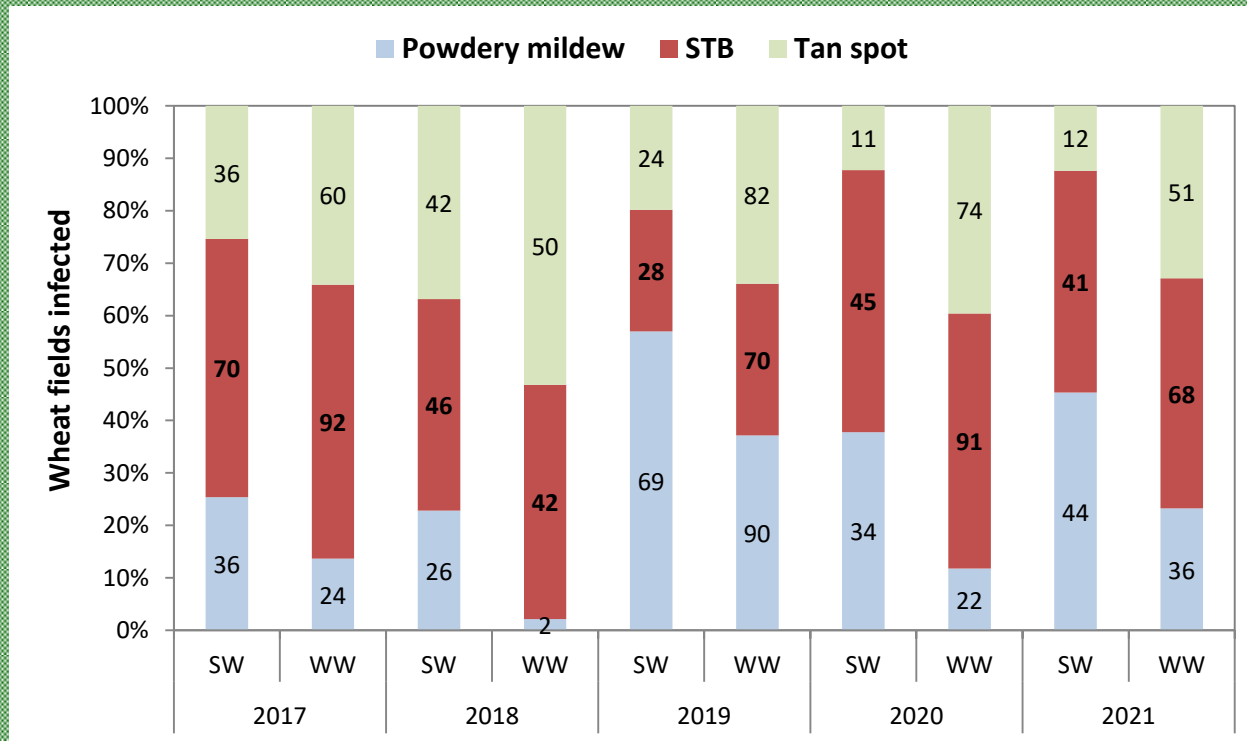


Fungicide resistance in Estonian *Zymoseptoria tritici* population



Riinu Kiiker, Andres Mäe, Marite Juurik

The status of major wheat foliar diseases in Estonia



- ✓ High incidence of STB (*Zymoseptoria tritici*)
- ✓ STB dominating on WW in 2017, 2020, 2021
- ✓ Over 50% of WW fields infected with tan spot (*Pyrenophora tritici-repentis*)
- ✓ High incidence of powdery mildew (*Erysiphe graminis f. tritici*) in 2019

Precipitation in March-July in 2019-2021

March

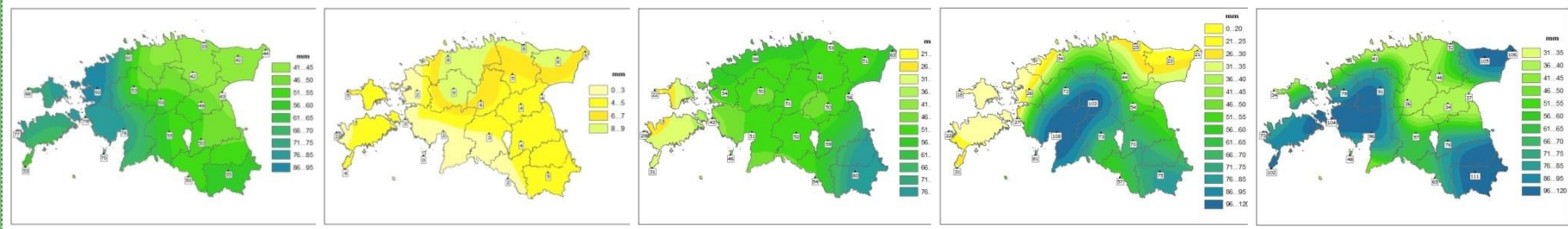
April

May

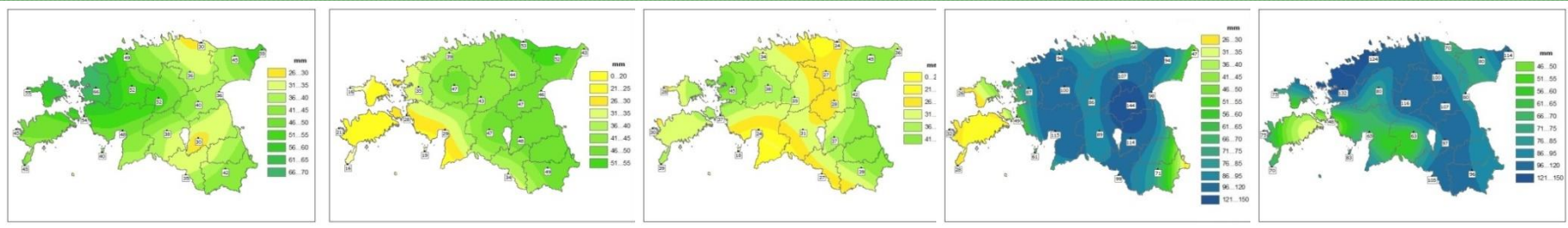
June

July

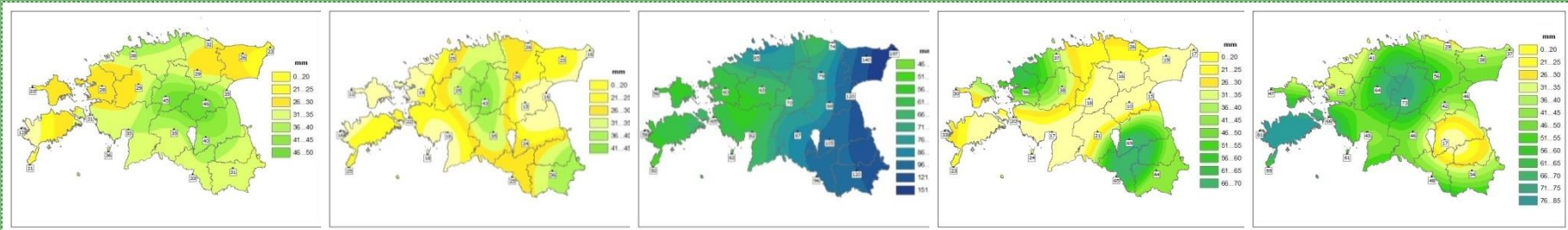
2019



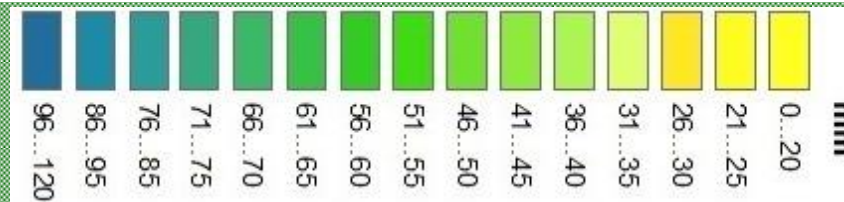
2020



2021



Estonian Weather Service



Avr. temperature in March-July in 2019-2021

March

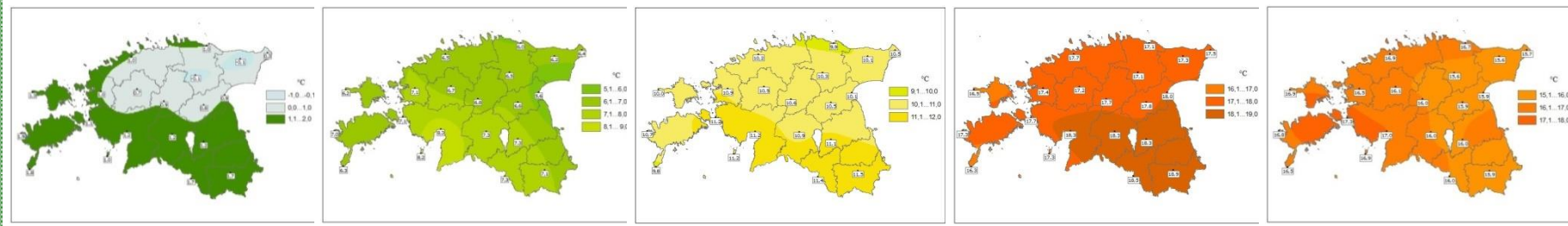
April

May

June

July

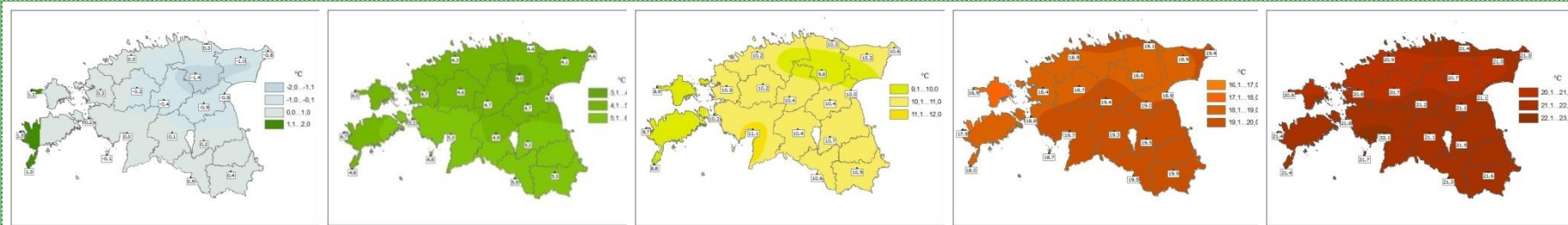
2019



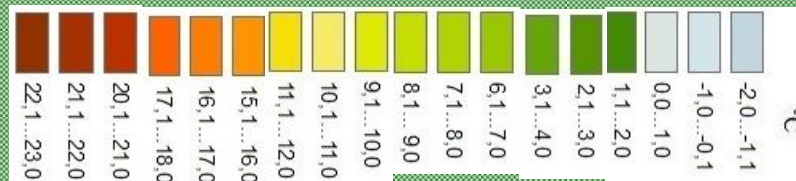
2020



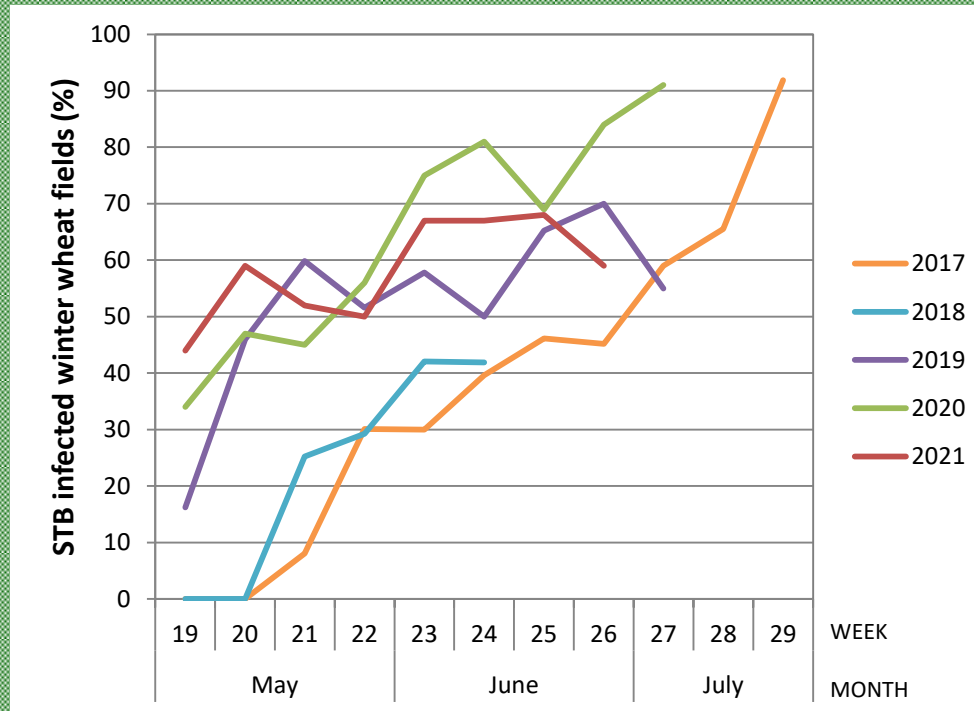
2021



Estonian Weather Service



STB spread and control in Estonia

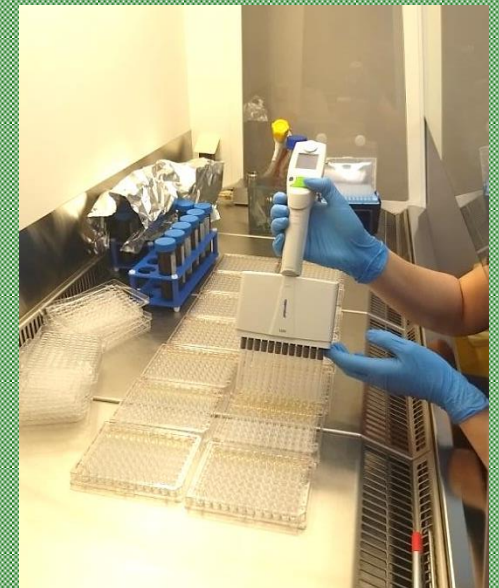
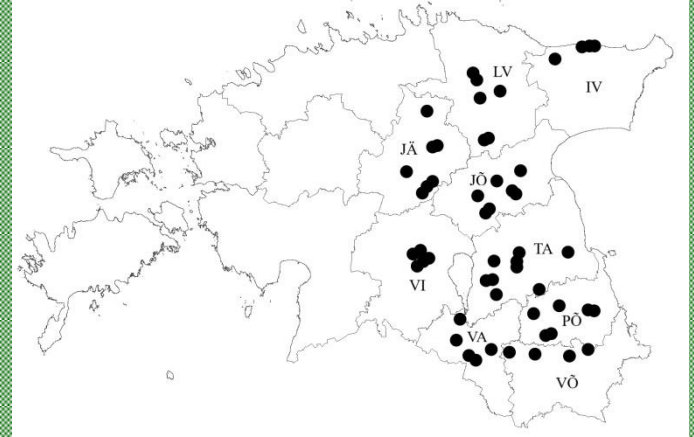


- ✓ DMI (prothioconazole, tebuconazole, difenoconazole, mefentrifluconazole, etc.),
- ✓ SDHI (bixafen, fluxapyroxad, etc.), and
- ✓ Strobilurin (pyraclostrobin, azoxystrobin, etc.) containing plant protection products are applied
- ✓ 2-3 applications per season

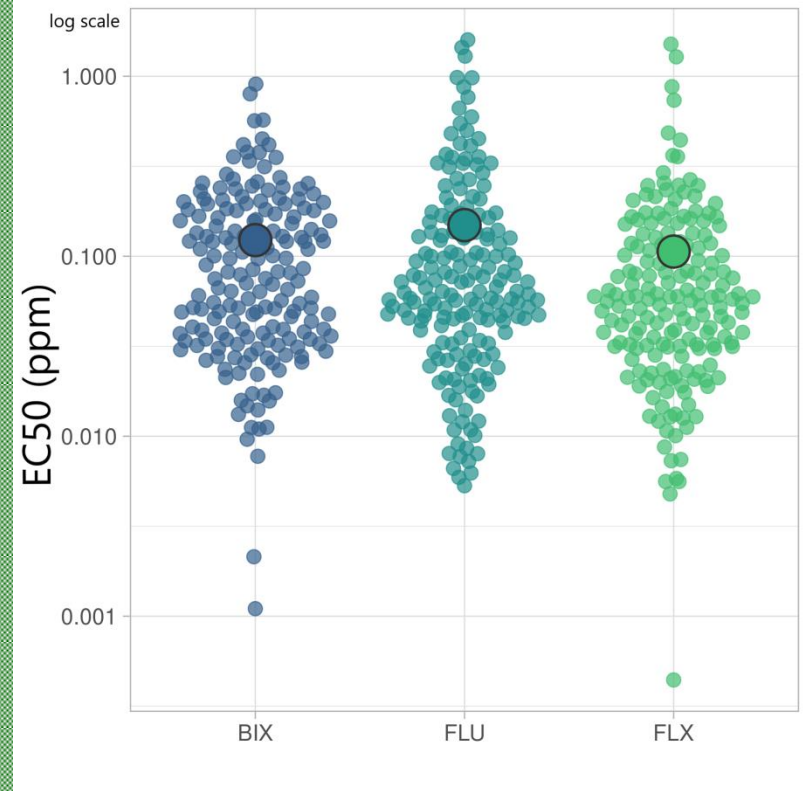
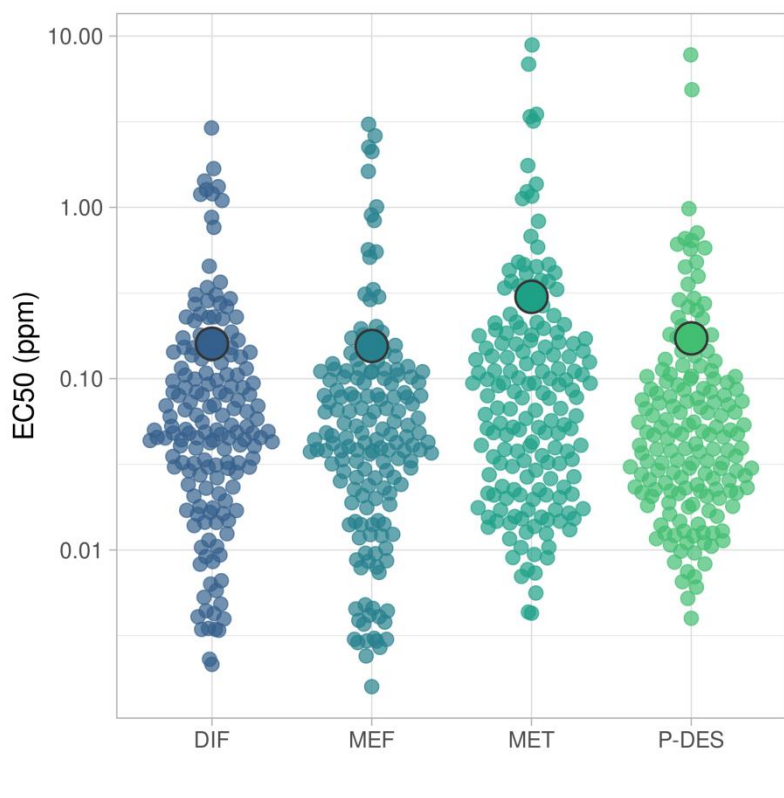
Zymoseptoria tritici population in Estonia

- ✓ 100-200 isolates analysed for fungicide sensitivity every year since 2019
- ✓ *ZT* collected from conventional WW fields from the main cropping regions

2021

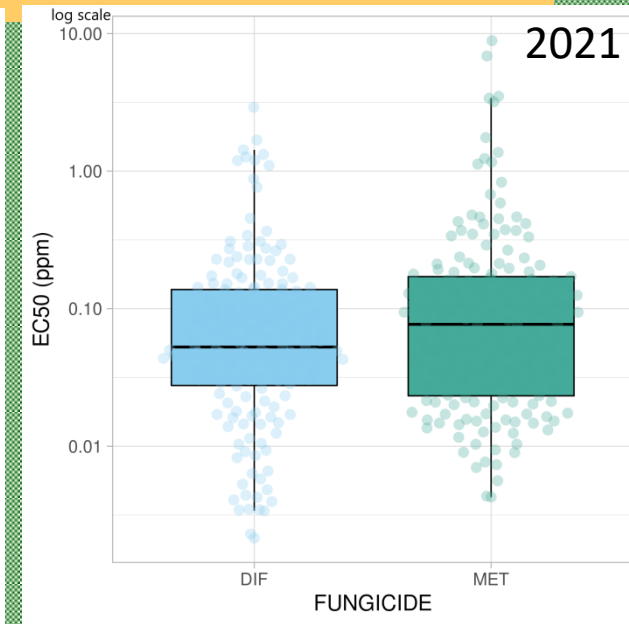
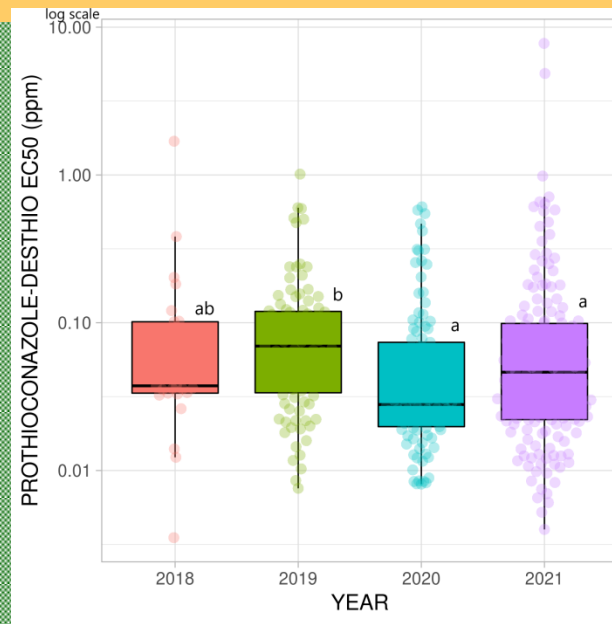
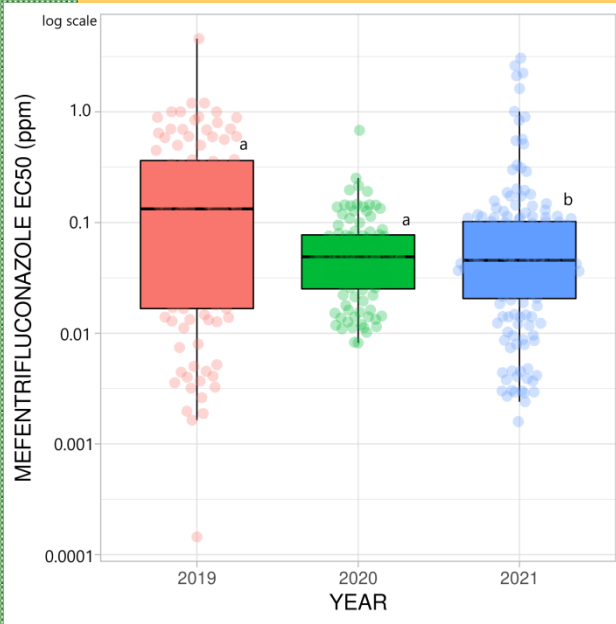


Zymoseptoria tritici fungicide sensitivity in 2021



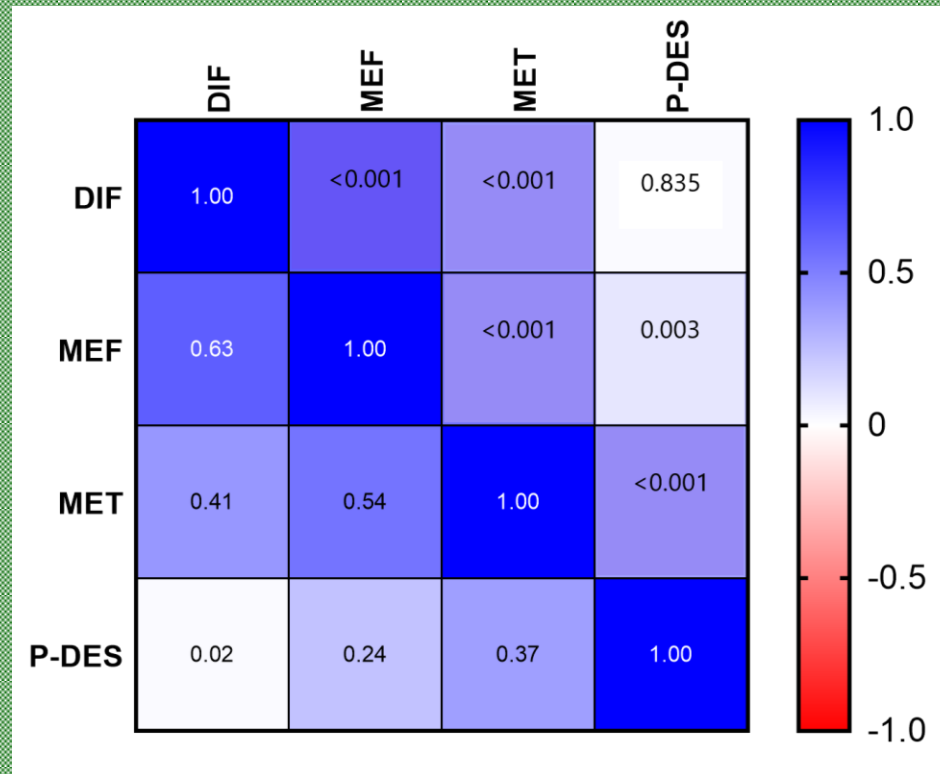
	DIF	MEF	MET	P-DES	BIX	FLU	FLX
MEAN EC50 (ppm)	0.16	0.16	0.3	0.17	0.12	0.15	0.11
SE	0.03	0.03	0.07	0.06	0.01	0.02	0.01

DMI sensitivity in 2018-2021

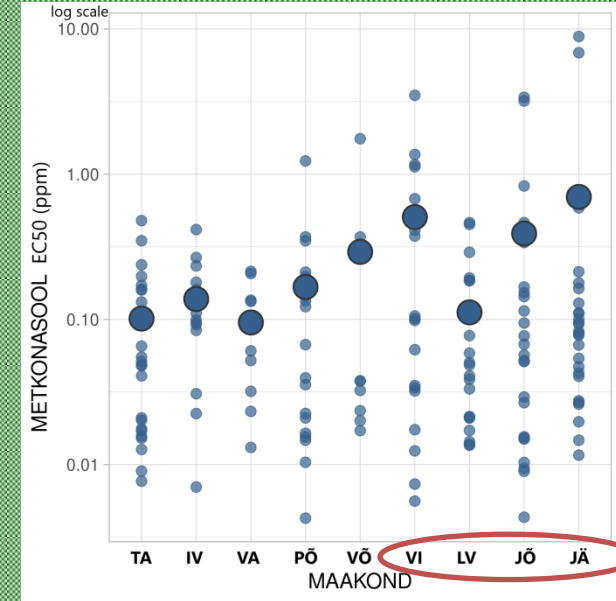
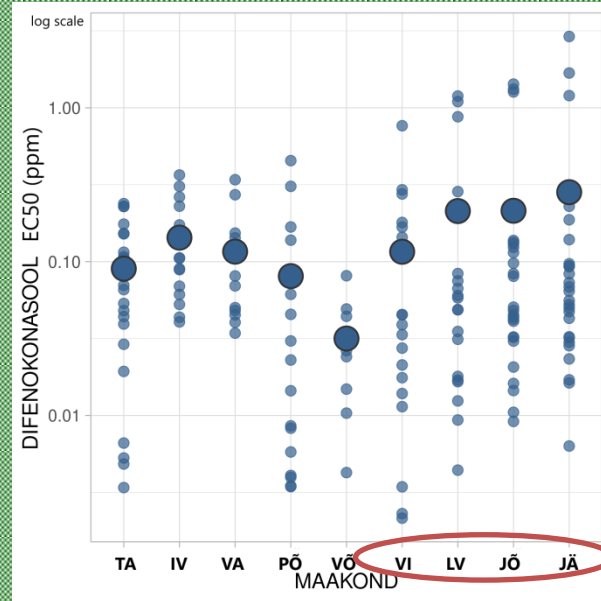
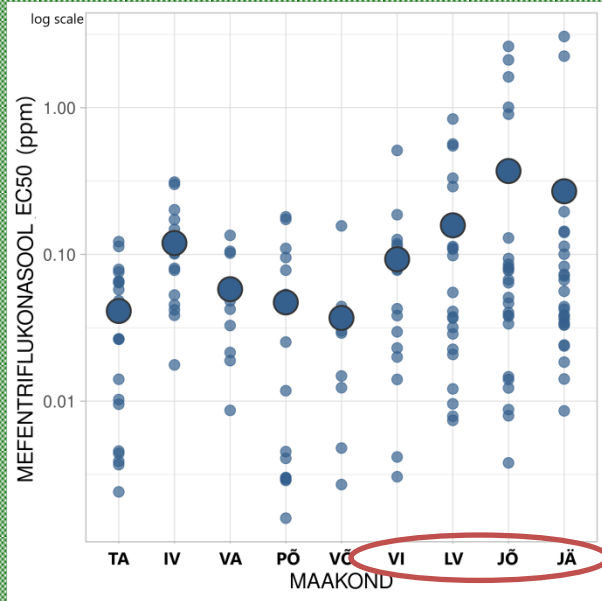


YEAR	MEFENTRIFLUC		PROTHIO-DES		DIFENOCONAZOLE		METCONAZOLE	
	MEAN EC50 (ppm)	SE	MEAN EC50 (ppm)	SE	MEAN EC50 (ppm)	SE	MEAN EC50 (ppm)	SE
2018	–	–	0.12	0.06	–	–	–	–
2019	0.29	0.05	0.11	0.02	–	–	–	–
2020	0.07	0.01	0.08	0.01	–	–	–	–
2021	0.16	0.03	0.17	0.06	0.16	0.03	0.3	0.07

Mefentrifluconazole cross-resistant with other triazoles



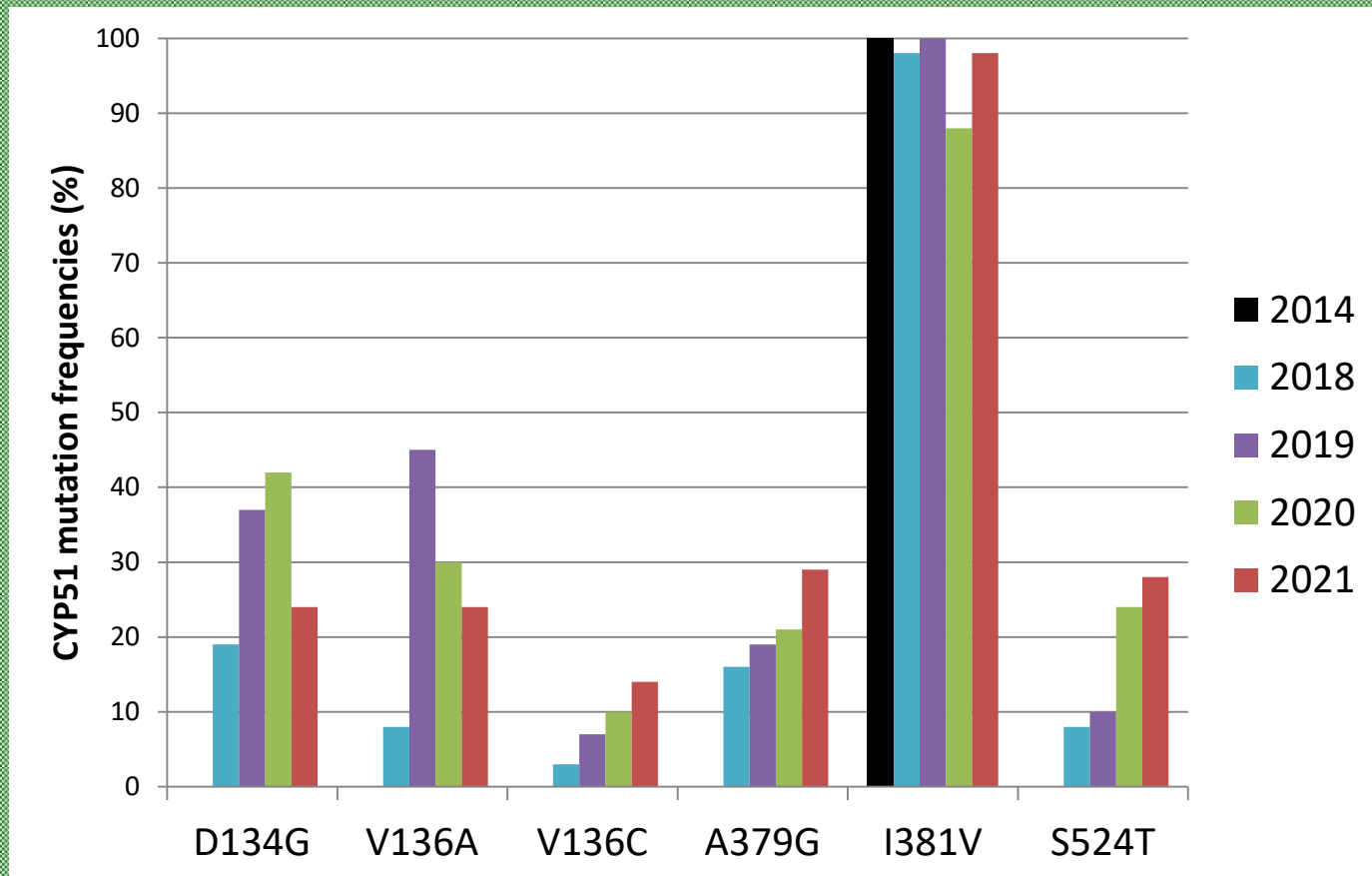
DMI sensitivity is highly variable between Estonian counties



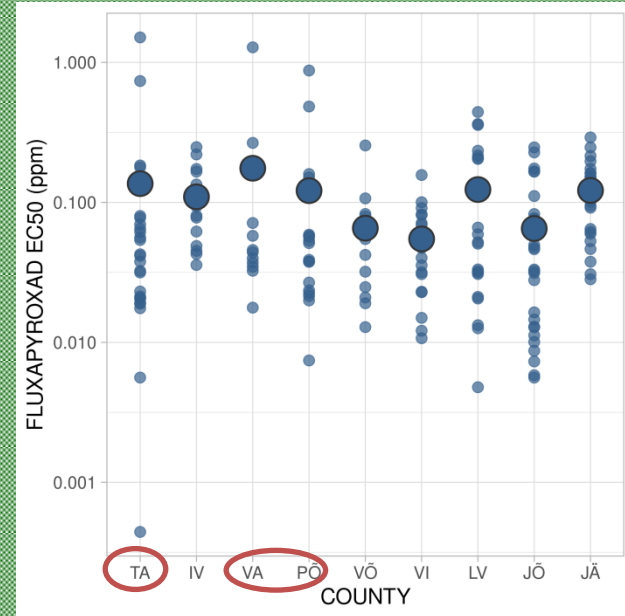
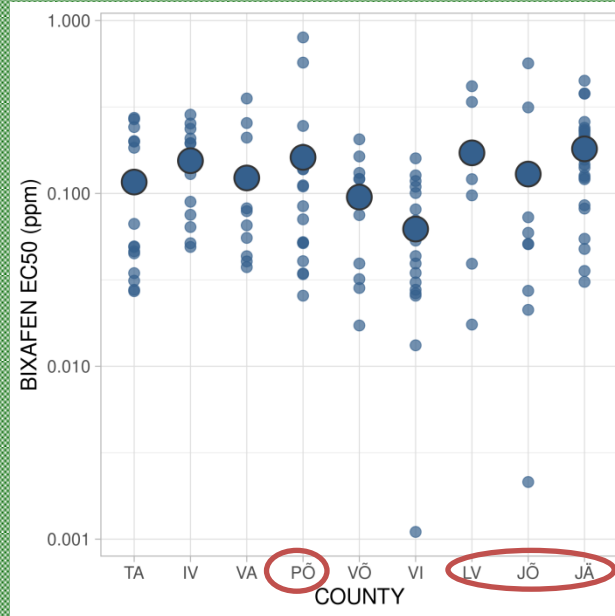
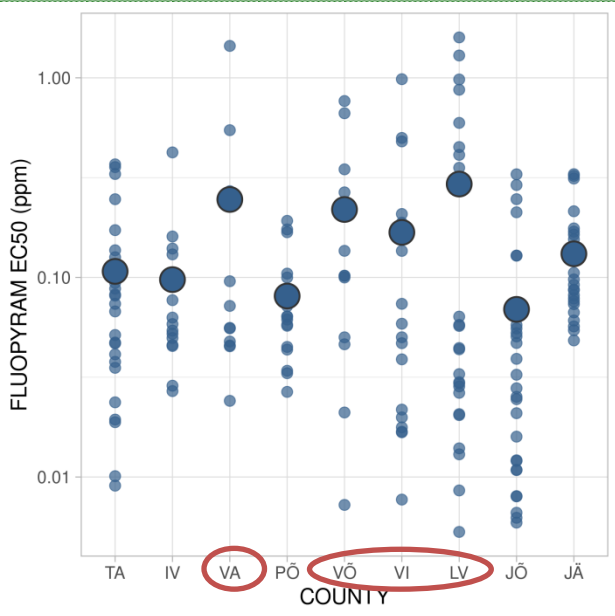
✓ Less sensitive isolates occurring in intensive farming areas



Mutation frequencies of V136C, A379G, and S524T in CYP51 are increasing in Estonian pop



SDHI sensitivity in 2021



SDHI sensitivity

- 3 isolates with SDHC-N86S mutation in 2021
- 6 isolates with SDHC-N86S mutation in 2020
- 3 isolates with SDHB-N225I mutation in 2020

- C-T79N, C-W80S, C-H152R, B-T268I mutations do not occur in the Estonian *Zt* population

G143A mutation frequency in *CytB* is rising in Estonian *Z. tritici* population

		G143A mutation frequency (%)			
		2018	2019	2020	2021
Estonia total		48	50	50	75
Estonian counties	IV			74	79
	LV	75	51	86	68
	JÕ	40	31	67	59
	JÄ			25	72
	TA	14		0	78
	VI		65	42	80
	PÕ			65	72
	VA		0	60	100
	VÕ		80	21	92



No isolates from these counties in 2018 and 2019

Summary

- Intensive triazole applications are driving the development of azole resistance, as observed by the accumulation of key CYP51 mutations
- More resistant *Z. tritici* isolates to triazoles are from intensive farming areas
- Resistance to strobilurins is rapidly increasing
- *Z. tritici* is mainly sensitive to SDHIs (bixafen and fluxapyroxad)
- Suggest sensible applications of triazoles and strobilurins especially in intensive farming areas

Acknowledgements

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- Dr. Steven Kildea, Teagasc

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Thank you!



Zymoseptoria tritici on PDA. Captured with Leica M205 FA fluorescence stereo microscope camera MC190HD. Author: Andres Mäe.