Large –scale phenotyping identify novel resistance markers and show that selection for resistance to Heterobasidion parviporum is unlikely to affect growth and wood quality traits in mature Norway spruce trees.

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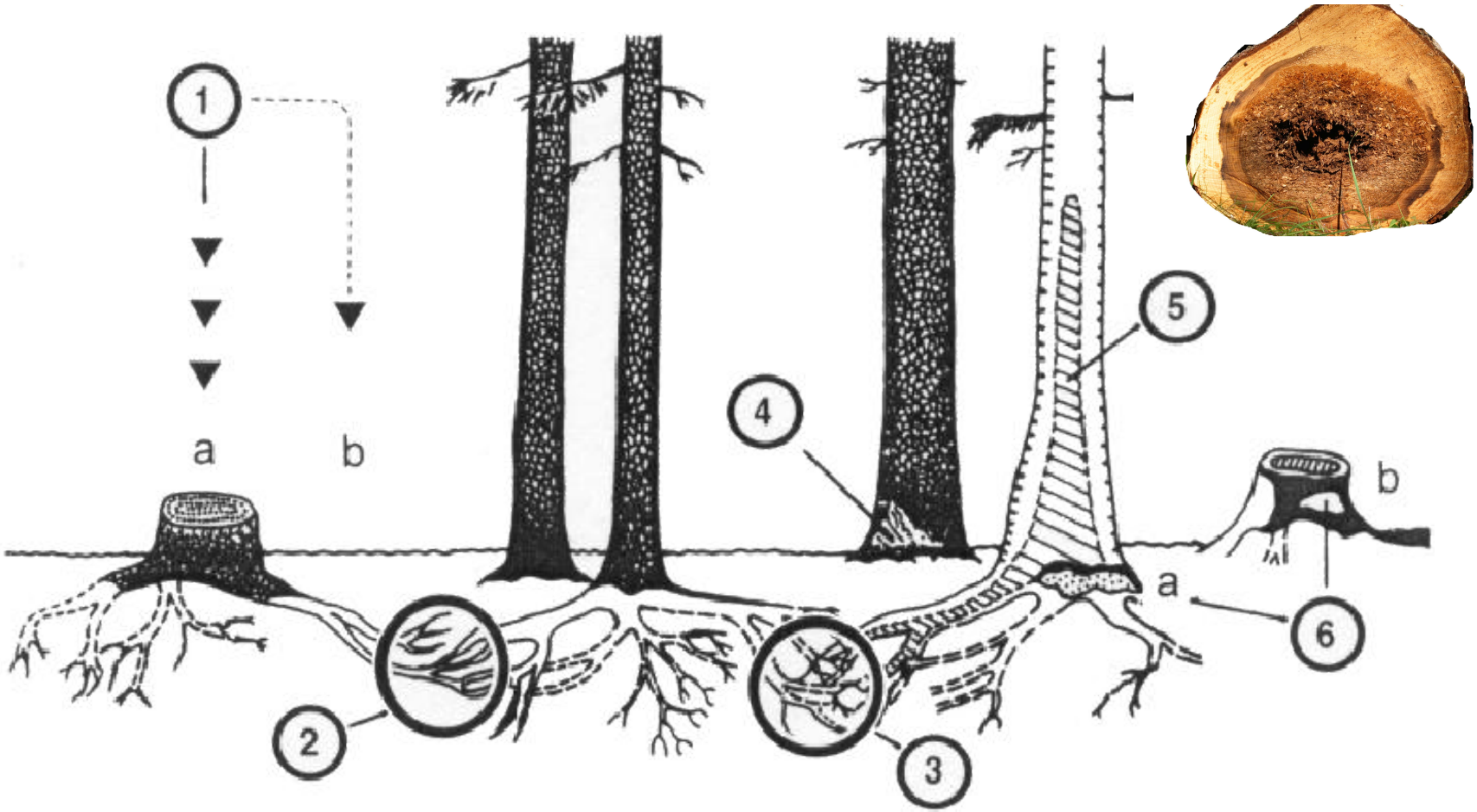
- **European Journal of Forest Research https://doi.org/10.1007/s10342-018-1120-5**

Synopsis

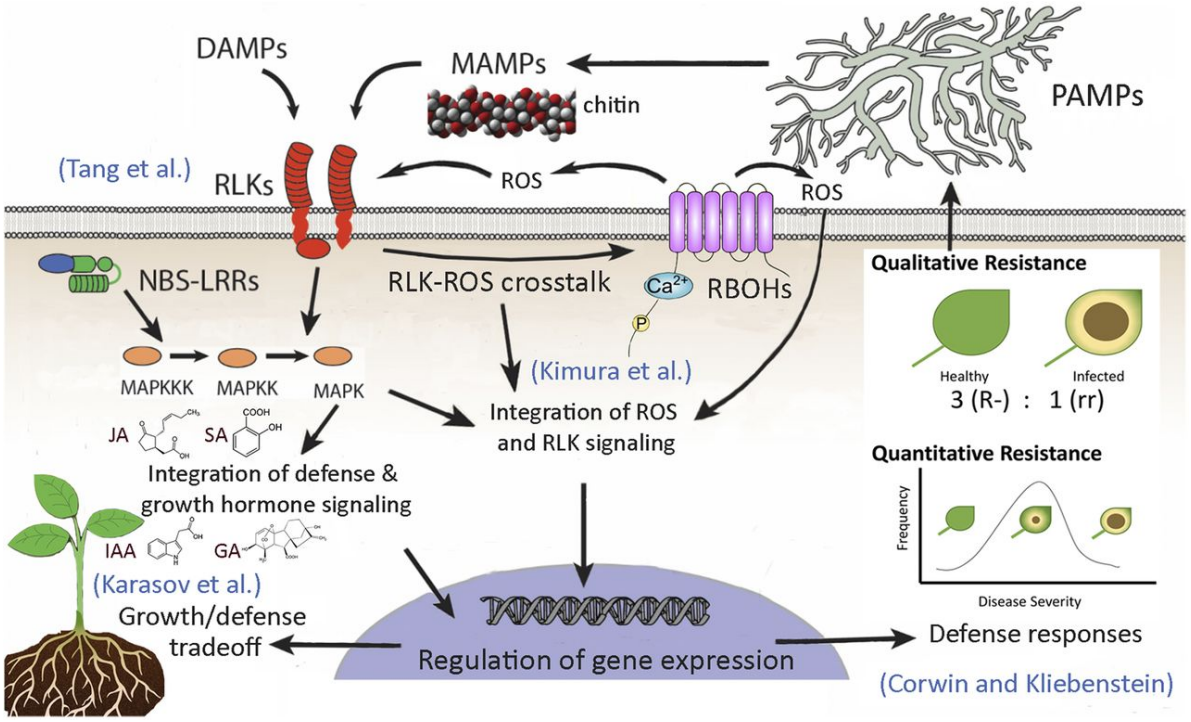
- Heterobasidion infection biology
- Growth defence theory
- The massive inoculation experiment
- Results
- Future work
- Conclusion

Heterobasidion infection

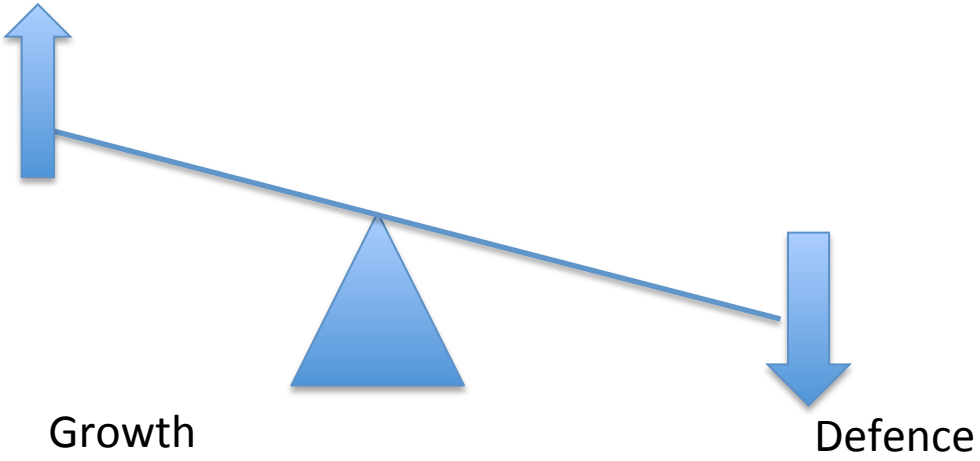


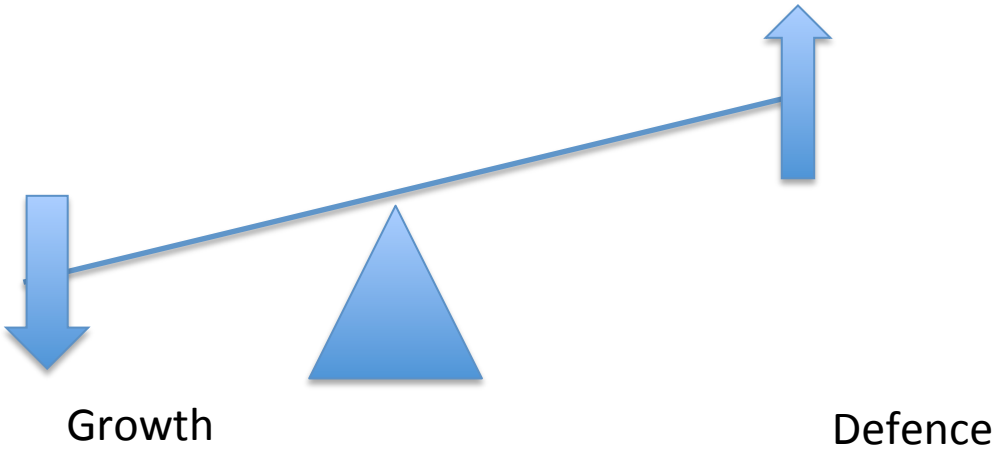
Growth vs Defence trade-off

- GDBH -growth-differentiation balance hypothesis
- Resources allocation
- Eckardt The Plant Cell 2017

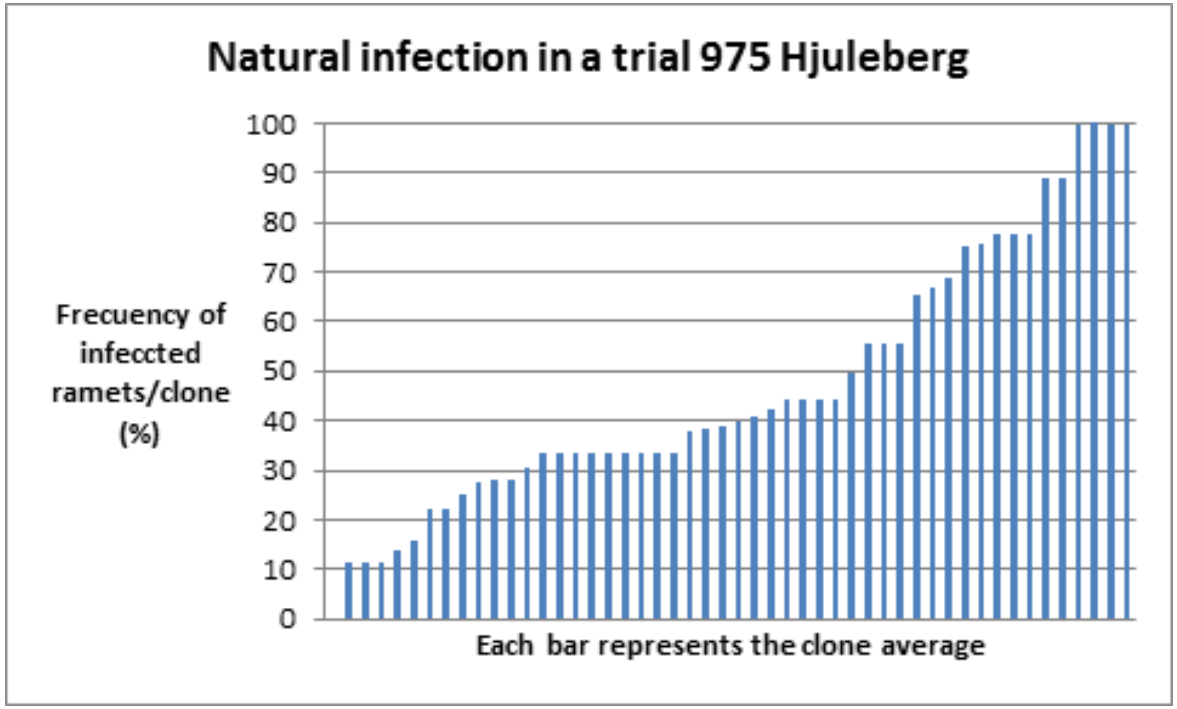


GDBH





In S21S842979 Natural rot incidence



Karlson & Swedjemark *Scandinavian Journal of Forest Research*, 2006; 21: 108-114

Does defence correlate with growth traits in the long run in the SSBP?

- Do mother trees with offspring that defend well display a reduced growth ?

Phenotyping of progenies from 500 plus trees from the Southern Swedish Breeding Population

- Aim :Phenotype mothers

- 243 families in common with open pollinated 21 year old trees phenotyped for growth traits (Chen 2014)

Growth traits on 21 year old trees from 243/470 families

Chen et al 2014

- Diameter Breast Height
- MFA (Microfibril angle)
- MOE (Modulus of elasticity)
- RFW (Radial fiber width)
- TFW (Tangential fiber width)
- FWT (Fiber wall thickness)
- FL (Fiber length)
- FC (Fiber Coarseness)

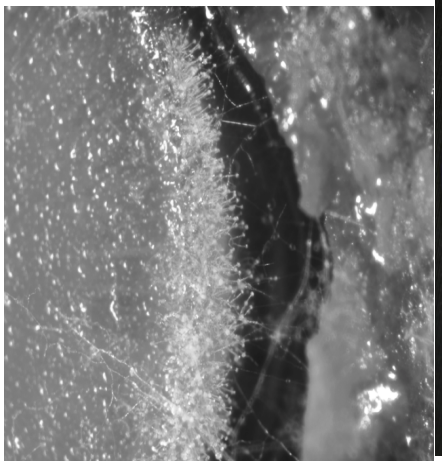
Approx 5000 plants from 470 open pollinated families

The experiment worked

- The number of failed infections is low
- Vitality scores were even between blocks
- Good estimate of the families resistance.

Inoculations

Lesion length and Sapwood growth



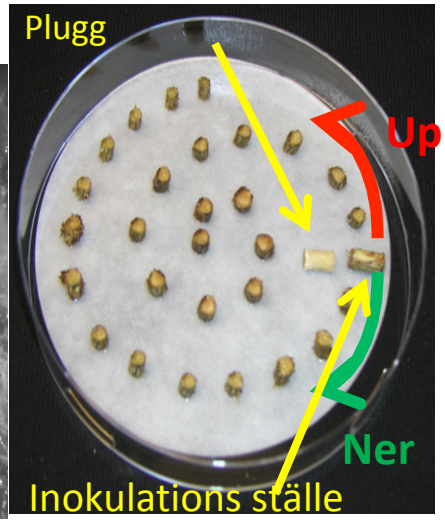


Figure 1

Results

Inoculation study	Acron.	Unit	N	Mean
Diameter	D	mm	4628	4.0
Lesion Length	LL	mm	4547	7.6
Fungal growth	FG/SWG	mm	4554	32.5
Vitality	Vitality	classes	4376	1.9

Results Heritability of Resistance

- LL 0.33
- FG 0.42

- Previous research (Swedjamark 199, Skröppa 2015, Steffenrem 2016)
- LL < 0.35
- FG < 0.27

Results Correlations

- FG and LL moderate correlation 0.47
- LL no correlations with growth traits
- FG and D in nursery experiment 0.27 phenotypic- and 0.47 genetic correlation
- FG no correlations with growth traits in grown up trees

Result Genetic gains

- LL 41%
- FG 52%

- **European Journal of Forest Research https://doi.org/10.1007/s10342-018-1120-5**

Future work

- GWAS of Disease traits with UPSC
- John Biason and Linghua Zhou and Rosario Garcia Gil

Candidates from GWAS

- FG

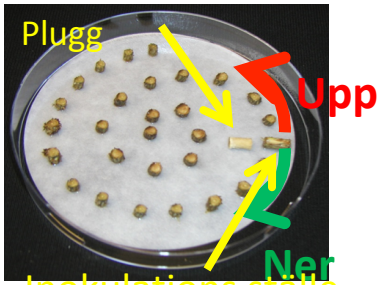


Figure 1

- LL

Gene
-ABC-type transport system, ATPase and permease component -Similar to the one found in *Corynebacterium mustelae*
Populus: Potri.001G369300 Arabidopsis: AT4G26620 -similar to sucrase (Solanum tuberosum)
Populus: Potri.001G353800 Arabidopsis: AT5G46420 - UTP--glucose-1-phosphate uridylyltransferase
Populus: Potri.004G059400 Arabidopsis: AT4G18750 - Pentatricopeptide repeat (PPR) superfamily protein
Populus: Potri.019G124300 Arabidopsis: AT2G30210 - Multicopper oxidase

Conclusions

- Variation in H.parviporum susceptibility in SSBP
- High narrow sense heritability for resistance
- No observed trade-off growth -defence

- Phenotyping of traits in combination with GWAS can provide marker candidates