Change in the level of biochemical indicators and the condition of the bee colony (*Apis mellifera* L.) exposed to pesticides and their mixtures

Abstract

While searching for food and water, worker bees may come into contact with a variety of low-concetration chemical plant protection products (PPPs). In many cases, after coming into touch with trace levels of PPPs (for example, in gathered food), they are able to return to the hive, potentially exposing the entire bee colony to harmful substances.

In this dissertation, the effect of exposure to PPPs and their combinations on the bee colonies and chosen biochemical markers of worker bees whose growth followed exposure to PPPs in the hive environment is presented. Commercial formulations of acetamiprid (insecticide), glyphosate (herbicide), and tebuconazole (fungicide) were utilized in this study in amounts/concentrations that corresponded to residues of these substances in the environment (i.e. 250, 7200 and 147 ppb). These substances are commonly used in plant production. The following biochemical indicators of the detoxification and antioxidant system were selected for the analysis: aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), gamma-glutamyltranspeptidase (GGTP), albumin, creatinine, urea, and the total antioxidant status (TAS). Colony strength, brood area and food supplies, as well as the rate of starter combs building and hygienic behavior were chosen as indicators of the condition of the colonies.

The author's own research has shown that PPPs and their mixtures cause changes in the level/activity of the examined biochemical indicators of worker bees, however no changes were noted in colonies. Acetamiprid (insecticide) significantly decreased the level of urea in the hemolymph of worker bees. Glyphosate (herbicide) did not affect significantly the level/activity of any of the analyzed biochemical indicators of female workers. Tebuconazole (fungicide) caused changes in the level of most of the studied biochemical indicators. PPPs had a distinct influence on the level/activity of the biochemical markers evaluated, both singly and in mixes.

The findings reveal that persistent exposure to PPPs at low concentrations produces biochemical alterations in bees, which might pose a hazard to them.

Aside from the PPPs, many other damaging variables, such as diseases, electromagnetic fields, and climate changes, have an impact on honey bees in the environment. Although their individual effects may not be obvious at the level of a bee colony, their combined influence may contribute to its major deterioration.