**Poster**

## Section 4 - Monitoring

# Evaluation of bee counters - introduction of a new protocol for measuring the accuracy of daily losses

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## Abstract

Automated bee counters have evolved and become more diverse over the last hundred years. To date, however, there is no method for standardized validation of counting accuracy and thus no reliable data on daily bee losses or background mortality in bee colonies. Such data, however, are urgently needed by regulatory agencies to establish future guidelines for pesticide risk assessment. In this work, we combined existing approaches into a new protocol for validating bee counters. In a case study with a visual artificial-intelligence-based monitoring system, we demonstrated that the protocol is sufficiently practical to determine the measurement accuracy of a commercial counting system. Measurement accuracy was modeled by the difficulty of specific measurement conditions. The daily loss, i.e., the difference between incoming and outgoing bees, can be used to assess colony health and environmental impact, and to draw conclusions about the effect of pesticides on bee colonies. The protocol developed makes innovations in this field measurable and creates a basis for benchmarking different types of bee counting systems. We discuss how it can be used to advance the sector in the future.

**Keywords:** Robbers test, Automated bee counting device, Regulatory risk assessment methodology, Harmonized validation protocol, Precision beekeeping, visual bee monitoring