Determination of the damage progression of whitespotted sawyer, *Monochamus scutellatus scutellatus* (Say), larvae in recently burned logs, by X Ray CT measurement

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Presentation outline

1) Context of the study

2) First objective: insect arrival

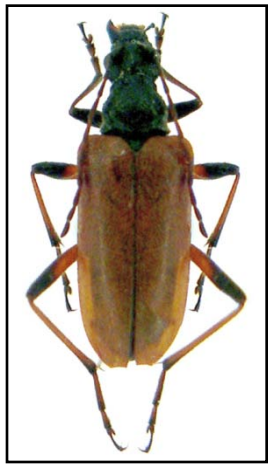
3) Second objective: speed of insect damage
   -Ct scan

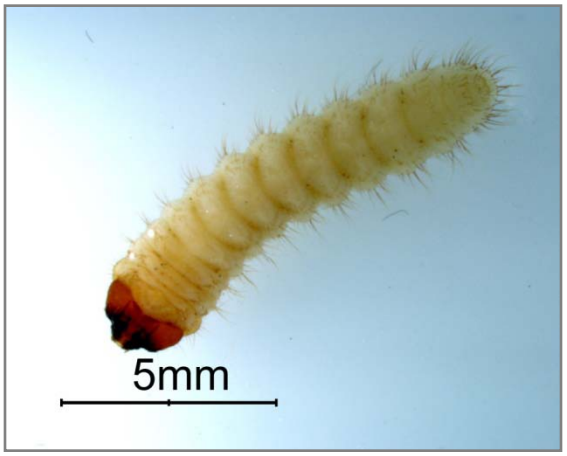
4) Conclusion: applicability in forestry

Context

- Forest industry in crisis
- Salvage logging in burned areas: contribute to maintain an adequate supply
- Race against time: to get the ressources before they loose too much economic value

Species collected





Acmeops proteus
(Acmaeops proteus proteus)

Whitespotted sawyer
(Monochamus scutellatus scutellatus)

Objective

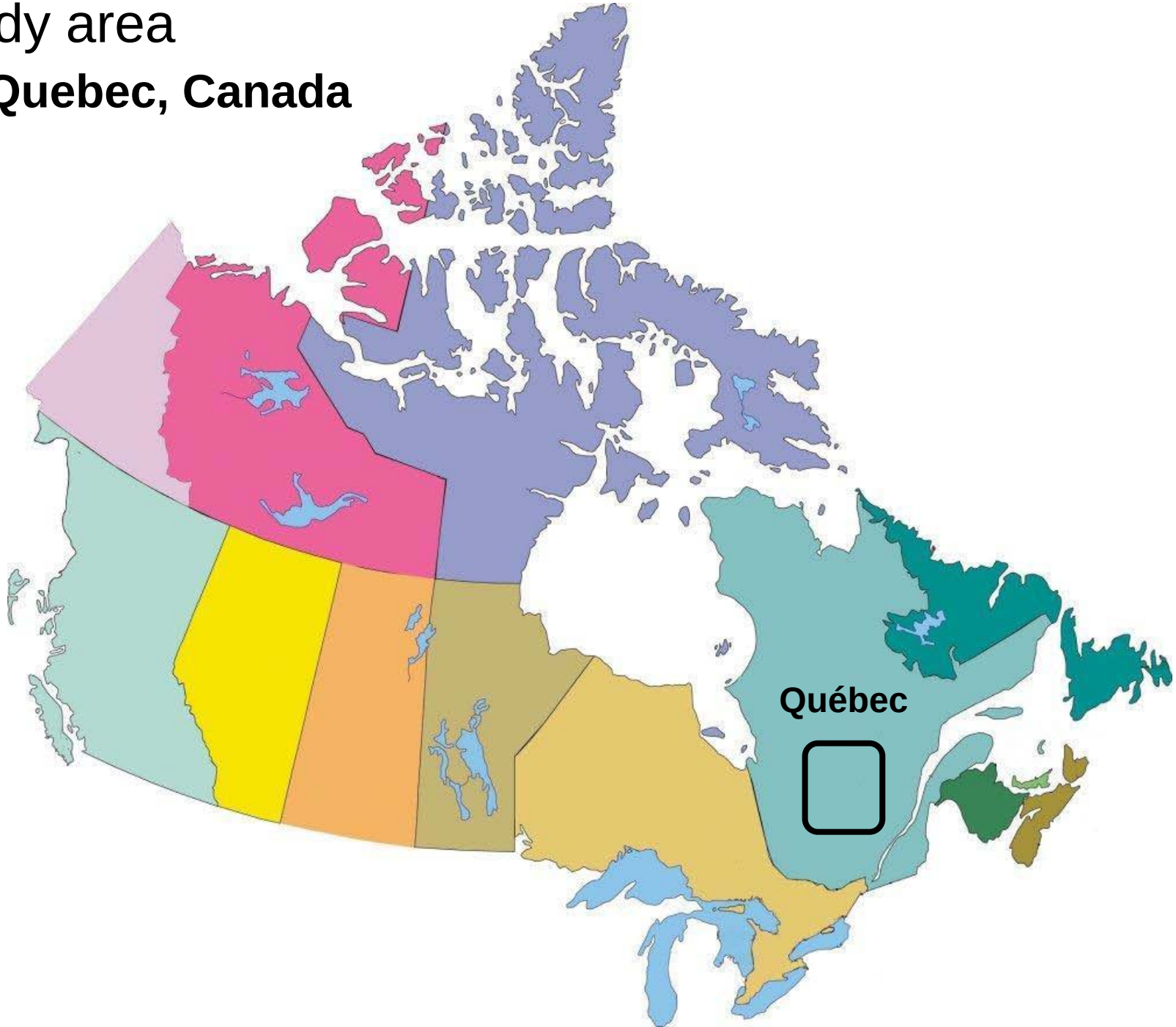
Objective 1 :

Determine the Whitespotted sawyer's attack periods after forest fires:

- in severly burned black spruce stands

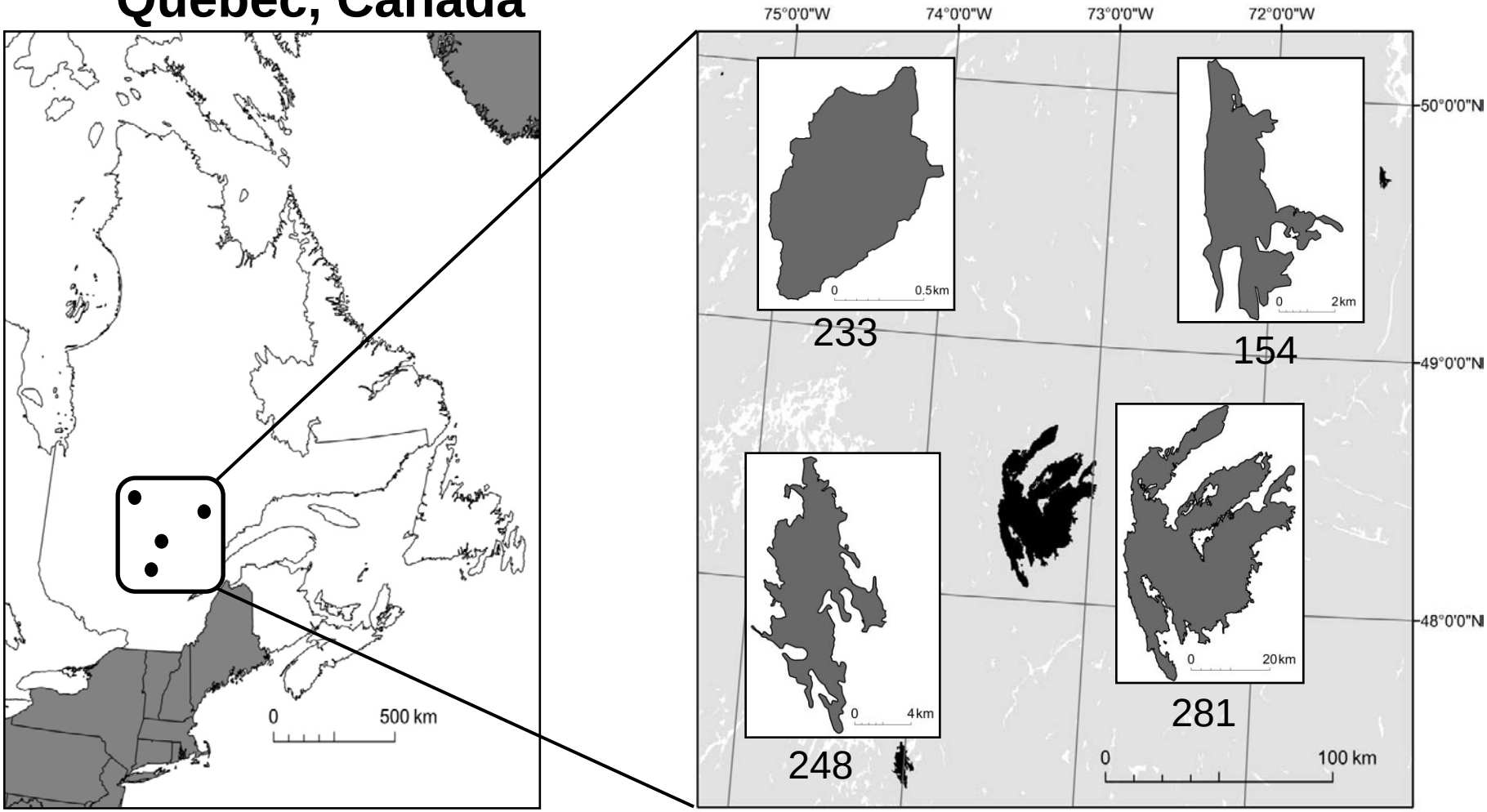
Study area

Quebec, Canada



Study area

Quebec, Canada



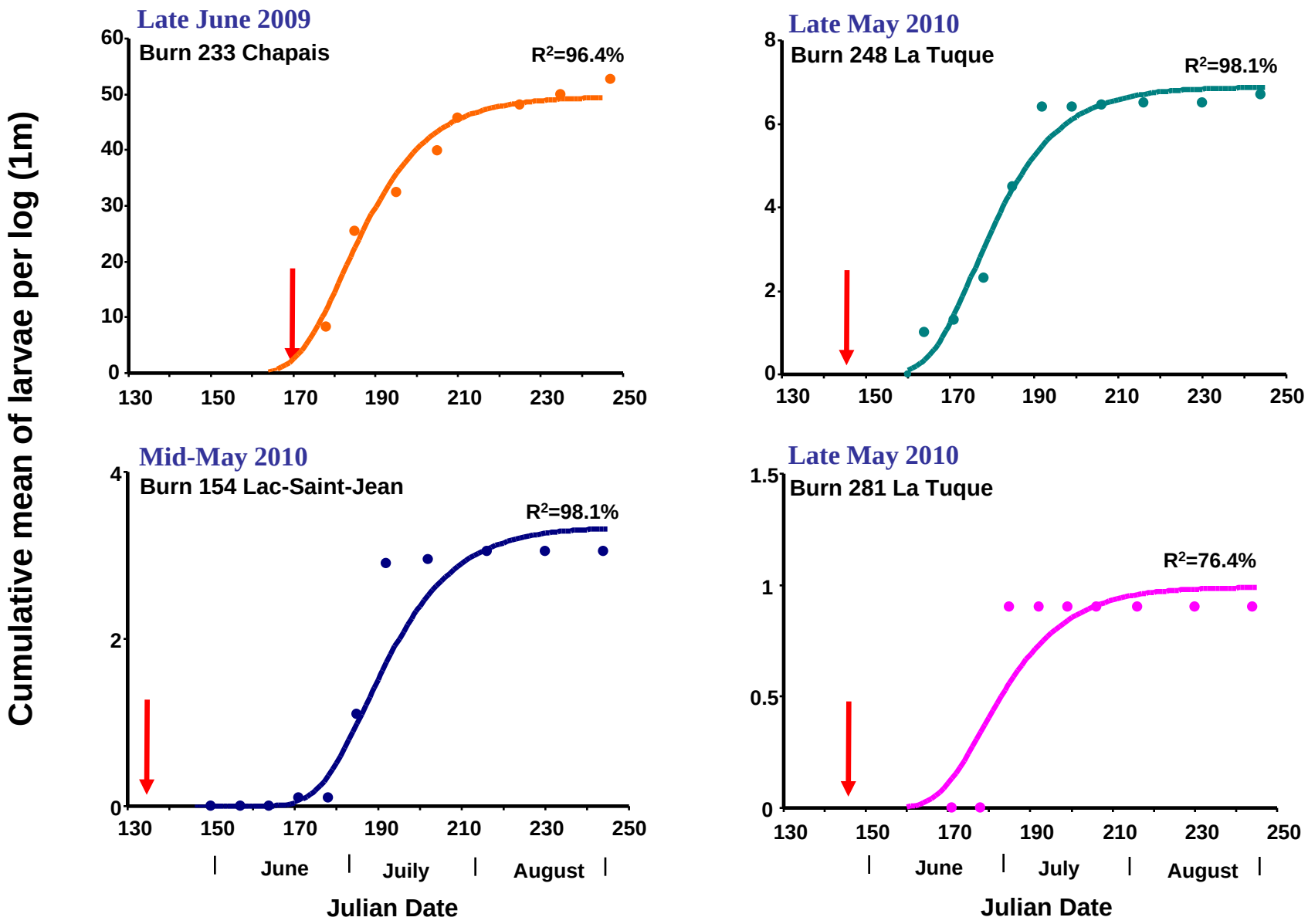
Materials and Methods

- 50 severly burned black spruce caged/burn site
- At intervals of 7 days, protection removed for 5 trees/burn site

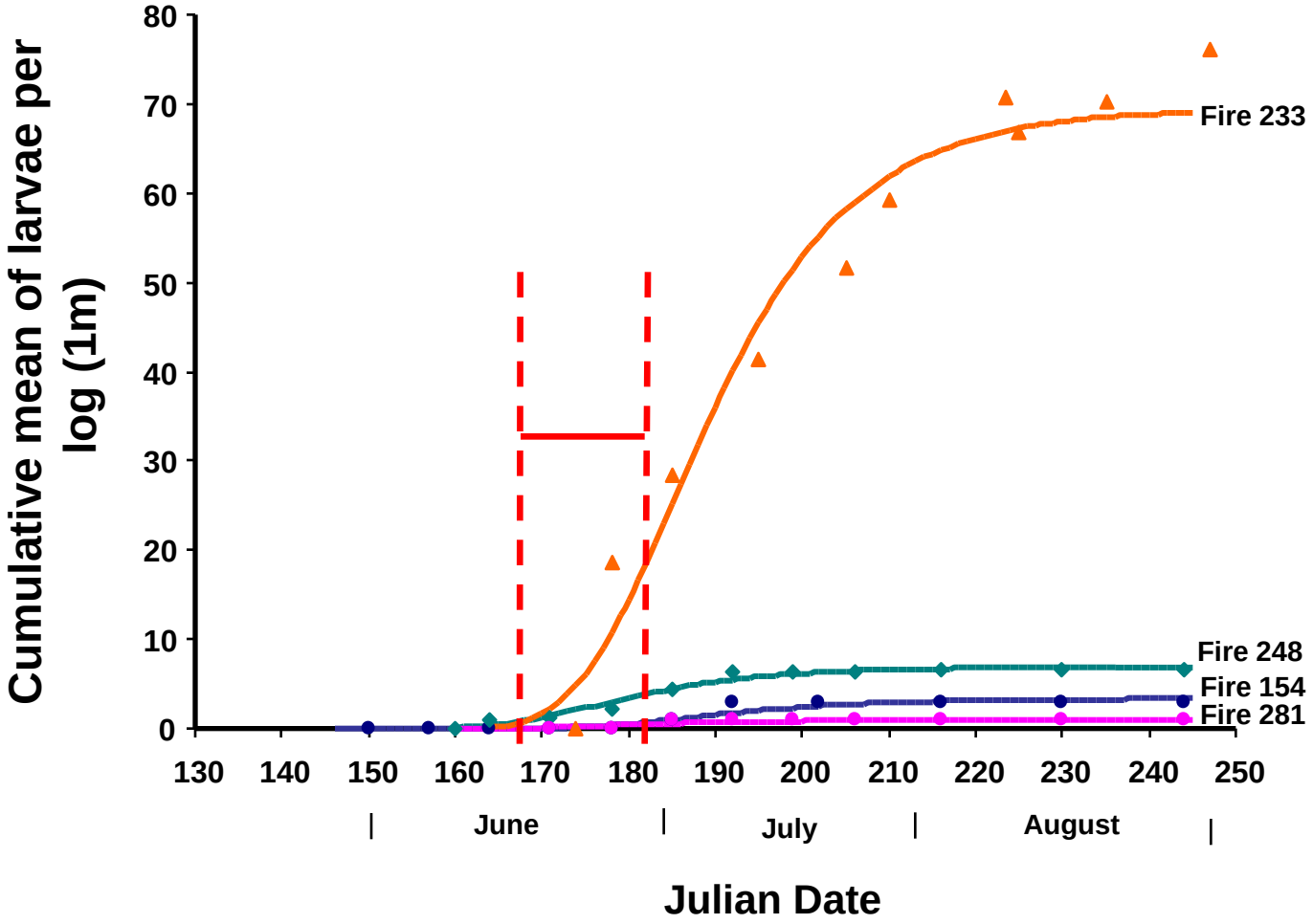
Materials and Methods

- Subsequent visit: exposed trees cut in 1m long logs
- Logs were brought back to the lab to be barked

Results:


Late June 2009
Burn 233 Chapais
R²=96.4%
Late May 2010
Burn 248 La Tuque
R²=98.1%
Mid-May 2010
Burn 154 Lac-Saint-Jean
R²=98.1%
Late May 2010
Burn 281 La Tuque
R²=76.4%
Cumulative mean of larvae per log (1m)
Julian Date
June
Juily
July
August

Results:


Cumulative mean of larvae per log (1m)
80
70
60
50
40
30
20
10
0
130
140
150
160
170
180
190
200
210
220
230
240
250
June
July
August
Julian Date
Fire 233
Fire 248
Fire 154
Fire 281

Discussion objective 1

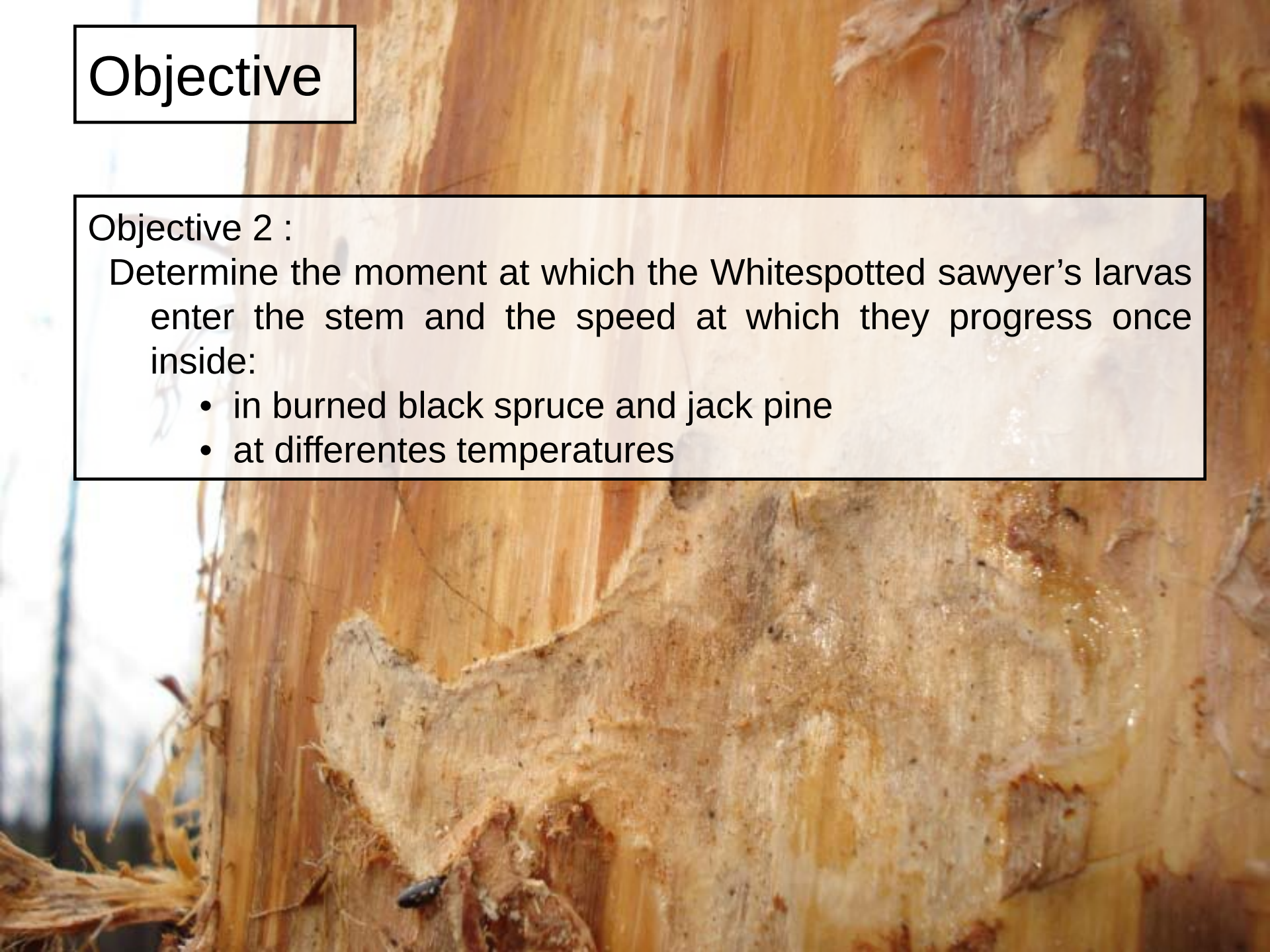
- Arrival of the insects between June 15-30 no matter when the fire started
  - Corresponds to the period when beetles move to reproduction
  - The abundance of larvae vary according to the fire: forest caracteristics (locality, severity, area) and the proximity of unburned stands

Objective

Objective 2 :

Determine the moment at which the Whitespotted sawyer's larvas enter the stem and the speed at which they progress once inside:

- in burned black spruce and jack pine
- at differentes temperatures



Materials and methods

- Total: 35 cages/trees species (1 log /cage)
- Logs were exposed to white spotted sawyer for 3 days

Materials and methods

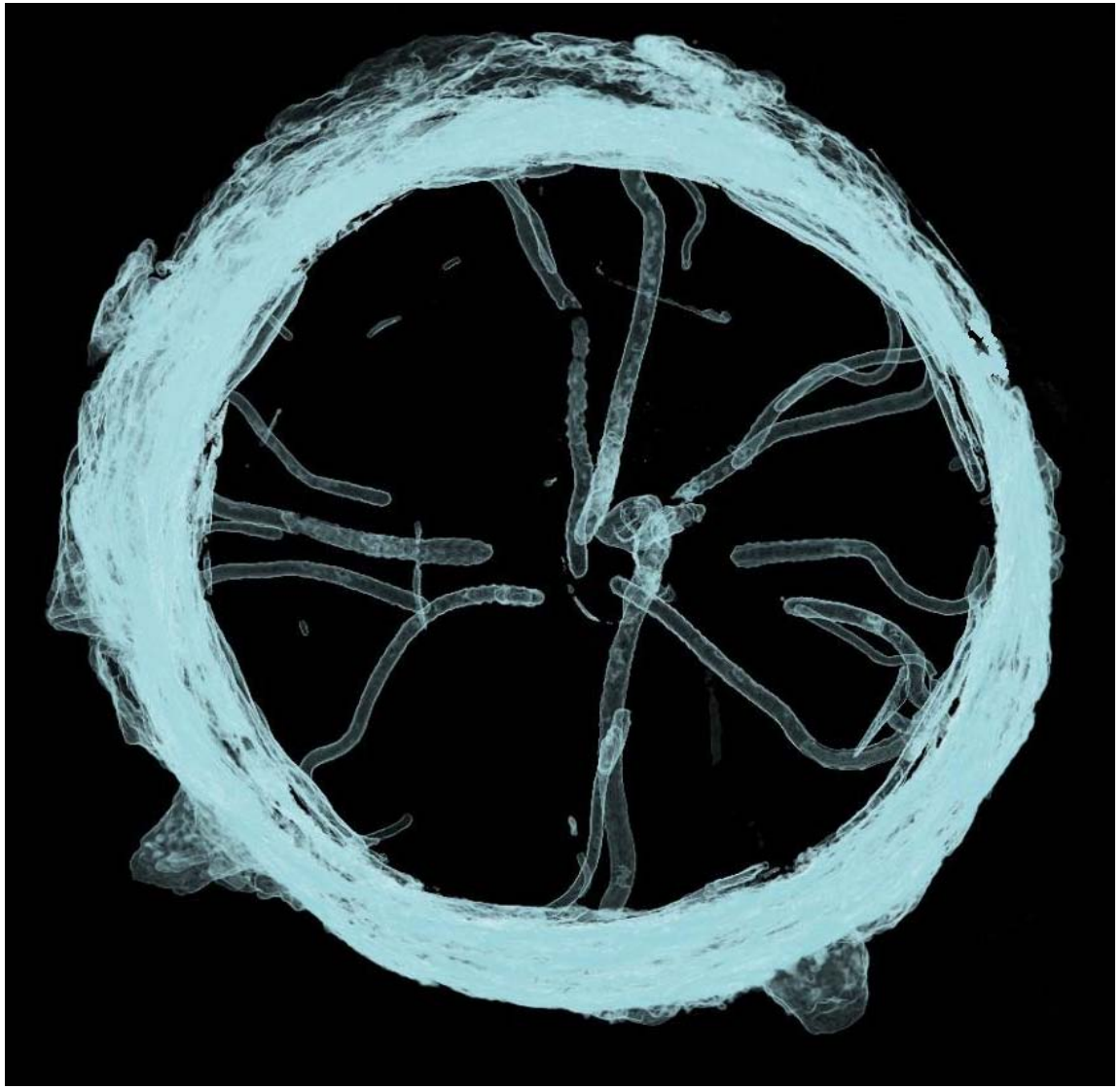
- Logs were put into incubation chambers
  - 7 logs/tree species placed at 12, 16, 20, 24 or 28°C
  - Total 35 logs/tree species

CT scan

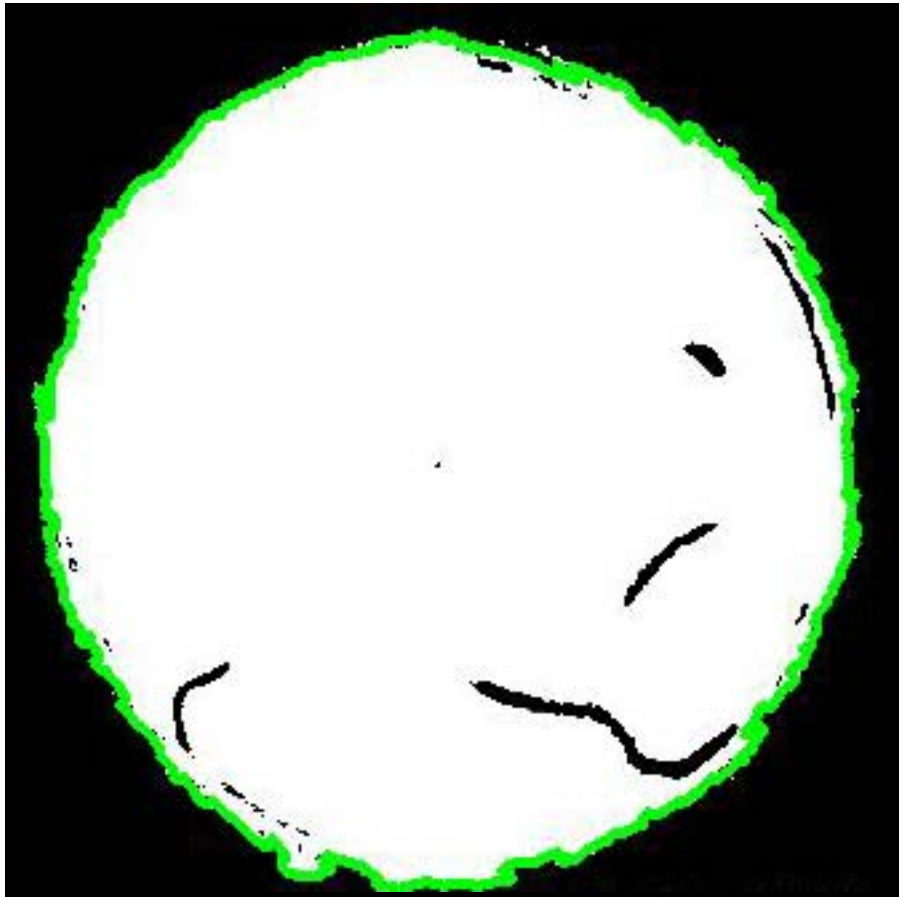
CT scan

Universite_Laval^Sebastien_Belanger
ID: Longicorne
* 1968-08-18
Study 2
2008-09-11
15:01:34
1006 IMA
A
INRS-Scanographie
Sensation 64
R
SL 0.6
SP -1299.5
Comment: e4 5 0.6 B75h
W: 1280
C: -460

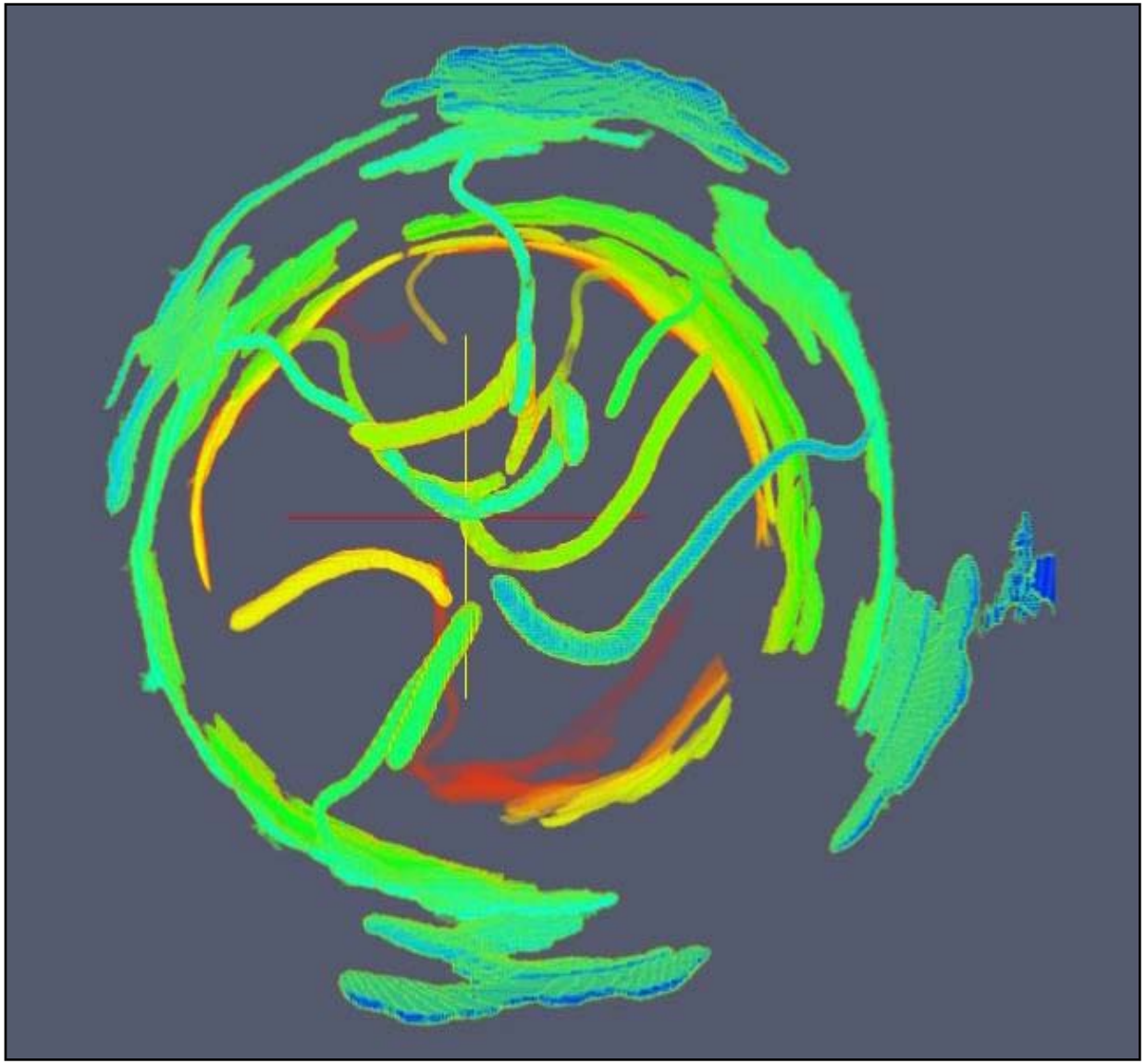
CT scan



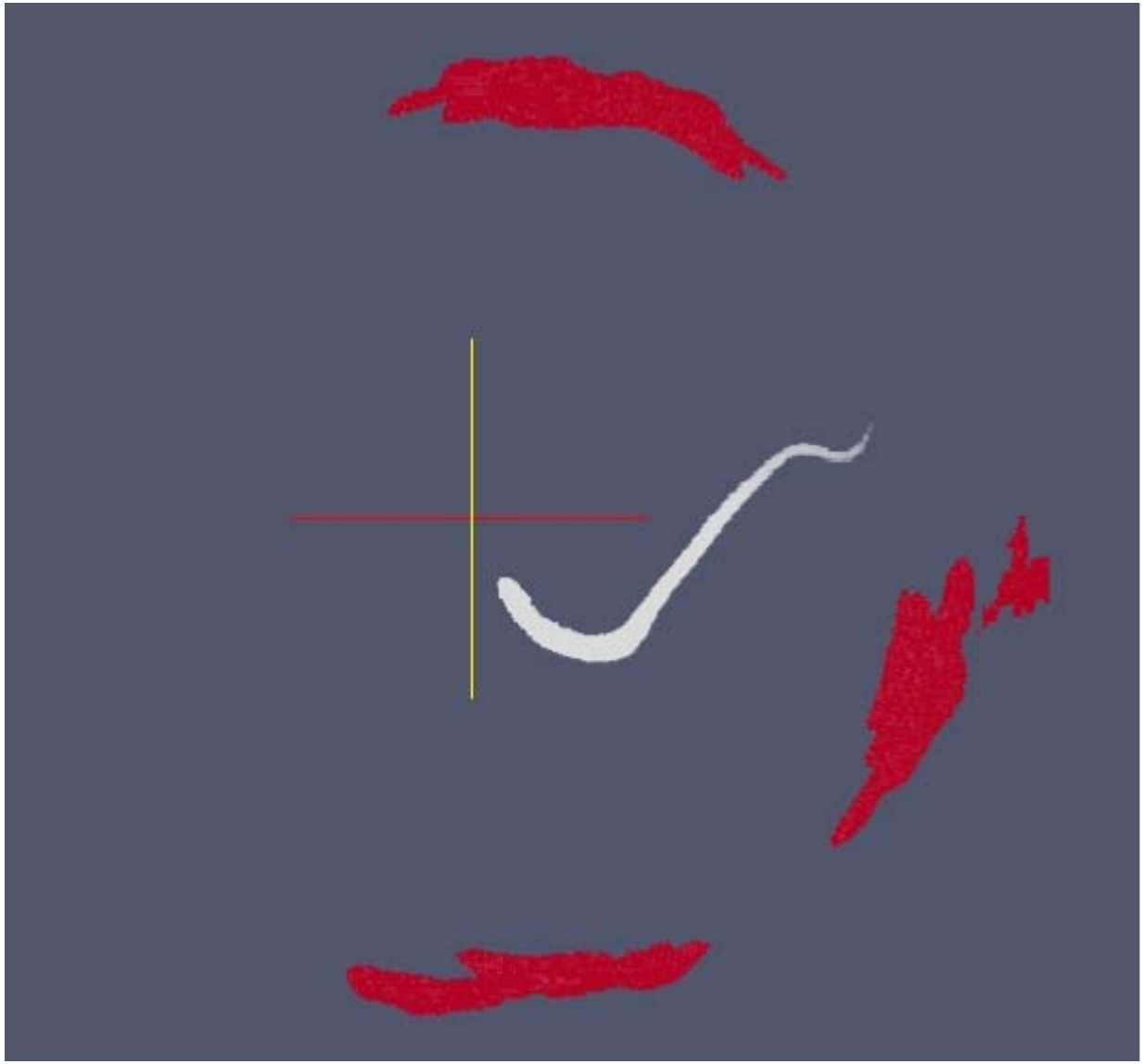
Matlab



Matlab



Matlab

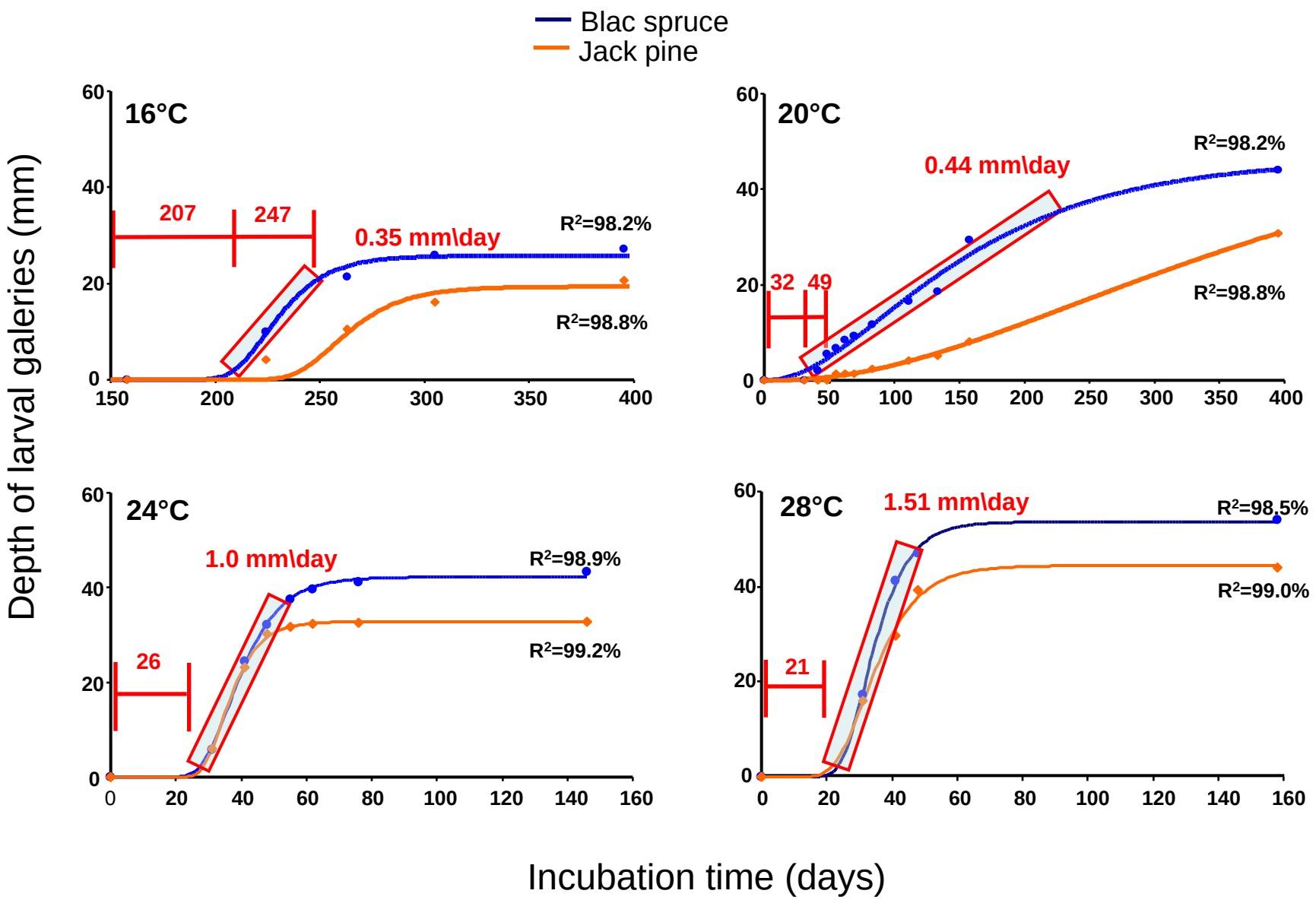


Matlab

Microsoft Excel - Classeur1

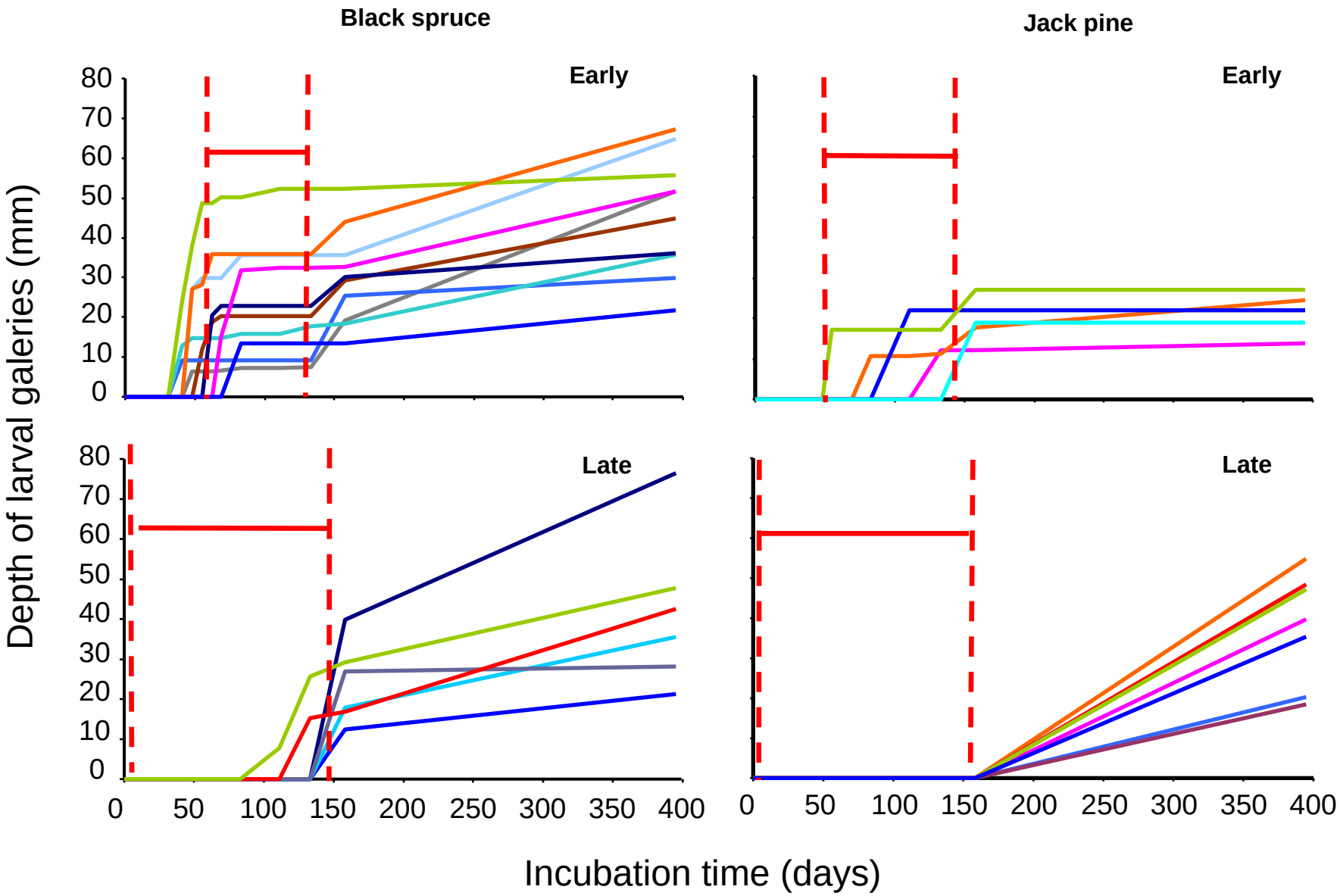
# Blob	Distance centre	Angle	Volume mm^3	Étendue galerie	minProfondeur mm	maxProfondeur mm	moy Profondeur mm
53	0,338361643	53,5956572	66396,825	20,30565748	283,4	376,2	92,8
29	0,338361643	67,8432211	89014,46484	19,17518309	177	261,4	84,4
57	2,166571639	10,804713	2866,05	2,466339789	303,8	323	19,2
62	8,672889444	21,9982668	51161,43516	11,0566761	325,4	397	71,6
28	12,18571772	4,43164539	1601,296875	8,177086063	173	175	2
4	12,59232756	13,7538009	78846,22969	21,35835424	89,8	141,8	52
20	14,40721468	17,5403871	57555,76641	12,29985384	144,2	238,2	94
46	14,59668756	8,12446122	79010,43047	21,53285521	264,6	375	110,4
26	14,69050762	24,2970368	116168,6602	15,47705163	168,2	343,8	175,6
56	21,37042424	8,86392974	42065,25469	15,60296442	303	338,6	35,6
43	37,18438977	6,57947578	17264,15156	13,27339879	245	260,6	15,6
17	47,51180653	6,50972243	15156,68203	5,250727221	135	160,6	25,6
2	55,67360158	11,8948282	64935,30234	4,861338519	39,8	96,2	56,4

Results:

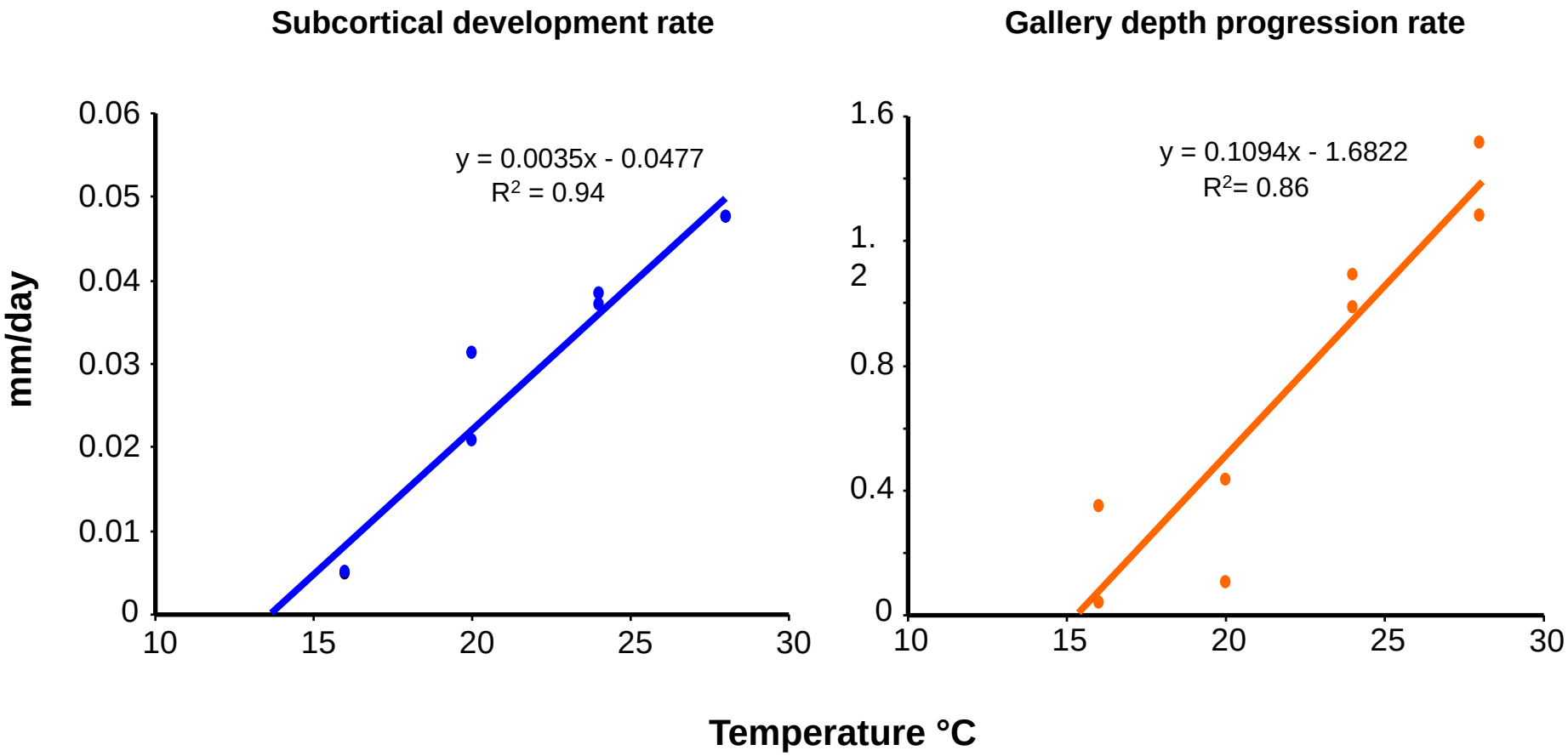

Blac spruce
Jack pine
16°C
207
247
0.35 mm\day
R²=98.2%
R²=98.8%
20°C
0.44 mm\day
32
49
R²=98.2%
R²=98.8%
24°C
1.0 mm\day
26
R²=98.9%
R²=99.2%
28°C
1.51 mm\day
21
R²=98.5%
R²=99.0%
Depth of larval galeries (mm)
Incubation time (days)

Results:

20°C


Black spruce
Jack pine
Early
Early
Late
Late
Depth of larval galeries (mm)
Incubation time (days)
0
10
20
30
40
50
60
70
80
0
50
100
150
200
250
300
350
400

Results:


Subcortical development rate
y = 0.0035x - 0.0477
R2 = 0.94
0.06
0.05
0.04
0.03
0.02
0.01
0
10
15
20
25
30
mm/day
Gallery depth progression rate
y = 0.1094x - 1.6822
R2= 0.86
1.6
1.
2
0.8
0.4
0
10
15
20
25
30
Temperature °C

Conclusion

- The use of the CT scan provides to characterize damage and improve knowledge on the biology of the whitespotted sawyer

- The subcortical development and gallery progression rates will allow developping a model for predicting damage as a function of temp to help forest managers to improve salvage logging plans

A
RES
LAO/RAO 115
CRAN/CAUD -90
R
L
kV 120
mA 95
LD VX 0.37x0.37x0.10
LD 512x512x381 [12 bit]
SL 0.4
SP 0.1
PX 0.37
512x512x381 [11 bit]
F
B 22 W 655
O 55 C -769
P

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Questions?