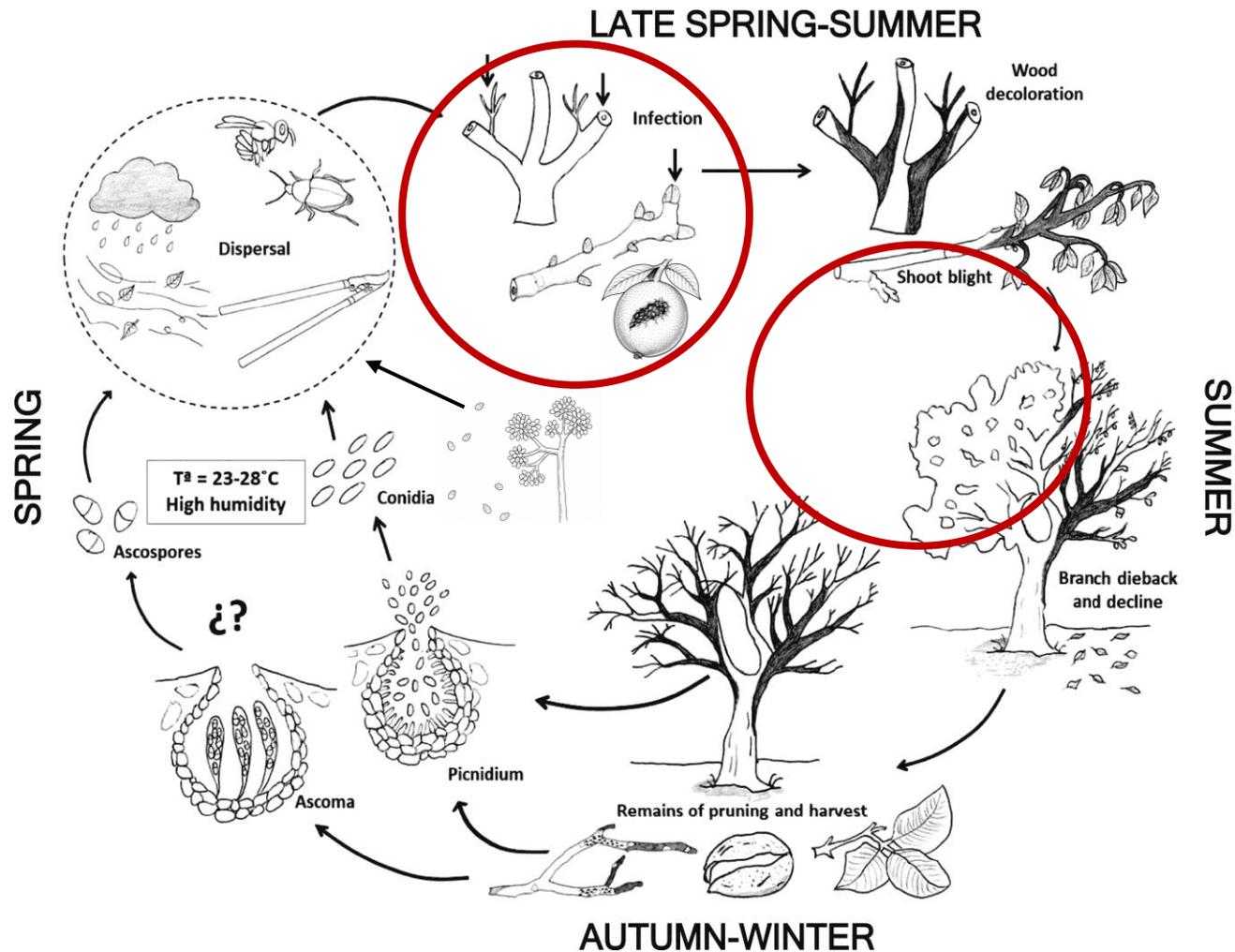
- ✓ Effective biocontrol agents
- ✓ Adapted to agricultural practices (pesticides)
- ✓ Adapted to climatic conditions (cold tolerance)

T. afroharzianum (TR04) and *T. simmonsii* (TR05)

- ✓ Safe – properly identified and appropriately characterized



Trico Immun application



- ✓ Bud protection
- ✓ Green nut protection

2 years

Minimal fruit loss



Publications

Acta Phytopathologica et Entomologica Hungarica
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Identification of *Botryosphaeria dothidea* and *Diaporthe eres* from rotted walnut fruits and other plant parts in different phenological stages

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Károly Pál¹  and Erzsébet Sándor^{1*} 

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A DIÓ TERMÉSKÁROSODÁSÁNAK ETIOLÓGIÁJA ÉS A VÉDEKEZÉS LEHETŐSÉGEI

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Article

Diaporthe and *Diplodia* Species Associated with Walnut (*Juglans regia* L.) in Hungarian Orchards

Andrea Zabiák^{1,2}, Csilla Kovács³, Ferenc Takács³, Károly Pál¹, Ferenc Peles¹ , Erzsébet Fekete⁴ ,
Levente Karaffa^{4,5} , Kata Mihály¹, Michel Flippi⁴ and Erzsébet Sándor^{1,*} 



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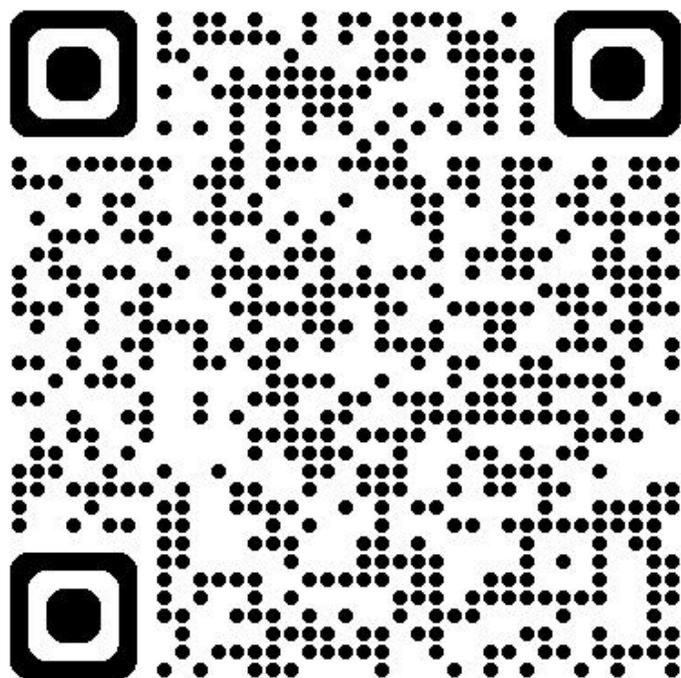
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Identification of *Botrytis cinerea* as a Walnut Fruit Rot Pathogen, and Its Biocontrol by *Trichoderma*

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