

IMAGING AND ANALYSIS OF AN APPLE PEST BEHAVIOUR: MRI AND X-RAY MICROTOMOGRAPHY COMPARISON

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In orchards, phenological models are used to control pests with a minimum number of pesticide treatments. However, these phenological models do not take into account pest behaviors in their natural habitats. As part of the research work dealing with the potential effect of pest behaviors on apple, MRI and X-ray imaging were compared in their ability to extract 3D tunnel made by the codling moth, *Cydia pomonella* (L) (Lepidoptera: Tortricidae), especially when they are exposed to the biological insecticide: the codling moth granulovirus CpGV. The target stage is the first caterpillar stadium when the *C. pomonella* caterpillar feeds on apple by making a mine.

Non invasive follow up of the caterpillar feeds was conducted on the 4.7-T Biospec with a Bruker BGA-12 gradient coil and with a 8 cm-diameter birdcage coil used as for RF transmission and signal reception. RARE imaging sequence was used with the following parameters: the FOV of up to 7 cm x 7 cm defined to cover the whole apple and 192x192 matrix size reconstructed to 256x256 resulting in the spatial resolution of ~ 250µm. Up to 128 0.5 mm- thick slices were acquired twice a week for each infected apple.

On the other hand, X-ray microtomography observations were carried out with a Phoenix Nanotom©. Because of the low absorption of the soft tissues, X-ray source was adjusted for low power emission (60kV, 400µA). 1620 projections (750 ms each) were recorded with a 0.22° step. 2x2 binning was used in order to minimize the total acquire time (around 20 min). The X-ray magnification was adjusted in order the apple fit with the detector size. The final 3D reconstructed volume was 1100x1170x1100 with 60µm isotropic spatial resolution.

3D Visualizations and image analysis were performed using ImageJ and an image processing software (PiafBto3D) was specially developed for NMR data to reconstruct 3D volume for the set of 2D images and extract tunnels. Comparison between NMR and X-ray tomography are given in terms of spatial and quantitative resolutions, acquire time, etc.