

# ACARICIDAL TREATMENT WITH FORMIC ACID SHORTENS HONEY BEE PUPAL LENGTH: A COMPUTED TOMOGRAPHY-BASED STUDY

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## INTRODUCTION

Formic acid (FA) when used against the mite *Varroa destructor* in honeybee colonies is reported to have deleterious, acute effects on brood development, detectable in most cases by visual inspection of the brood combs [1-3]. Moreover, possible subacute effects of FA on honey bee brood are not sufficiently known, due to the difficulties of carrying out in-vivo investigations inside the capped brood cells. In this study, a non-invasive Computed Tomography (CT) technique was used to assess a subclinical effect of FA acaricidal treatment on honey bee brood.

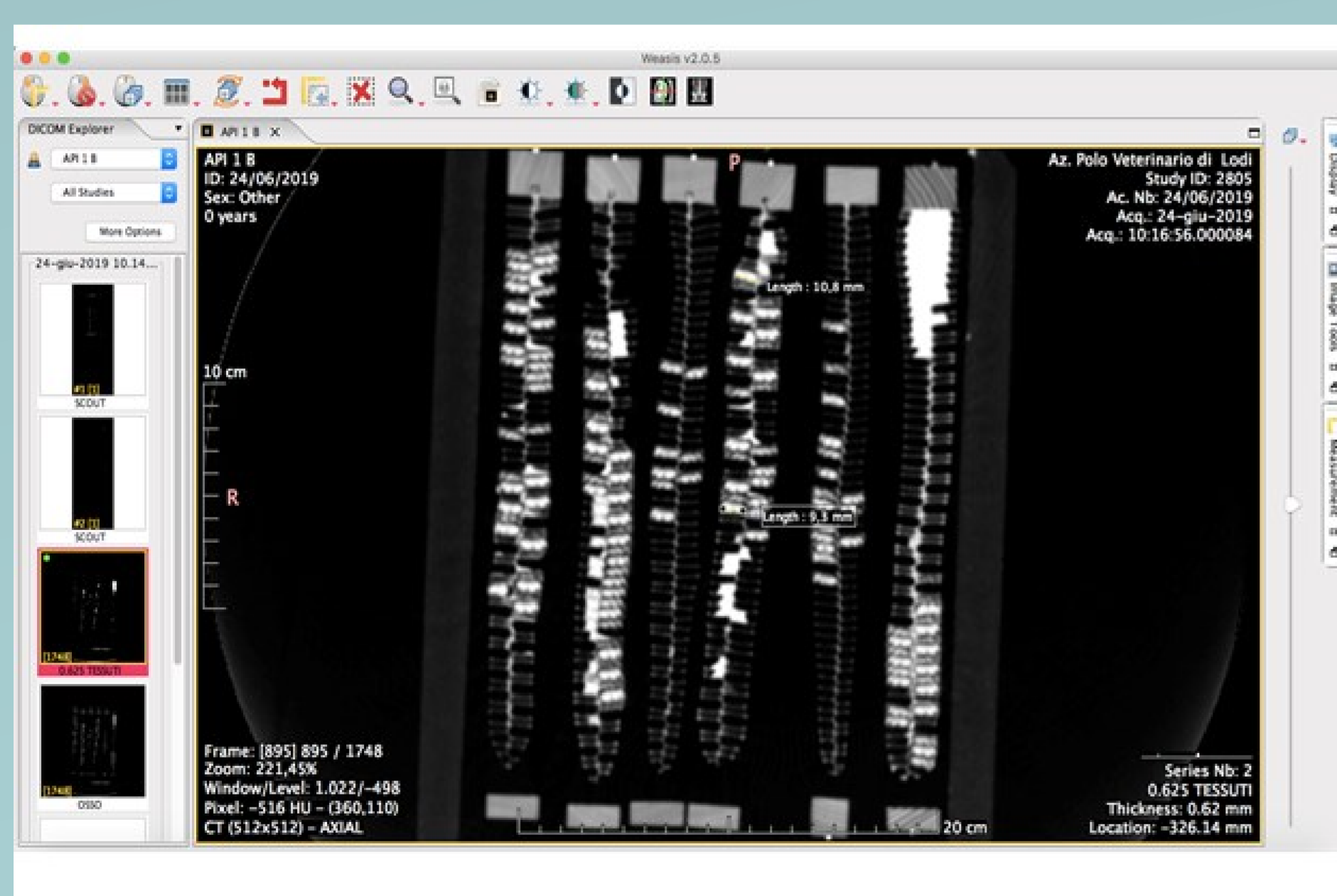
## MATERIAL & METHODS

The study was performed in June 2019 on honey bee colonies housed under field-like conditions in Lodi, Italy. From three colonies, a comb hosting eggs was submitted to CT examination with a GE Brightspeed™ 16-slices CT scan before (on day 9<sup>th</sup> after egg deposition) and after (on day 19<sup>th</sup>) an acaricidal treatment course with FA gel pads (MAQS®, NOD Apiary Products Ltd) (Figure 1 and Figure 2). Combs from three untreated families were subjected to the same procedure. For each comb, a set of images was analyzed to assess the length of each pupa by Weasis version 2.0.5 image viewer (Figure 3 and Figure 4). The data were analyzed by the GLM procedure of SAS® 9.4 including the effects of treatment group, side and interaction between treatment group and side.

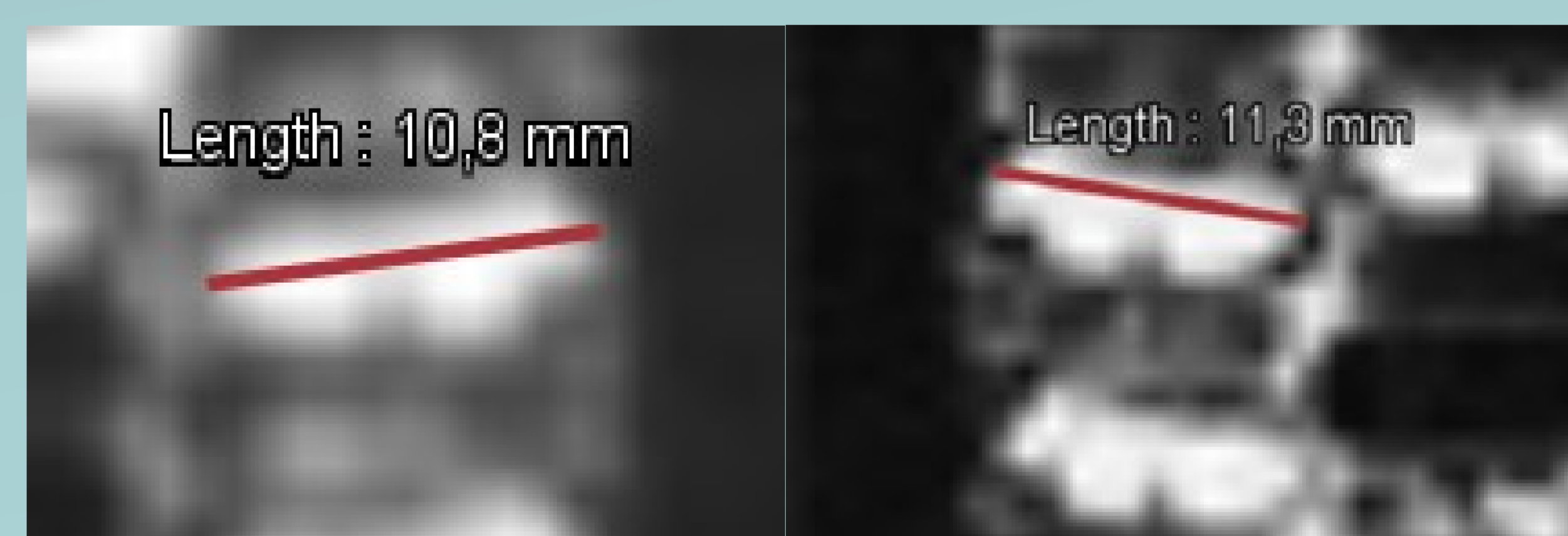
**Figure 1.** In-hive acaricidal treatment with FA gel pads (courtesy S. Valle)



**Figure 2.** Computed Tomography examination of the brood combs temporarily inserted in a 6-frame polystyrene hive



**Figure 3.** Screenshot of a CT-scan image showing brood comb cells hosting developing pupae on day 19<sup>th</sup> after egg deposition



**Figure 4.** Example of pupal length assessment using the measurement tool provided by Weasis image viewer (courtesy S. Valle)

## RESULTS AND CONCLUSIONS

A total of 521 pupae (386 in the control colonies, and 135 in the treated colonies) were measured. Pupae in the treated combs were significantly ( $p < 0.05$ ) shorter ( $9.92 \pm 0.07$  mm) than those one in the control group ( $10.71 \pm 0.04$  mm), regardless of which side of the honeycomb they were located on. This study supports the evaluation of hidden tolerability issues provided by FA acaricidal treatments on honeybee brood by applying a non-invasive CT imaging technology.

## REFERENCES

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