

## Summary

The aim of the dissertation was to evaluate the possibility of shaping the features of bees and bee colonies using combs with small (about 4.90 mm) and standard (about 5.50 mm) cells width. The influence of combining combs with small and standard cells in the same bee colony on the morphometric traits and activity of the proteolytic system of worker bees as well as the efficiency of hygienic behavior of the colonies towards dead brood were analyzed. The simultaneous maintenance of colonies small- and standard-cells combs is a novel approach of the use of the small-cells combs in beekeeping.

The values of the morphometric traits of workers (thorax width and length, proboscis length, fore wing length and width, length of cubital vein distances a and b) were assessed in workers reared in colonies with the following combination of combs: (1) bees reared in small-cell combs in colonies kept on small-cell combs, (2) bees reared in small-cell combs in colonies kept on standard-cell combs, (3) bees reared in standard-cell combs in colonies kept on standard-cell combs, and (4) bees reared in standard-cell combs in colonies kept on small-cell combs. Moreover, the activity of proteases and their inhibitors in the hemolymph of workers reared in combs with small and standard cells was compared. The measure of the efficiency of hygienic behavior was the speed of removal of dead brood from combs with small and standard cells.

The value of most morphometric traits of workers reared in combs with small cells was usually significantly lower than that of workers reared in combs with standard cells. However, the change in the value of the worker morphometric traits was not proportional to the change in the width of the comb cells in which they were reared, since these traits varied to a much lesser extent. Feeding the larvae raised in combs with small cells by workers reared in combs with standard cells resulted in an increase in the length of the proboscis and the value of the cell filling factor. The value of morphometric traits used in the assessment of subspecies affiliation of the honey bee changed to a small extent compared to the change in the width of the comb cells, as such a changes were within the range of changes assumed as seasonal. The resistance of these traits to the change in the width of the comb cells confirms their great suitability in the assessment of subspecies affiliation of the honey bee.

The width of the comb cells significantly influenced the activity of proteases and their inhibitors as well as the effectiveness of dead brood removal. In 1-day-old workers, higher concentrations of total protein were found in workers reared in small-cells combs, and the higher activity of proteases and their inhibitors in 1-day-old workers reared in combs with standard cells. The opposite trend was found for older workers aged of 7, 14 and 21 days old. On the other hand, dead brood was removed faster from combs with small cells than from combs with standard cells.

The simultaneous keeping of bee colonies on combs with small and standard cells is an effective tool for shaping the features of bees and bee colonies. The hypothesis concerning the influence of rearing workers in combs with cells of different widths on the division of labor in a caste of workers, and thus on the value of the functional traits of colonies, which is largely shaped by interactions between workers, is worth verifying. It will also contribute to elucidating the role of the significant difference between the cell width in combs built without the use of a wax foundation, and therefore will provide new insight into the biology and evolution of the honey bee.

**Keywords:** Honey bee, *Apis mellifera*, small-cells combs, morphometric traits, proteolytic system, hygienic behavior