The impact of resistograph on tree decay

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With the financial support of the Walloon Region (Ir J-C. Gobeaux, Director)

1. The case : 280 limes (*Tilia cordata* and *T. europea*) were drastically pruned in 1992

In 2002, an experimentation was started to test the efficiency of several soil treatments in increasing vitality. It was also necessary to assess problems of wounds and cavities. Numerous 10 years old wounds are now presenting rots and cavities. Another important problem is the infection of old injuries by decay fungi (*Ganoderma sp.* and *Ustilina sp.*). In the frame of stability diagnostic, resistograph was used to precisely measure the extension of decay. After trees were cut down, it became evident that the intrusive measurement allowed the discolored zone to progress. In regional administration services, recent tendency is to use resistograph systematically to detect problems in street trees. This could have consequences on tree-rot fungi relationships.

2. Decaying tree was firstly pointed out following two clear symptoms:

- **The crown heterogeneity (figure 1). One half of branches are dying.**
- **The presence of heart rot fruit body (*Ganoderma* sp.) at trunk base (figure 2) and 120 cm (old bark wound).**

Position of decaying branches matched with the presence of fruit bodies and dead bark.

Figure 1: in july 2003, a lime showing crown asymmetry and severe leaf symptoms.

Figure 2: fruit body found at the trunk base (12 cm large).

3. In July 2003, six measurements were realised with Resistograph IML-Résistograph F-400 at trunk base and 120 cm. Data were processed according to a method described previously (Campanella *et al.*, 2003). Following the localization of weakened zones in the 6 directions, an estimation of fungus extension in the trunk was presented to local authorities to traduce the risk associated with this tree.

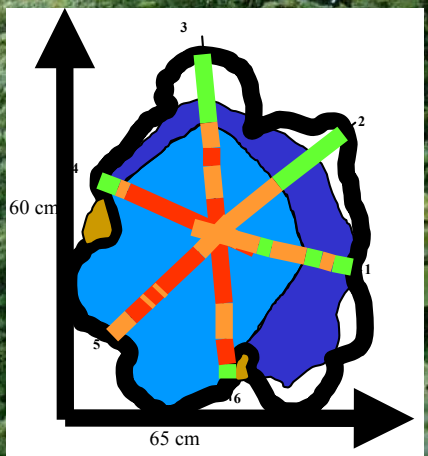

Figure 3: visualization of resistograph results (green: healthy wood, orange: weakened wood, red: amorphous wood or cavity). Hypothesized extension of fungus at the trunk base (pink) and its real observed extent in november (pink+red).

4. After tree cutting down (November 2003), two major observations were made:

- The extension of the discolored zone and the fungus is more important than postulated after resistograph measurements (figure 3). It is particularly true in the direction of measurements 1,2 and 3. This could partly be due to heart rot progress during 4 months (figure 4).
- The impact of measurements 2 and 3 are visible. Locally, where news injuries occured, discolored zone is more extended.

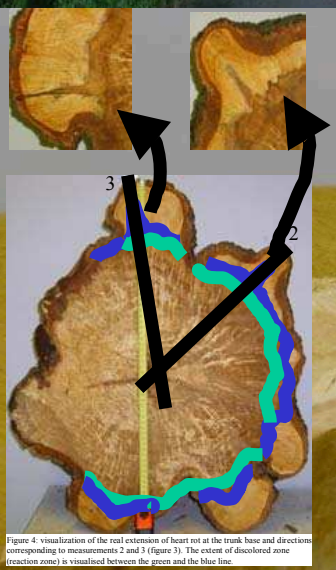

Figure 4: visualization of the real extension of heart rot at the trunk base and directions corresponding to measurements 2 and 3 (figure 3). The extent of discolored zone (reaction zone) is visualised between the green and the blue line.

5. Two wood samples were taken to describe the extent of reaction zone in the 3 dimensions (figure 5 and 6). Polyphenol accumulations were also visible under microscope (figure 7). This accumulation occurs in vessels as well as parenchymatic rays. No trace of fungus was identified in discolored zone.

Figure 5: longitudinal (left) and tangential (right) vue of the discoloured zone and the ancien drilling trace from sample 3. 1 : 1 cm.

Figure 6: longitudinal (left) and tangential (right) vue of the discoloured zone and the ancien drilling trace from sample 2. 1 : 1 cm.

Figure 7: microscopic vue of polyphenol accumulation in wood vessels and parenchymatic rays.

References:

Campanella, B., A. Toussaint, et al. (2003). "Amélioration de l'interprétation des données fournies par le résistographe pour la gestion d'arbres d'alignement. 1 : le cas du tilleul." Arbres et Sciences **9**.

Shigo, A. (1989). Tree pruning: a worldwide photo guide for the proper pruning of trees. Durham.

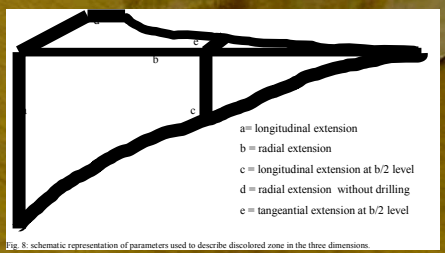

Fig. 8: schematic representation of parameters used to describe discolored zone in the three dimensions.

	Sample 2	Sample 3
a	5,1 cm	6,7 cm
b	10,1 cm	8,4 cm
c	1,9 cm	2,0 cm
d	2,5 cm	2,0 cm
e	0,5 cm	0,7 cm
b/d	404%	420%

Table 1: extension of discoloured zone and comparison of its progress with and without drilling trace (b/d).

6. Dimensions of the neoformed reaction zone are slightly different between the two samples (table 1). Compartmentation is more efficient in the tangential direction (e) than in the longitudinal one (a, c), which is consistent with CODIT model (Shigo, 1989). In this particular case, the extent of reaction zone is 4 fold increased after drilling. It must also be mentioned that wall 4 of the CODIT model has been broken by the fungus.

Conclusion:

In this particular case, resistograph was useful to complete diagnostic and demonstrate the importance of decay. Nevertheless, intrusive measurement could have consequences on fungus developpement. After 4 months, reaction zone has normally developed around the hole. Even if fungus has not been detected in the hole, its progress will certainly be easier as wood structure has been broken down and oxygen is present. It is then important to know that the use of resistograph could accelerate the process. Moreover, the even more common practice of systematic resistograph use should be avoided as some trees showing cavities could be remained in place if the decay was efficiently contained. Systematic measurements realised in cities could accelerate the decay of street trees.