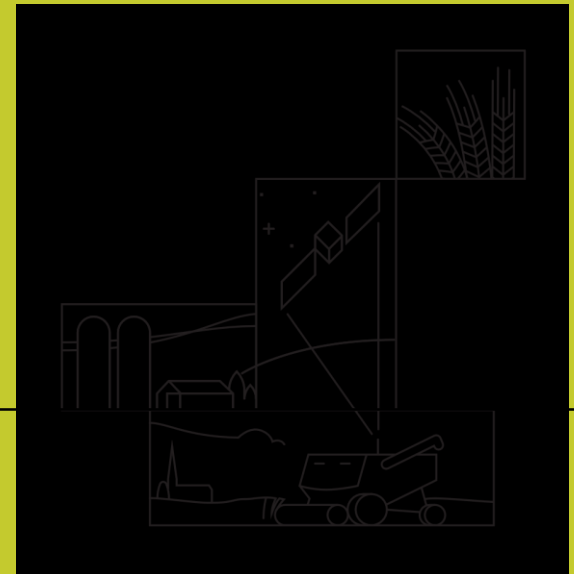
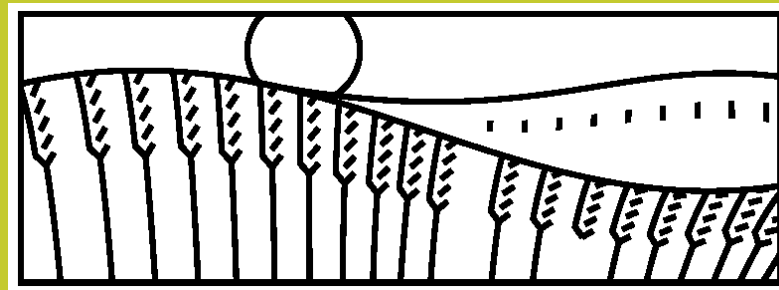


# Fungicide sensitivity status of *Zymoseptoria tritici* population in Estonia

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Senior Researcher

18 April 2024



Previously:  
Estonian Crop Research Institute and  
the Agricultural Research Centre

**+100**  
years of innovative research  
& Estonian varieties

**+300**  
dedicated and motivated employees

**8**  
locations across Estonia

- Research, monitoring, assessment, and analysis in the field of agriculture, rural life, and rural economy, including laboratory analyses.
- Variety breeding and field trials of agricultural crops.
- Knowledge transfer, advisory, and innovation services in the field of agriculture and rural life.
- Activities necessary for the implementation of the common agricultural policy of the European Union.



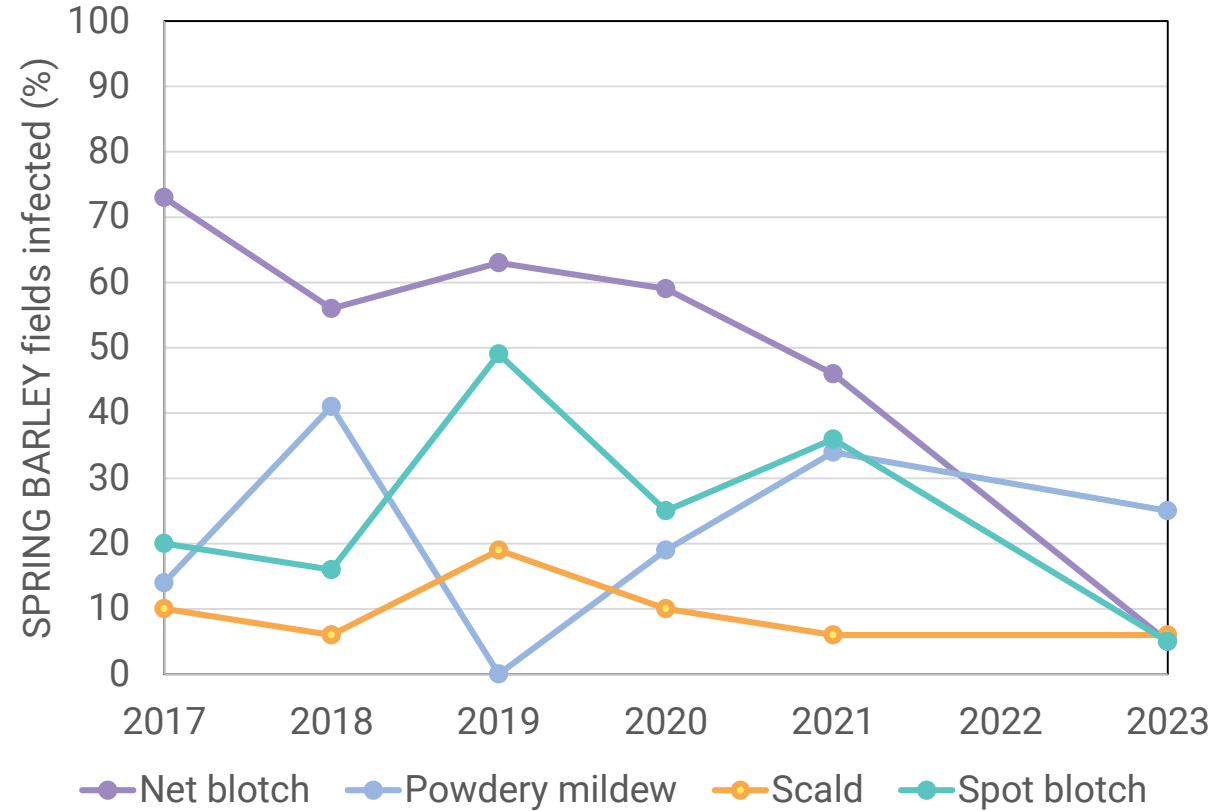
In 2023, wheat was grown on 173 565 ha (24% of arable land) and barley on 112 326 ha (16%)

winter wheat 152 7373 ha  
spring wheat 28 234 ha

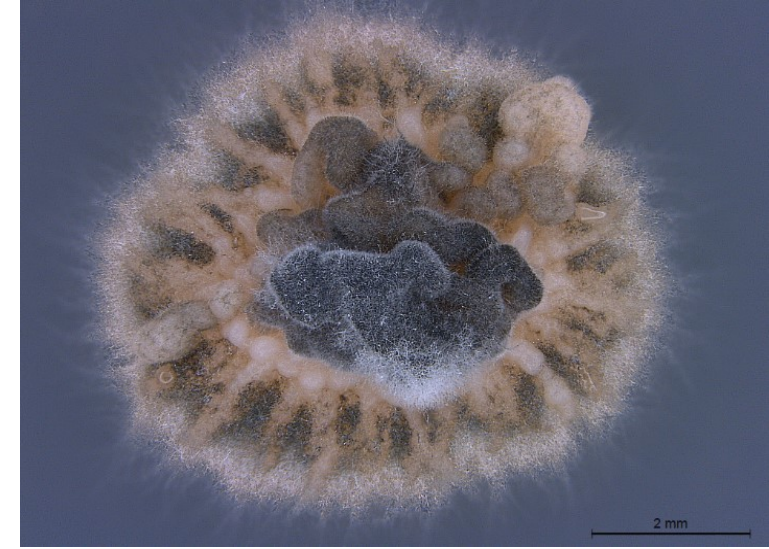
winter barley 35 433 ha  
spring barley 80 957 ha



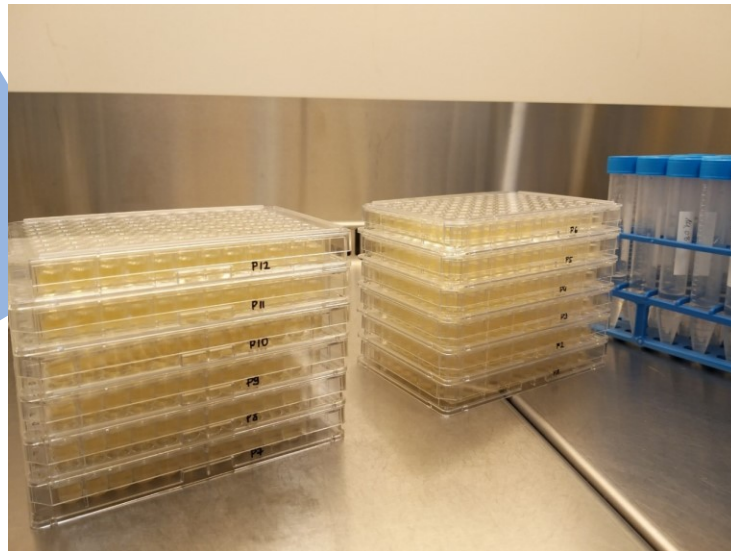
# Commercial fields of wheat and barley monitored in May and June



# Collection, isolation, analysis of *Z. tritici*



Fungicide sensitivity in vitro microtiter plate assays



Mutations in target protein genes

**CYP51**

**CYT B**

**SDH-B**

**SDH-C**

**SDH-D**

# Fungicide sensitivity of *Z. tritici* in Estonia

## Azoles, DMI (FRAC 3)

- tebuconazole, prothioconazole-desthio, mefentrifluconazole

## Strobilurins, QoI (FRAC 11)

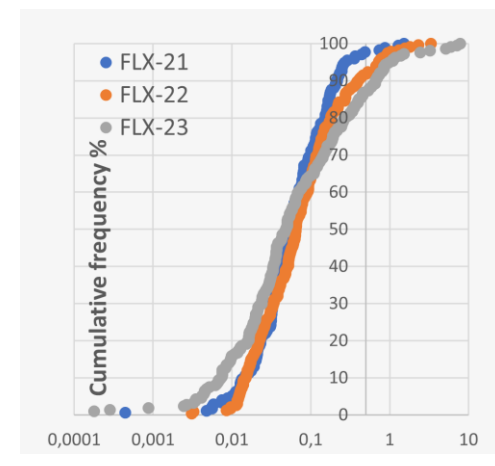
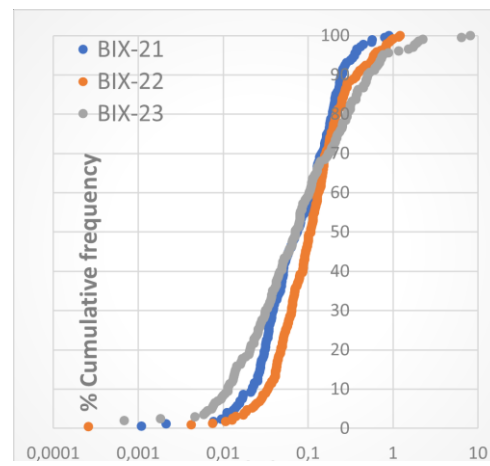
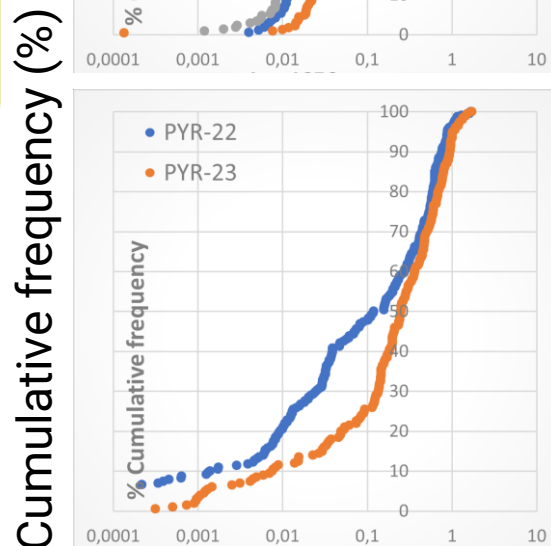
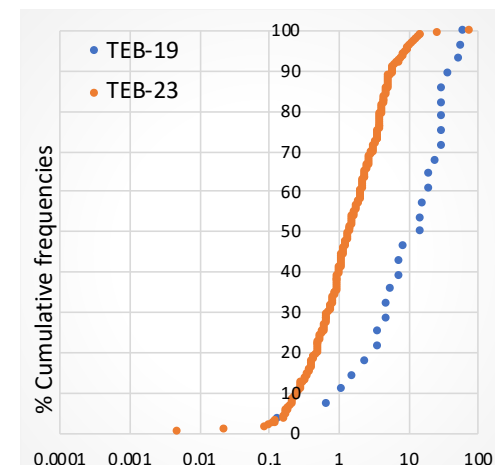
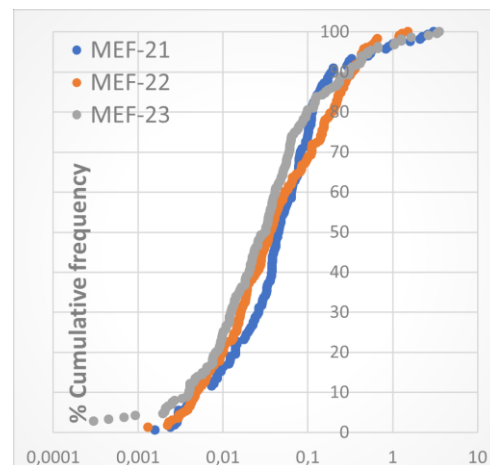
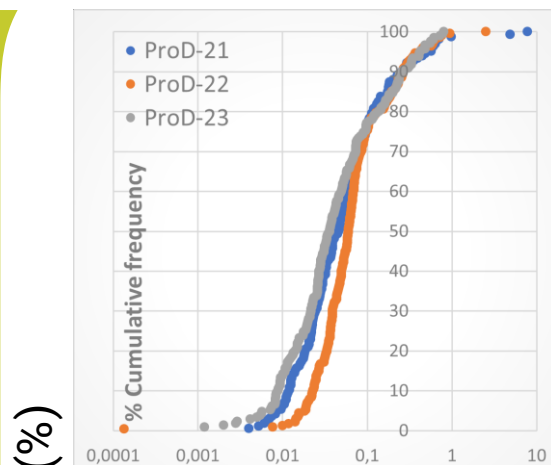
- pyraclostrobin, asoxystrobin

## SDHI (FRAC 7)

- fluxapyroxad, bixafen

## \*Picolinamide (FRAC 21)

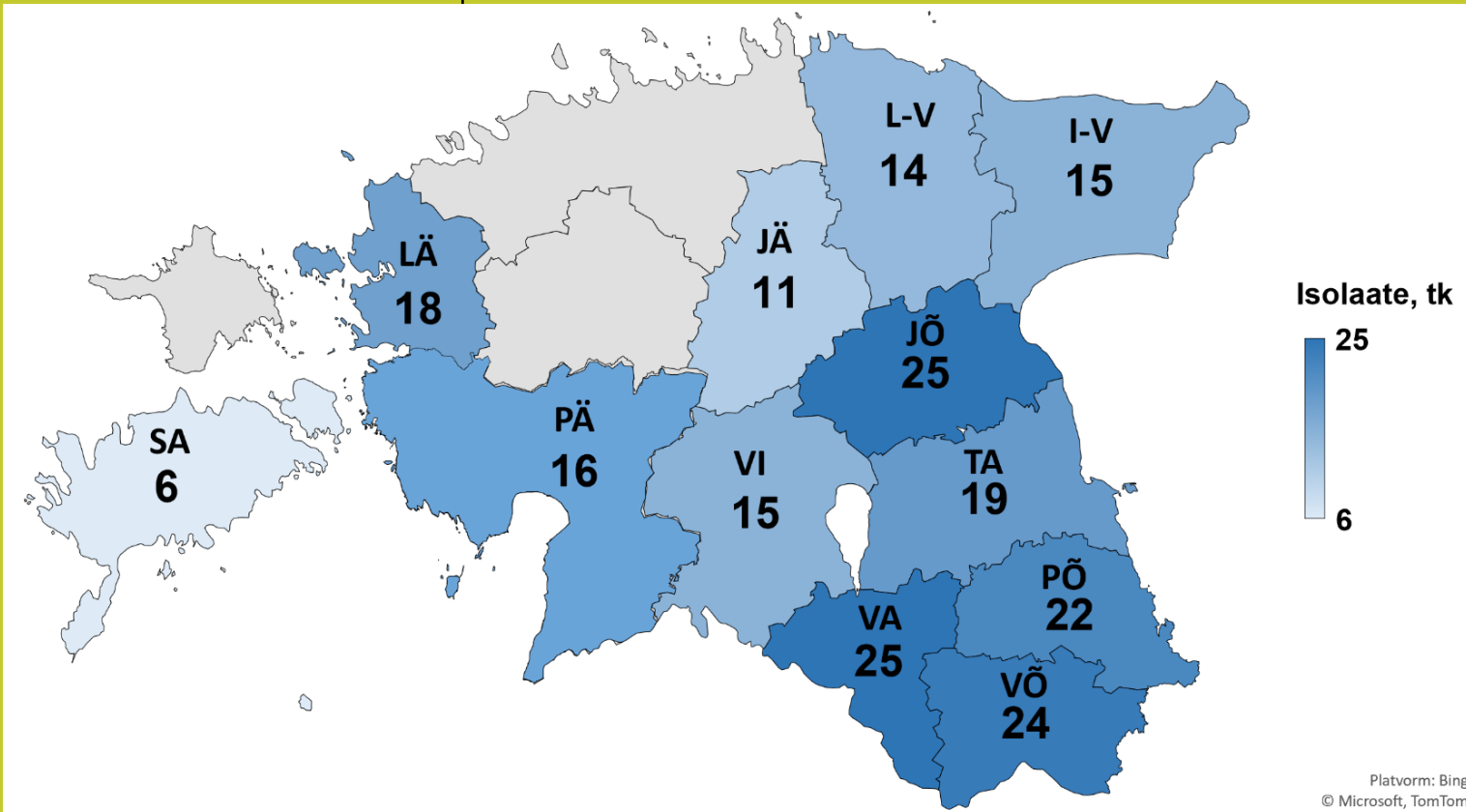
- fenpicoxamid (Inatreq)



Cumulative frequency (%)

$\log_{10}EC_{50}$  (ppm)

# In 2023, 210 *Z. tritici* isolates were analysed



## Fungicide sensitivity of *Z. tritici* in 2023

### Azoles, DMI (FRAC 3)

- tebuconazole, prothioconazole-desthio, mefentrifluconazole

### Strobilurins, QoI (FRAC 11)

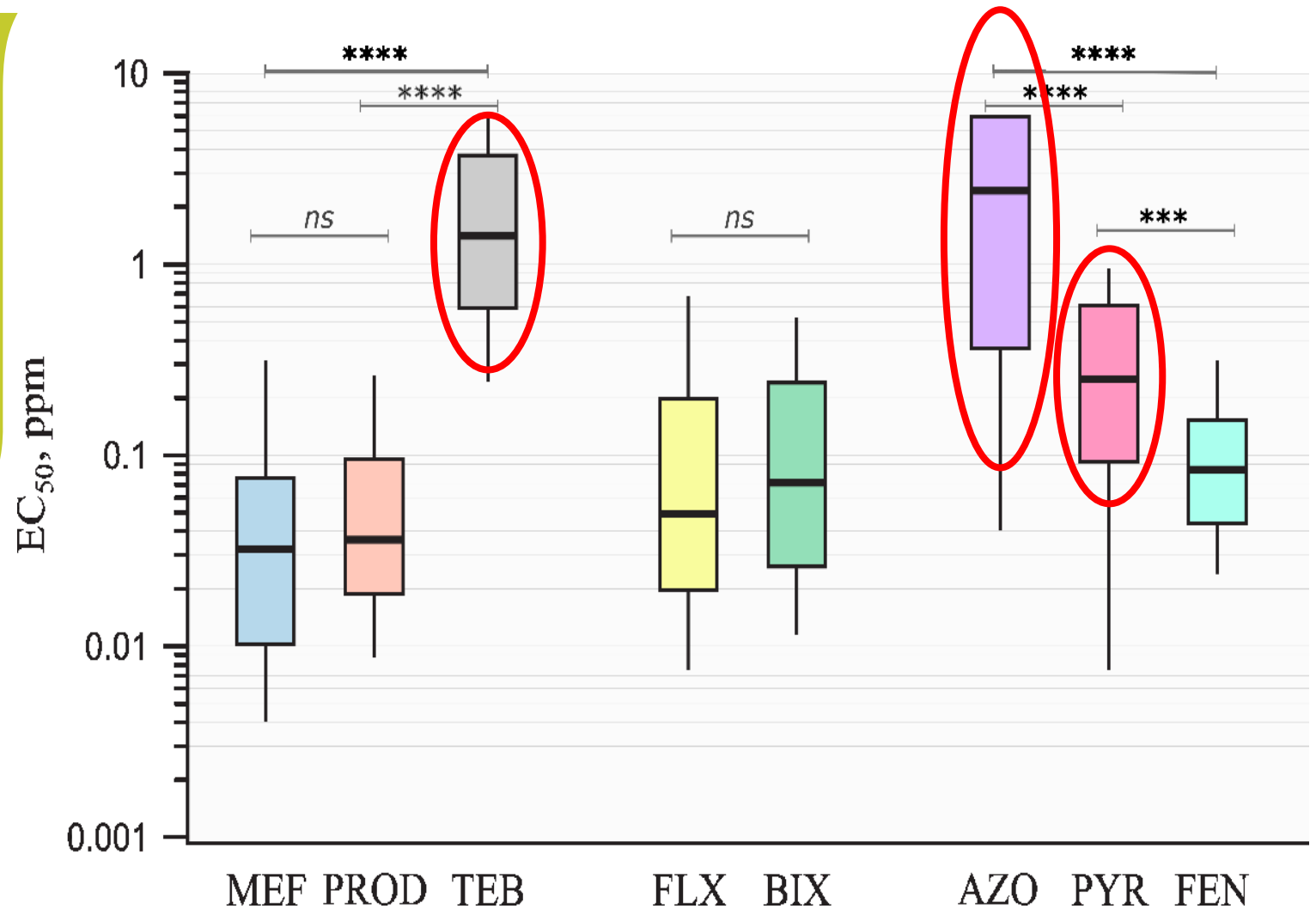
- pyraclostrobin, asoxystrobin

### SDHI (FRAC 7)

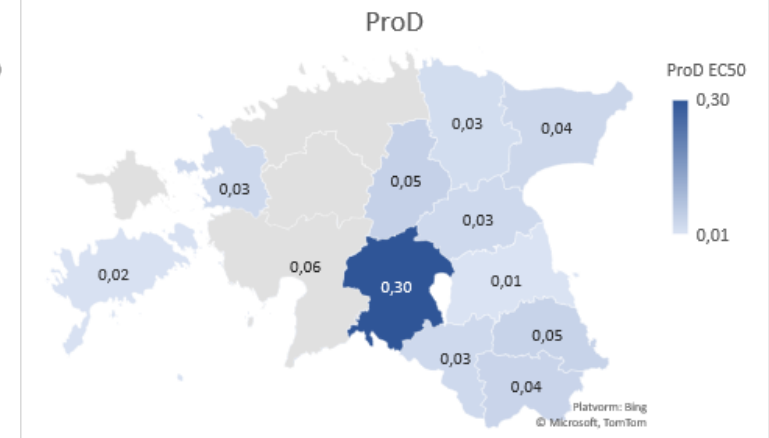
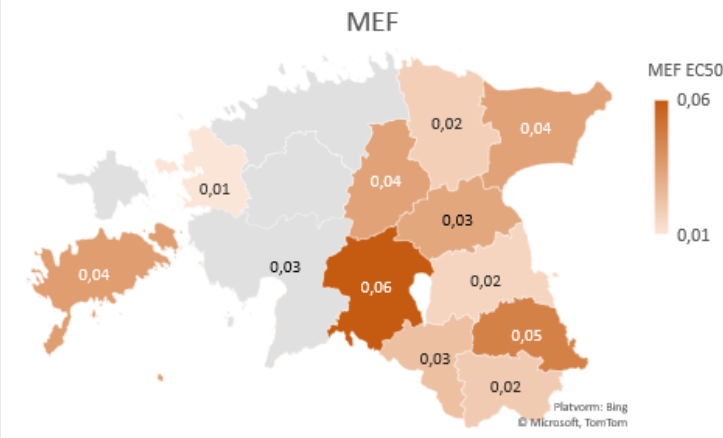
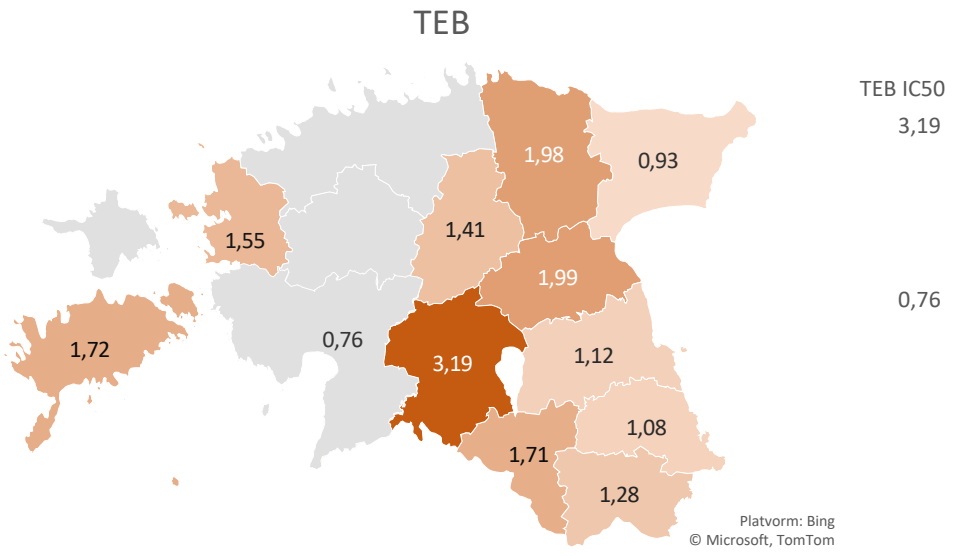
- fluxapyroxad, bixafen

### \*Picolinamide (FRAC 21)

- fenpicoxamid (Inatreq)

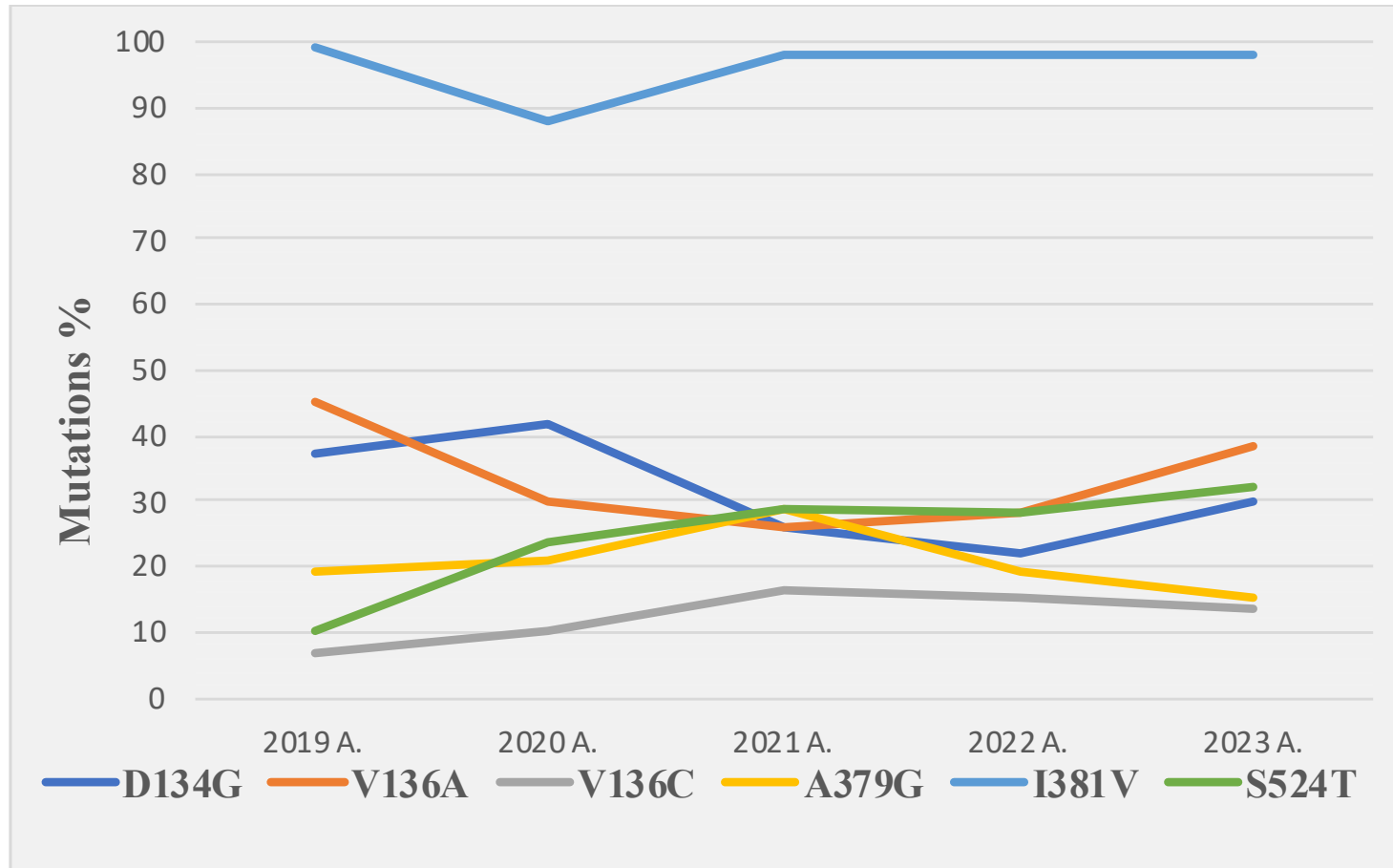


# Sensitivity to azoles



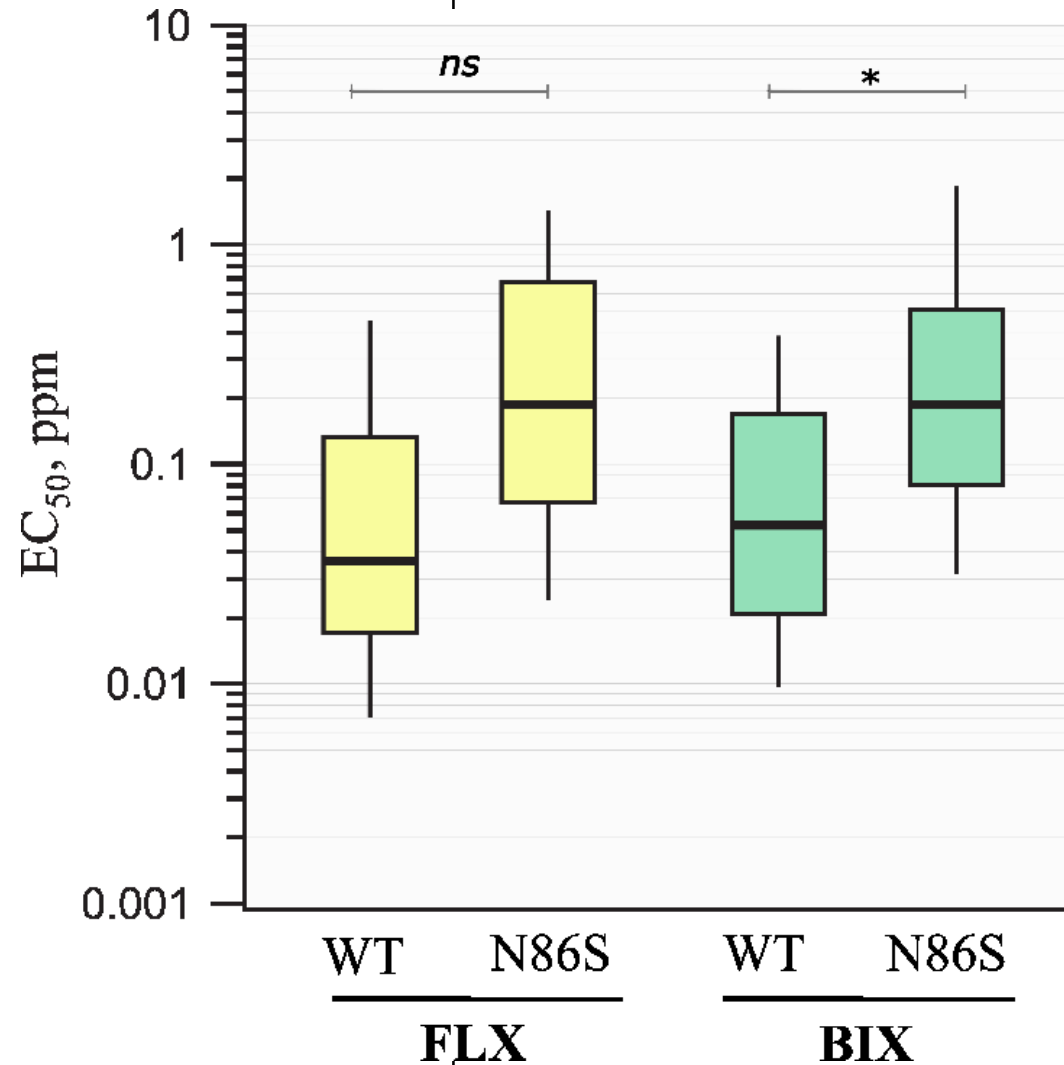
- High sensitivity to prothioconazole-desthio and mefentrifluconazole
- Reduced sensitivity to tebuconazole
- Strong correlation between tebuconazole and mefentrifluconazole sensitivity ( $r=0.647$ ;  $p<0.001$ )

## Frequencies of CYP51 amino acid substitutions

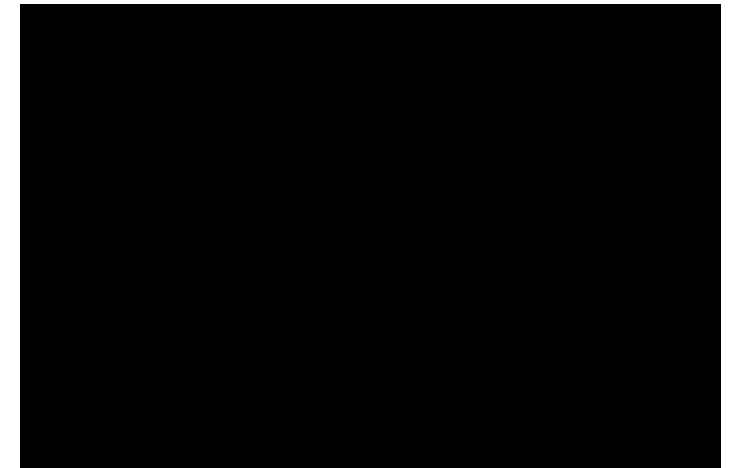


- S524T frequency has increased 10% → 32%.
- I381V is present in almost every isolate
- Other frequencies are variable
- Only rare findings of CYP51 wild-type isolates

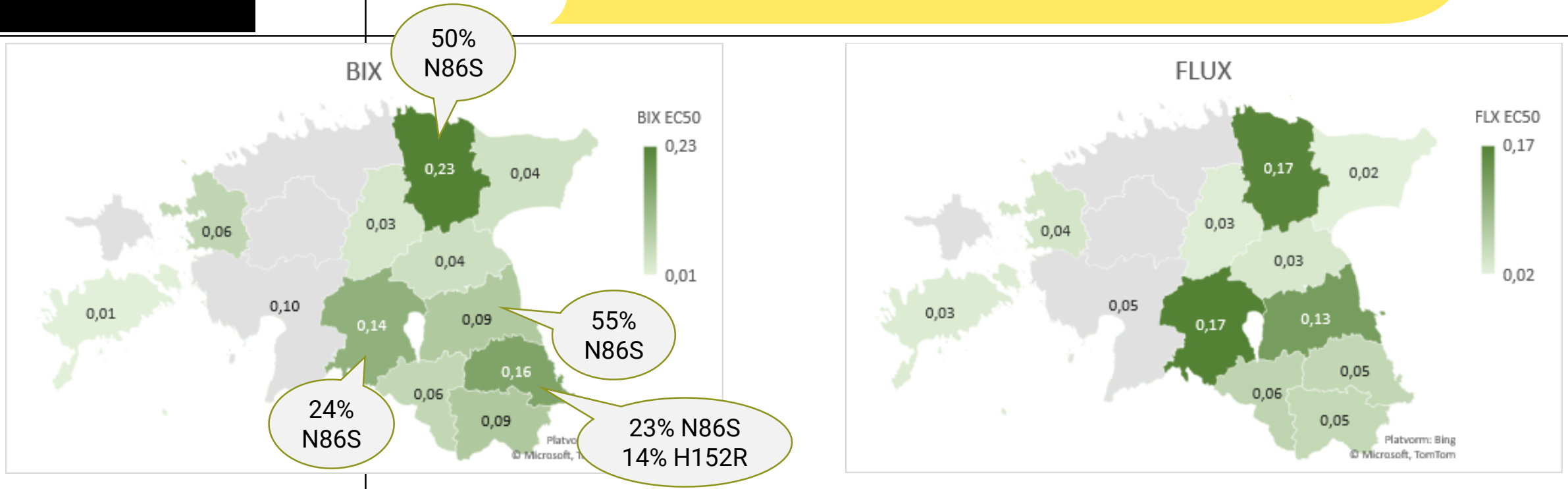
# Sensitivity to SDHIs



Year	SdhC				
	T79N	W80S	N86K	N86S	H152R
2020	0	0	0	2	0
2021	0	0	0	2	0
2022	0,5	1	0	3	1,2
2023	3	0	0	25	1,5

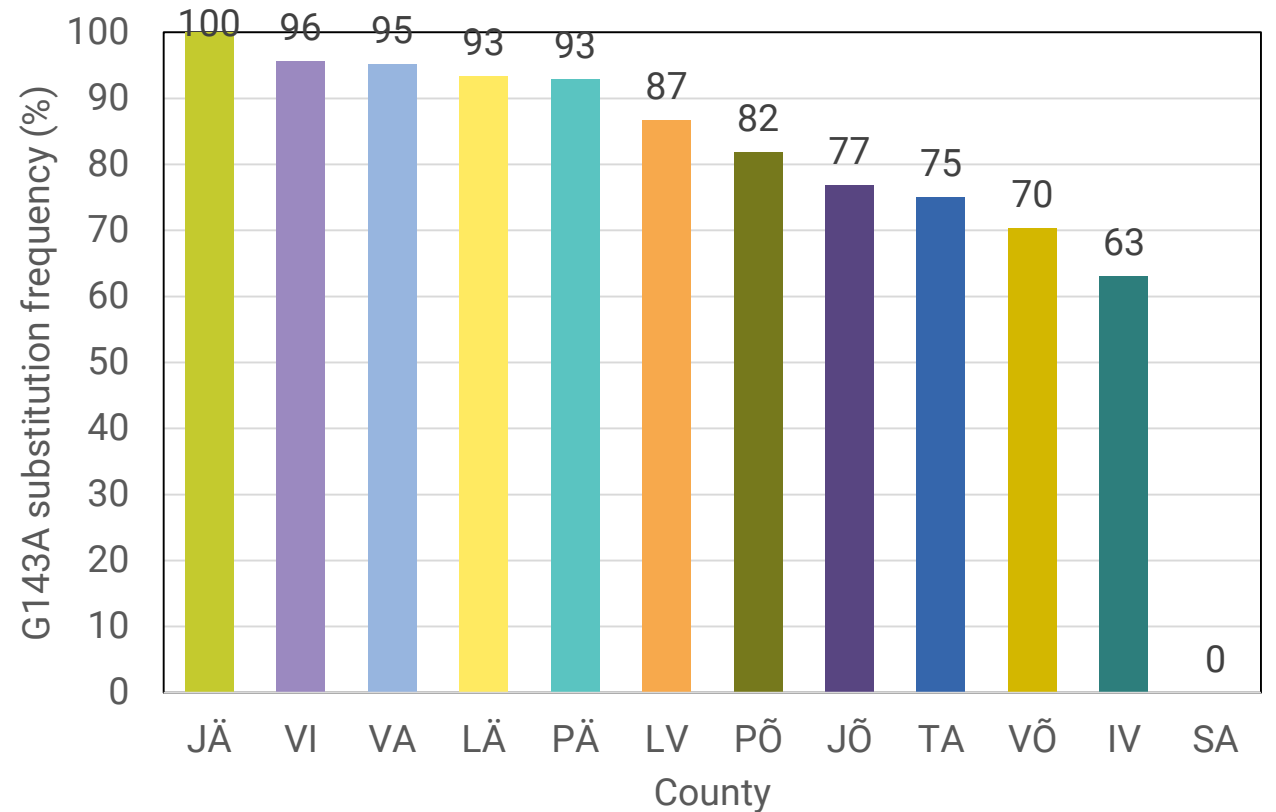
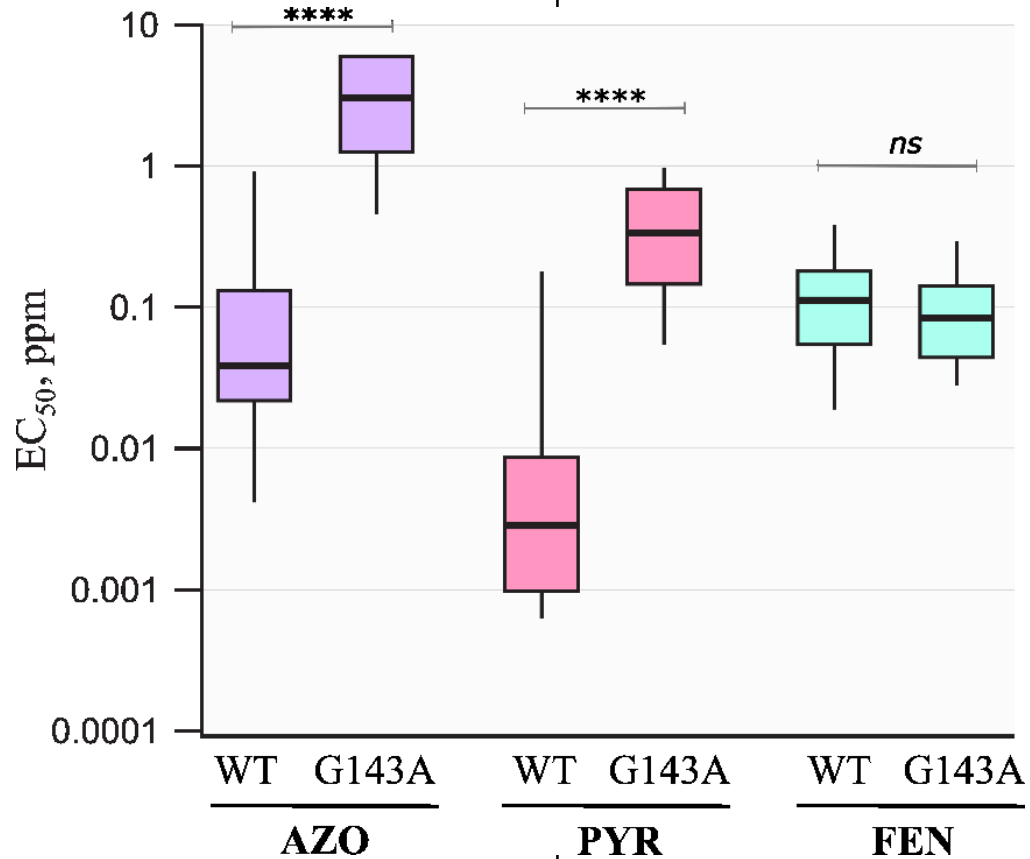


# Sensitivity to SDHIs



- Isolates with amino acid substitutions N86S and H152R in SDHI target protein have reduced sensitivity to SDHIs
- High correlation between fluxapyroxad and bixafen sensitivity ( $r=0.746$ ;  $p<0.001$ )

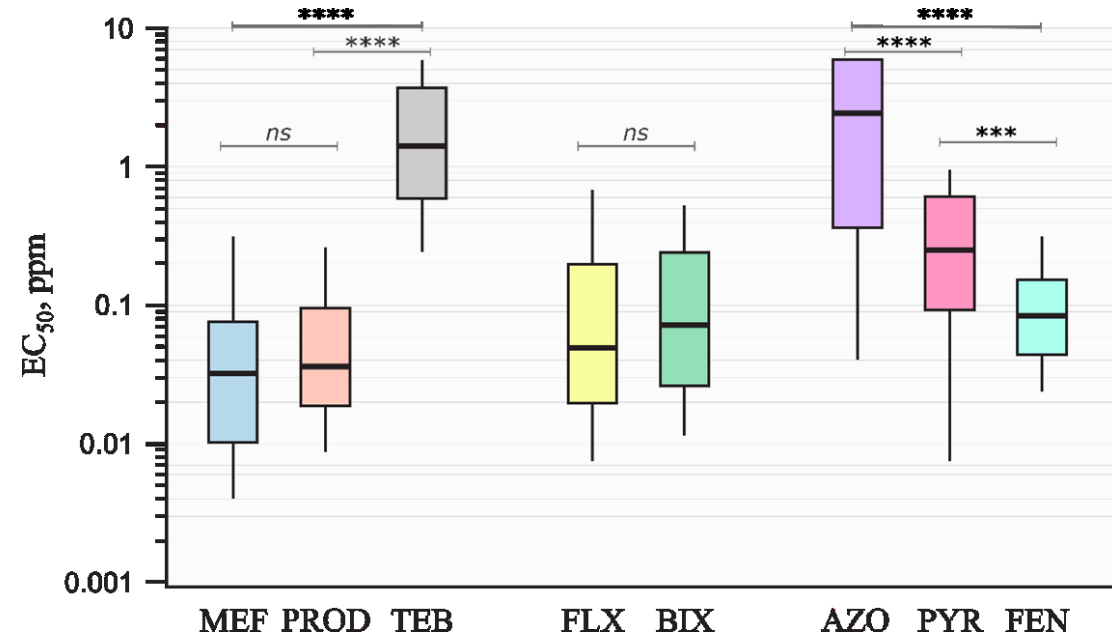
# Sensitivity to strobilurins is influenced by G143A substitution in CytB



- The mean frequency of G143A was 81% (78-88%) in Estonia in 2019-2023.
- G37V is absent in CytB

## Summary of fungicide sensitivity in *Zymoseptoria tritici* population in Estonia

- High sensitivity to prothioconazole-desthio and mefentrifluconazole
- Reduced sensitivity to tebuconazole, azoxystrobin and pyraclostrobin
- G143A mutation in CytB is prevailing
- S524T mutation frequency in Cyp51 is increasing
- Mutations N86S and H152R in SdhC subunit impact *Z. tritici* sensitivity to SDHIs



# Acknowledgements



- **Busy farmers**
- **Tiiu Annuk and Meelis Värnik from Estonian Farmers Cooperative KEVILI**
- **Our research group in METK**
  - Andres Mäe, Regina Pütsepp, Lee Põllumaa, Liis Andresen, Kersti Lilleväli, Silvia Pihu
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  - Ministry of Regional Affairs and Agriculture of the Republic of Estonia with projects 10.1-2/177 and 10.1-2/256
  - Ministry of Education and Research of the Republic of Estonia with project “Sordiaretus” no. 2014-2020.4.01.16-0037
  - Estonian Research Council grant no. PSG827

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