

SHR

Detection of activity of wood attacking insects

FaBBI seminar Tartu - Tallinn

October 17-18th, 2011

Jos Creemers
SHR Timber Research

Wood attack by insects

FaBBI seminar 17-18 October 2011

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Overview of presentation

- Short introduction to SHR
- Biological wood attack
- Detection of insect attack and activity
- Detection of insects using AE


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SHR (Timber Research)

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SHR (Timber Research)

Organization:

- Founded in 1991 as independent research institute
- Anno 2011: 25 employees, about half of which have an academic degree

SHR reinforces and stimulates innovation by means of **research**, product and process development, advising on **and testing** of **wood and related products**




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SHR fields of work



- Climate separating applications (e.g. window frames, doors, timber frame walls)
- Interior applications (e.g. constructions, furniture, floors, decoration)
- Exterior applications (e.g. cladding, decking, civil engineering)
- "Old wood" (e.g. historical constructions, timber piles, archaeological wood)

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Jos Creemers

Expertise:

- wood decay in buildings (fungi and insects)
- pest control expert
- damage assessments
- expert in lawsuits
- wood species / wood properties



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Biological wood attack

Several wood decaying organisms:

- bacteria
- molluscs
- crustaceans } in salt water
- fungi
- insects } in buildings (and objects)

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What are 'they' looking for?

mostly **FOOD!**

but not always:
leafcutter bee (*Megachile* sp.)
in decayed hemlock fir



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Dealing with decay in historical wood,

you will have to

- **BE CAREFUL**
- **KNOW:**
 - what you are talking about
 - what to look for ---> **ALL SENSES:**
 - feeling
 - seeing
 - hearing
 - (smelling)
 - what you *could* do
 - what you *have to* do

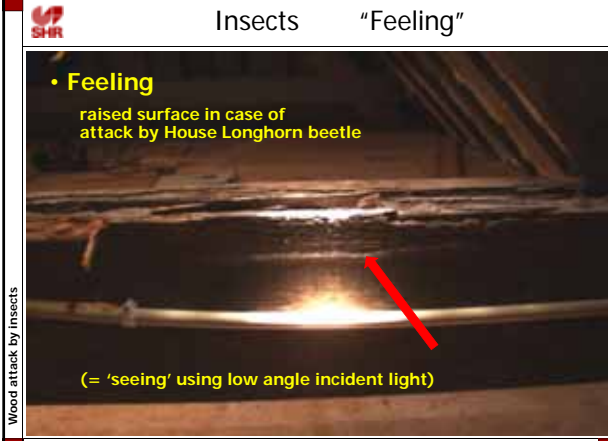
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Insects "Feeling"

- **Feeling**
raised surface in case of attack by House Longhorn beetle

(= 'seeing' using low angle incident light)



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Insects "Seeing" 1

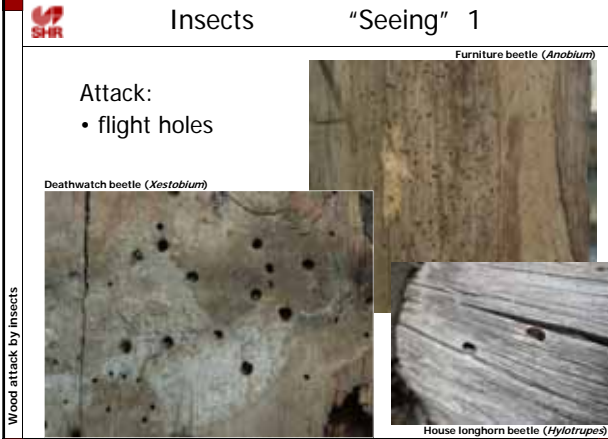
Attack:

- flight holes

Furniture beetle (*Anobium*)

Deathwatch beetle (*Xestobium*)

House longhorn beetle (*Hylotrupes*)




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SHR Insects "Seeing" 2

Attack:


- old / dead beetles



House longhorn beetle (*Hylotrupes*)



Furniture beetle (*Anobium*)



Powder post beetle (*Lyctus*)

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SHR Why work on detection of insect activity?

- More need for action when active
- 3 possible situations in practice :
 - clearly active
 - well, I'm not sure
 - definitely old

treatment firm / guarantee

↕

cultural heritage / protection

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SHR Why detect insect activity?

Clarity about activity of attack will help to:

- decrease tension between parties
- conserve more historical material in it's original quality
- prevent unnecessary treatments
- use more targeted treatments (e.g. microwaves)


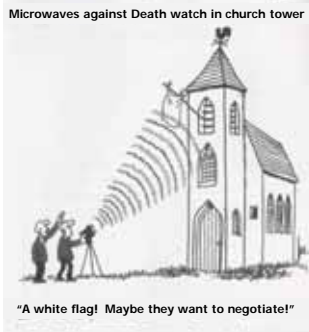
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SHR Microwave treatment experiment

Possibility for targeted treatment in buildings:

Test on an Oak beam in the church tower at Polsbroek (NL) in 2005: no new flight holes since then (last check in April 2011)

Microwaves against Death watch in church tower

"A white flag! Maybe they want to negotiate!"


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SHR Insects "Seeing" 3

Activity:

- new holes?
- sharp edges
- 'fresh wood'-color inside
- close or mark them
- cover with paper




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SHR Insects "Seeing" 4

Activity:

- living larvae / beetles
- actively expelled fresh bore dust




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Monitoring for living beetles



using glued boards as is ...



... or in combination with light traps

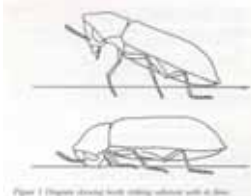
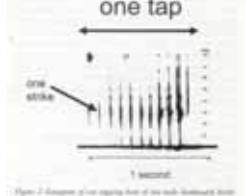
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Insects "Hearing" 1

- 'dull' sound when knocking on wood with serious (internal) damage
- the tapping by Anobiid beetles, specifically Xestobium (Death watch)



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Insects "Hearing" 2

- audible gnawing sounds (e.g. House longhorn beetle)
- recording of gnawing sounds
- Acoustic Emission - sensor

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Woodworm Detector 1

- meant for termites
- SHR work in the lab as well as in practice proved it to work also for our common Western-European dry wood boring insects

but:

- little possibilities for own settings
- no automatic registrations




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Woodworm Detector: questions

- Minimum age of attack / size of larvae?
- Minimum temperature for measurements?
- Optimal time of day for measurements?



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Woodworm Detector 2 = AED-2010

- apparatus looks the same

but:

- magnetic coupling using a screw and also touch sensor
- more possibilities for own settings
- automatic registrations



Measuring at Korsi long farmhouse on Ruhnu island

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SHR AED-2010: How does it work?

Acoustic Emission =

"The class of phenomena whereby transient elastic energy is generated by the rapid release of energy from a localized source or sources within a material, or the transient elastic wave(s) so generated."

A piezoelectric sensor in contact with the material producing the acoustic emissions, can convert the sound waves into small variations of voltage, which can be measured.

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SHR AED-2010: How does it work?

- insect activity = 'burst type' AE
- best characterized by threshold crossing detection
- every crossing of the threshold is a 'count'

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SHR AED-2010: How does it work?

Measurement of subterranean termite activity at vTi, Hamburg

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SHR AED-2010: Minimum temperature test

Measurements at:
18, 15, 12, 10, 8, 6, 4, 3, 2 °C

Result:
Minimum temperature ± 3-4 °C

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SHR AED-2010: Time of day test

Measurements (8 days):

- activity with AED
- air temperature
- air humidity
- temperature inside wood

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