

Stilbenes as constitutive and inducible protection compounds in Scots pine (*Pinus sylvestris* L.)

Anni Harju & Martti Venäläinen

Punkaharju Research Unit, METLA, Finland

4th International Workshop on the
Genetics of Host-Parasite Interactions in
Forestry

July 31 – August 5, 2011, Eugene, Oregon,
USA

Starting point for the study

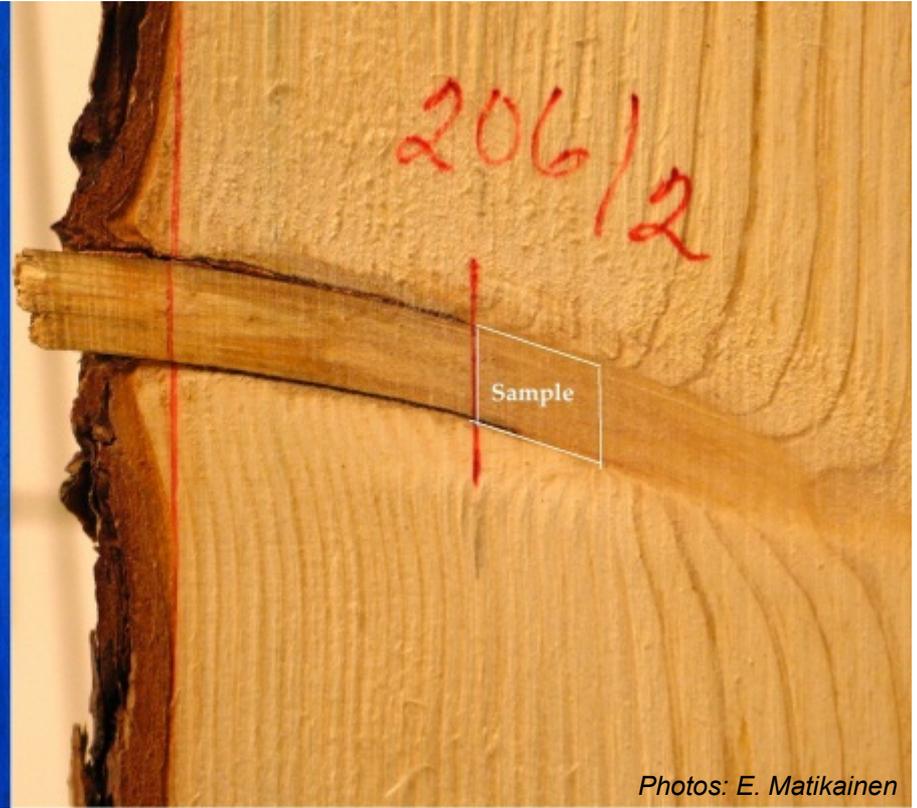
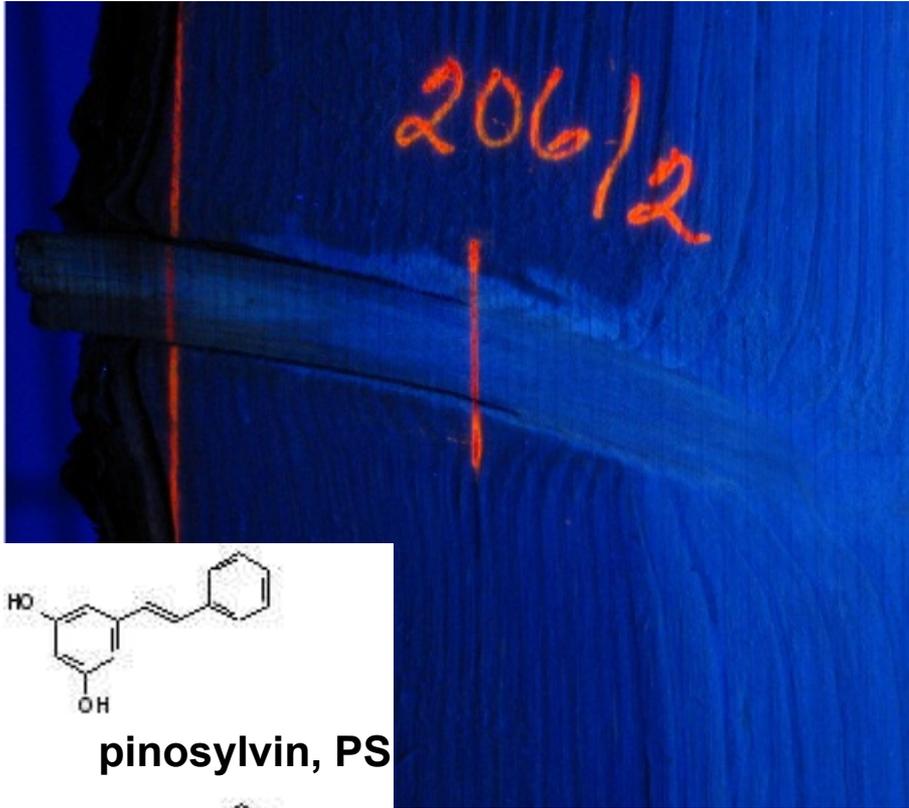


Photo: M. Venäläinen

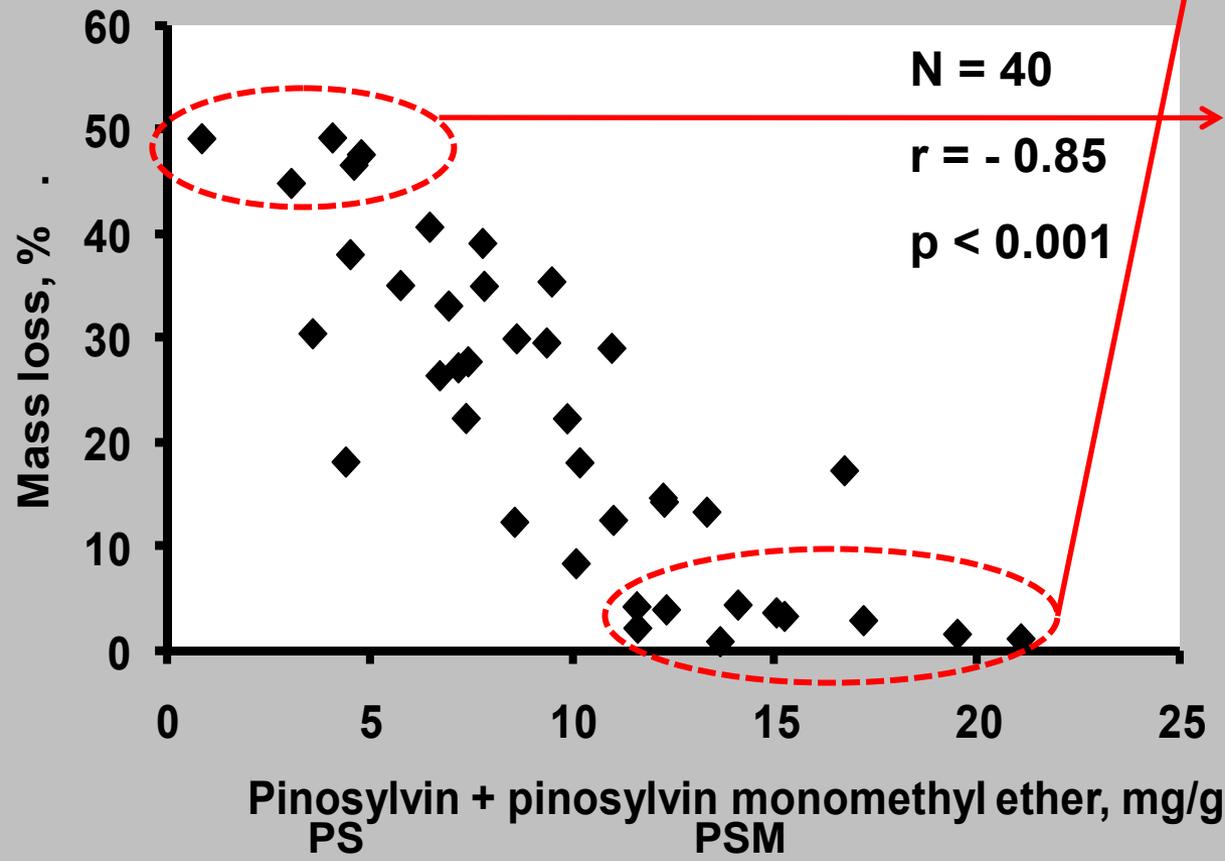
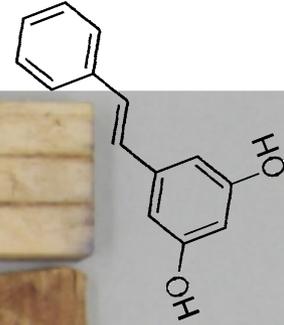
Scots pine heartwood is an important timber resource because of its natural characteristics.

Natural decay resistance of Scots pine heartwood is an example of an important wood quality trait.

Natural decay resistance of Scots pine heartwood is due to extractives

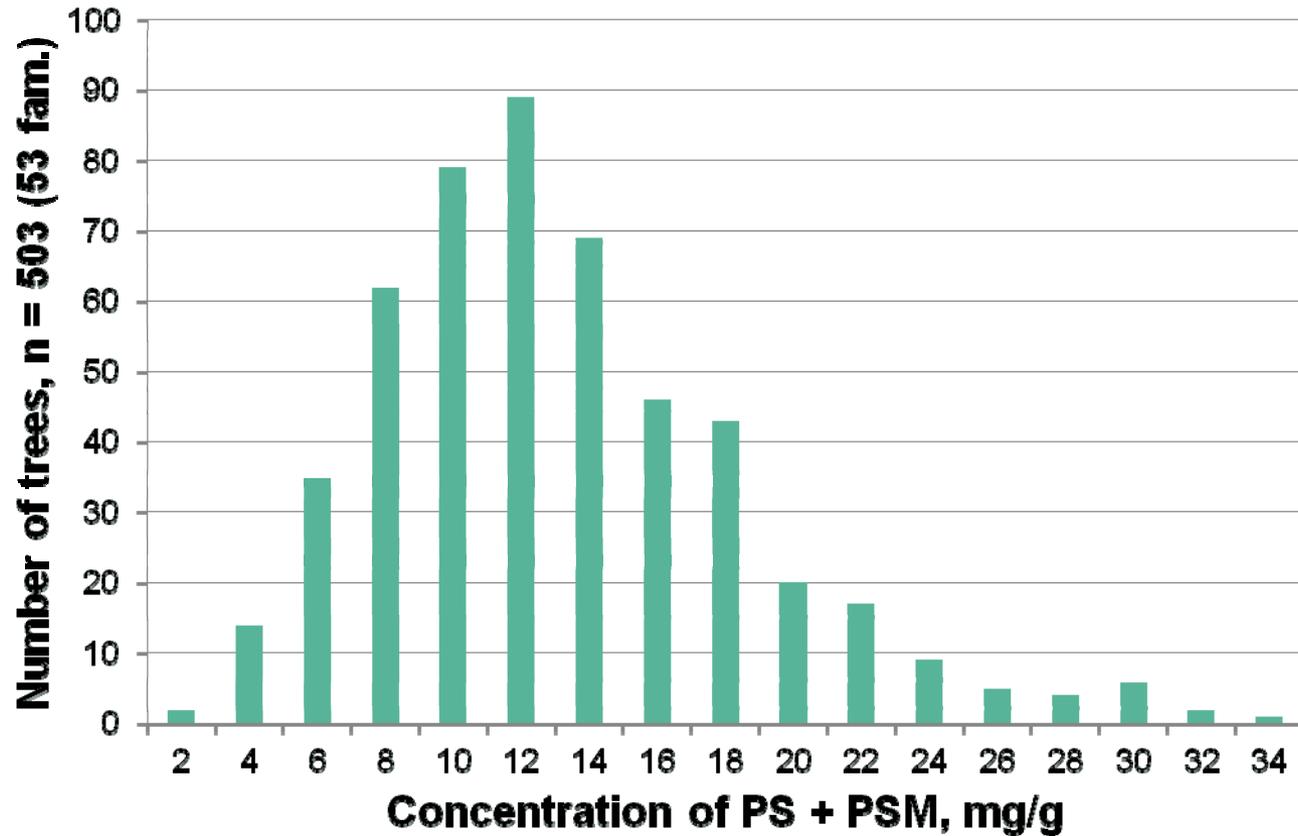


stilbene concentration in Scots pine heartwood



Natural variation stilbene concentration

Stilbene distribution in heartwood in a progeny trial 1



Estimation of genetic parameters: heritability of heartwood stilbenes

Heritability ($CV_A\%$)			
	Progeny trial 1		Progeny trial 2
Sampling year	2003	2009**	2010
PS		0.67 (35)	
PSM		0.41 (33)	
PS+PSM		0.56 (33)	
Total phenolics	0.71 (33)*	0.52 (26)	0.54 (31)
Density	0.60 (6)	0.58 (7)	0.26 (6)
D	Heritability $h^2 = \text{additive genetic variance} / \text{phenotypic variance}$		

*Harju & Venäläinen 2006

**Partanen & al. (submitted manuscript)

Estimation of genetic parameters: genetic correlation

Genetic correlation between environments (r_x),
progeny trial 1 vs. progeny trial 2

Genetic correlation B	
	r_x
Total phenolics	0.86
Density	0.91
DBH	0.80
Heartwood proportion	0.93

Estimation of genetic parameters: genetic correlation

Genetic correlation between traits estimated from progeny trial 1

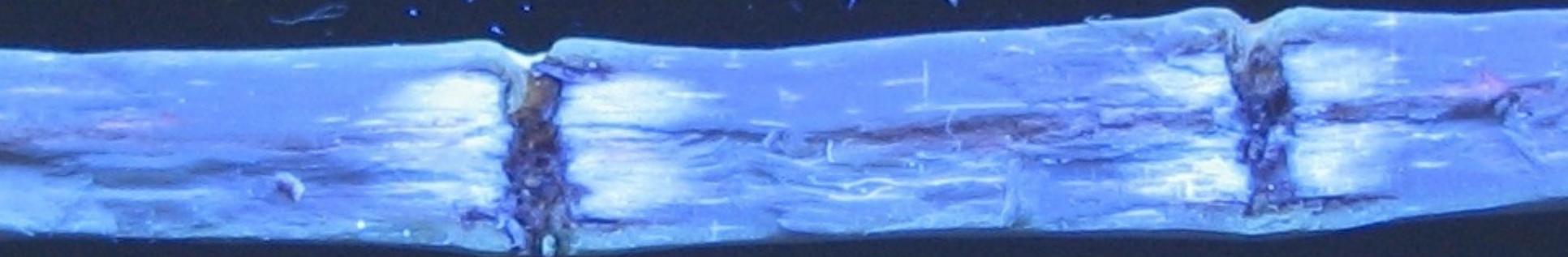
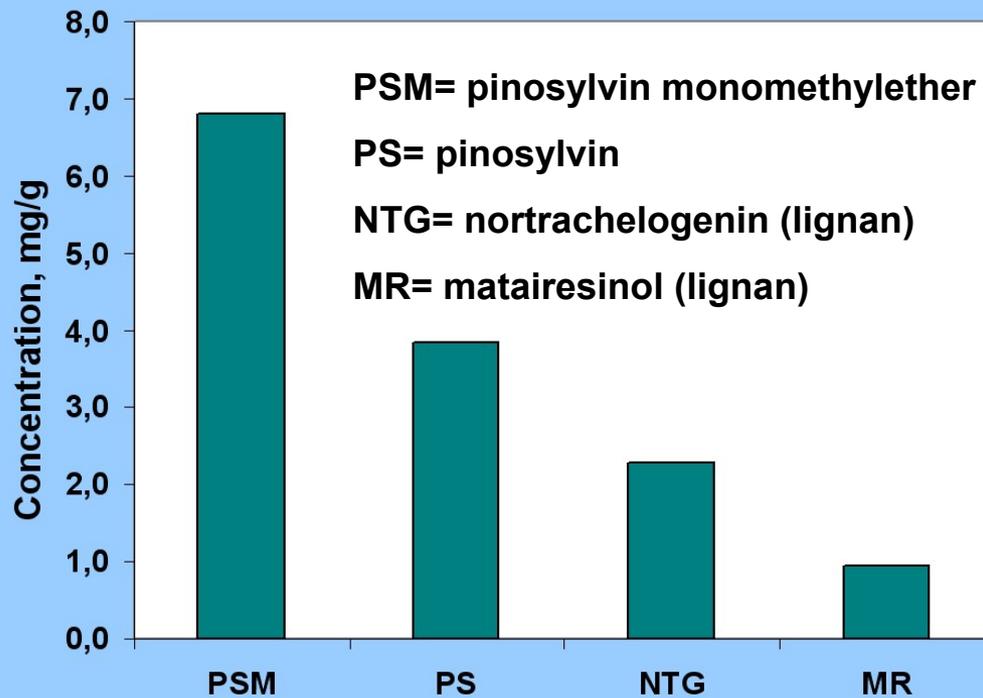
		Genetic correlation		
		PS	PSM	PS+PSM
	PSM	0,88		
	Total phenolics	0,81	0,75	0,78
-0.35 (Density	-0,13	-0,28	-0,24
	DBH	-0,06	-0,33	-0,25
	HW annual rings, number	0,02	-0,08	-0,05
	Heartwood proportion	0,19	0,21	0,21

Induced production of stilbenes in Scots pine seedlings



Material

- 18 half-sib families of Scots pine
- height 51 cm,
- diameter 6.3 mm
- drilling in April, sampling in August



UV light, 313 nm

Photo: M. Venäläinen

Estimation of genetic parameters: heritability of induced stilbenes in three-year-old seedlings

	Heritability	CV _A %
PS	0.71	36
PSM	0.35	25
PS+PSM	0.62	34
Height	0.84	10
Diameter of the sampled section	0.64	8

What is the role of induced production of stilbenes for the survival of the trees?



Photo M. Venäläinen

Is it possible to select for constitutive and induced resistance at the same time?

Prospects to utilise the natural variation in stilbene content of heartwood of Scots pine

1) Grading of existing timber

- requires a fast grading technique
 - optical spectroscopy from solid wood?

2) Breeding of decay resistant heartwood

- evaluation of breeding material in genetic field trials and/or seed orchards (based on screening of heartwood)
 - requires fast technique for screening
- indirect early testing for seedlings
 - based on molecular markers or induced reactions

3) Selective seed harvest from seed orchards

- requires fast technique for screening

➤ **More uniform quality of wood material**

➤ **Value increase**

Thank you!



Photo: T. Nikkanen