

# MORPHOLOGICAL DIFFERENCES IN PROTHORACIC SPIRACLES BETWEEN THREE STRAINS OF *APIS MELLIFERA* (L). EXISTENCE OF A RESISTANCE MECHANISM AGAINST *ACARAPIS WOODI*

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## INTRODUCTION

A morphometric study was conducted on the prothoracic spiracles of *Apis mellifera macedonica*, *Apis mellifera ligustica* and *Apis mellifera carnica*. *Apis mellifera macedonica* is a sub-species of Northern Greece, which shows resistance to *Acarapis woodi*. In Southern Greece, since *Apis mellifera ligustica* has been introduced, tracheal mite infestations have become severe. *Apis mellifera carnica*, which is also susceptible to *Acarapis woodi*, was used in this study for comparative reasons.

**Keywords:** *Apis mellifera* / morphometry / spiracles / *Acarapis woodi* / resistance

## METHODS AND MATERIALS

The parts of the cuticle (2 x 1mm) with the left and right prothoracic spiracles (including the auricle, the lobe and part of the trachea, nomenclature from Snodgrass, 1956) were removed and cleaned from the cut ends of muscle fibres. The dissected parts of the cuticle (including part of the trachea) were then dehydrated in a graded series of ethanol (30%, 50% 70% and 100%) and were finally mounted on slides for light microscopy. The preparations were examined with a Leica DMLB microscope and photographed using the Image Pro Plus software (by Digital Image Systems). The facilities of the image analysis system permitted the accurate measurement of certain dimensions of the spiracles like the length of atrium (LA, see Fig. 1), the width of atrium (WA) and the area of the atrium (AA).

## RESULTS

Figure 2 is an image of a prothoracic spiracle of *A. mellifera*. The statistical analysis on the measurements of the specific dimensions of the spiracle (as shown in Fig. 1) revealed significant differences between the bee strains examined: the length of atrium was found to be  $800 \pm 91\mu\text{m}$  and  $751 \pm 52\mu\text{m}$  respectively for *A. m. ligustica* and *A. m. carnica* (larger by 21% and 14% respectively) compared with *A. m. macedonica* ( $658 \pm 48\mu\text{m}$ ) (Fig. 3). The width of atrium was found to be  $230 \pm 34\mu\text{m}$  and  $197 \pm 20\mu\text{m}$  respectively for *A. m. ligustica* and *A. m. carnica* (larger by 29% and 14% respectively) compared with *A. m. macedonica* ( $177 \pm 21\mu\text{m}$ ) (Fig. 3). The most important parameter, the area of atrium was also found to be significantly larger in *A. m. ligustica* ( $148,900 \pm 17,100\mu\text{m}^2$ ) and in *A. m. carnica* ( $132,100 \pm 14,500\mu\text{m}^2$ ) (by 46% and 29% respectively) compared with *A. m. macedonica* ( $101,800 \pm 16,900\mu\text{m}^2$ ) (Fig. 4).

The cross-diameter at the opening of the trachea was found to be  $221 \pm 19\mu\text{m}$  in *A. m. ligustica* and therefore 8% larger than the trachea of *A. m. macedonica* ( $204 \pm 22\mu\text{m}$ ). About  $600\mu\text{m}$  from the outer part, the cross-diameter becomes significantly larger for both strains and finally tapers significantly to  $236\mu\text{m}$  and  $197\mu\text{m}$  for *A. m. ligustica* and *A. m. macedonica* respectively.

## DISCUSSION

The smaller area of the atrium and the smaller diameter of the trachea found in *A. m. macedonica* could be a major resistance mechanism against the tracheal mite that could delay and finally prevent its entrance to the trachea. *A. woodi* has never been observed to parasitise the trachea of *A. m. macedonica*: either cannot enter the trachea at all (small size of atrium+ dense setae) or has difficulties in entering and when it does, is not reproductive. *A. m. macedonica* seems to have the desirable properties, along with its other qualities (profitability, gentleness, over-wintering with small populations, small tendency to swarming) to be conserved and then used as the basic stock in breeding programs for resistance to *A. woodi*.

Morphometric studies such as those undertaken in this work could determine the special morphological characteristics of local populations of honey bee strains, which are worthy to be preserved under the general scheme of the honey bee biodiversity.

## REFERENCES

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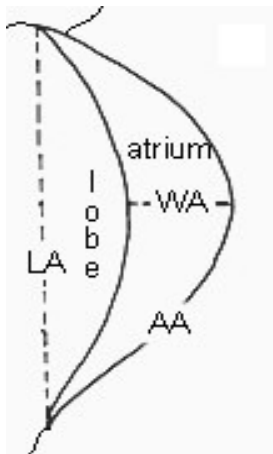
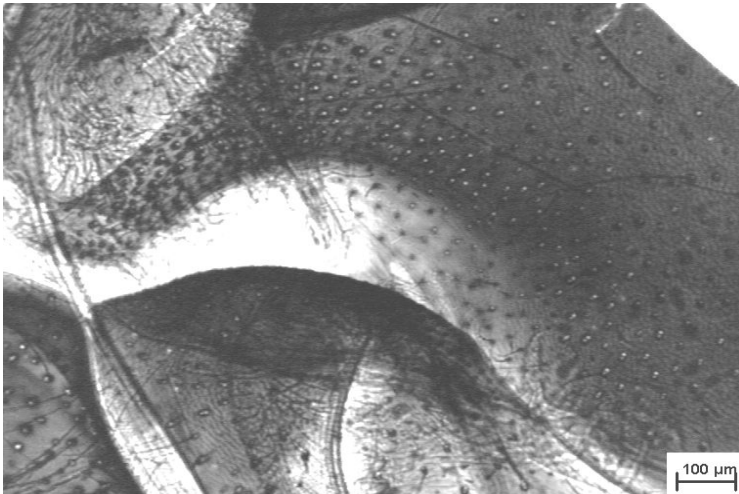
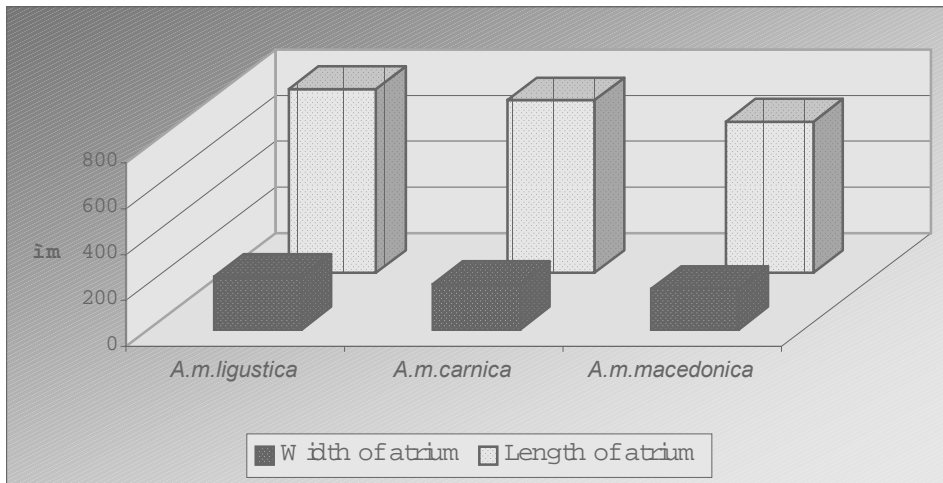


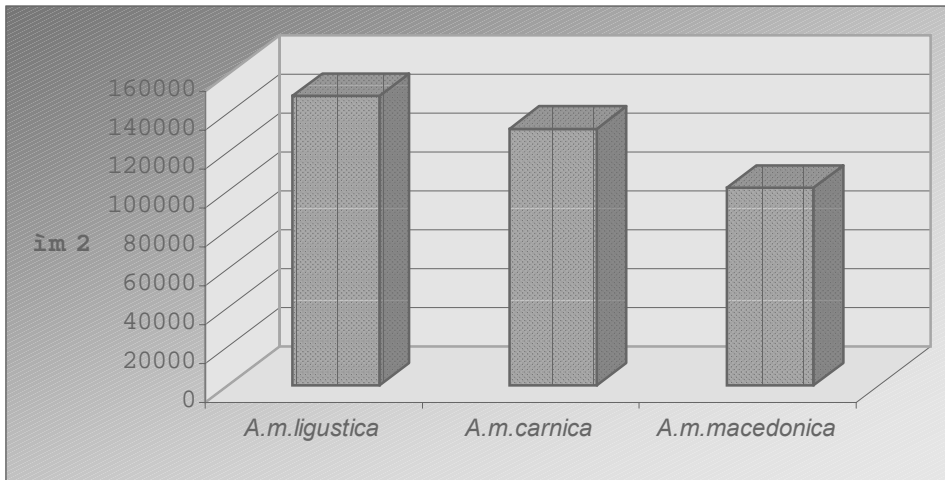
Figure 1. Diagram of the prothoracic spiracle: LA: length of atrium, WA: width of atrium, AA: area of atrium



**Figure 2. Prothoracic spiracle of *Apis mellifera***



**Figure 3. Differences in the width and the length of atrium between the three honey bee strains**



**Figure 4. Differences in the area of atrium between the three honey bee strains**