PP-162 [Bee Health]
Detection of miticide resistance in Varroa destructor mite population in Canadian apiaries

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In the last decade, honey bee health has substantially declined with the main driver of colony losses being the parasitic mite Varroa destructor, and its associated load of viruses. In Canada, the national winter loss in 2023 was 32% with provincial losses ranging from 11% to 46% (CAPA, 2023). Control of varroa mite in beekeeping has become a tireless all season long endeavour. Amitraz acaricide has been the main alternative for controlling varroosis, and it has been used intensively in apiculture for over a decade. Resistance to amitraz in mite populations has been described in Europe and US. In Canada, there are reports of reduced amitraz efficacy, and amitraz resistance is widely discussed among beekeepers. This study aimed to screen Varroa mite populations in Canadian apiaries for genetic mutations associated with resistance to amitraz (octopamine receptor gene) and pyrethroid (voltage-gated sodium channel gene). Our results confirmed the presence of Y215H amitraz-resistance mutation in mite population in Alberta, Manitoba and British Columbia. This mutation was found in 98%(AB), 97% (MB) and 80% (BC) of the apiaries tested, with allele frequency ranging from 14-100%, 62-100%, and 5-81%, respectively. In parallel, the L925I and L925M pyrethroid-resistant mutations were found at similar prevalence in the same apiaries. Testing historical samples from the 2014-2017, the Y215H amitraz-resistant mutation was not detected in the apiaries tested; whereas the L925I and L925M pyrethroid-resistant mutation were already present in 50% of the apiaries tested. These findings support the implementation of a nationwide monitoring of miticide resistance using genotyping of mite populations. This will provide beekeepers and regulatory agencies timely information that will enable them to make decisions regarding control methods used to manage varroosis, including rotation of available treatments.