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PP-119 [Bee Health]

In-person workshops increase the likelihood of beekeepers adopting best management practices that are supported by science

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Background

Best management practices (BMPs) are widely recommended in apiculture, as they can reduce honey bee (*Apis mellifera*) colony losses[1,2]. Yet, BMPs are not readily adopted by all beekeepers. For example, the alcohol wash is recommended for *Varroa destructor* monitoring, but it is lethal for honey bees. Thus, some beekeepers prefer to use the powdered sugar shake as it is non-lethal. Until recently, this was merely an assumption[3]. Beekeepers accepted it as "fact" based on hearsay. It is crucial to test longstanding assumptions that may impede adoption of BMPs. Additionally, we need to identify learning environments in which validated information are effectively transferred to beekeeper, promoting behavior changes and ultimately increased adoption of BMPs in apiculture.

Methods

We assessed the lethality of a sugar shake to honey bee workers via a mark-release-recover protocol and compared three treatment groups (TG): *Powdered Sugar Shake*, *Powdered Sugar Coat* and *Control*. In 20 colonies across three U.S. states, 300 honey bee workers per TG were colored-coded, subjected to their treatment and returned to their colony (Figure 1). Recovery rates of color-coded workers were evaluated five days later. We also determined the relative efficacy of the powdered sugar shake to dislodge *V. destructor* compared to the alcohol wash.

Fig. 1: Color-coding honey bee workers, covering them with powdered sugar and performing a powdered sugar shake. Colored boxes reflect actions performed for each TG.

To identify effective learning environments (LEs), we developed in-person and online curricula focusing on BMPs specific to *V. destructor*. Both LEs included a theoretical presentation, followed by an online recording of an alcohol wash and powdered sugar shake, or an apiary visit to directly apply the two monitoring methods (Figure 2). Beekeepers from two U.S. states took a pre- and post-survey to evaluate which LE was more effective at invoking a behavior change.

Fig. 2: Sample presentation slides, recording and hands-on application of alcohol wash and powdered sugar shake

Results

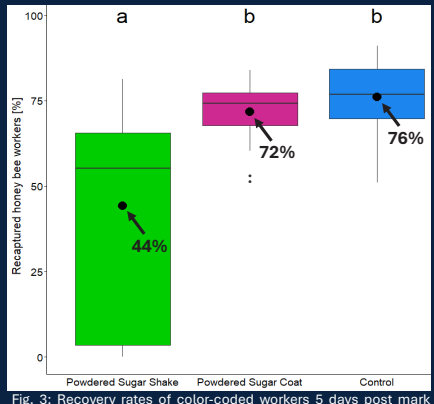

Fig. 3: Recovery rates of color-coded workers 5 days post mark release. Different letters indicate significant differences ($p \leq 0.05$).

The *Powdered Sugar Shake* TG had the lowest recovery rates ($p<0.001$) (Figure 3).

The powdered sugar shake had a relative efficacy of 67% to 100% in dislodging *V. destructor* but was not different from the alcohol wash ($p>0.05$).

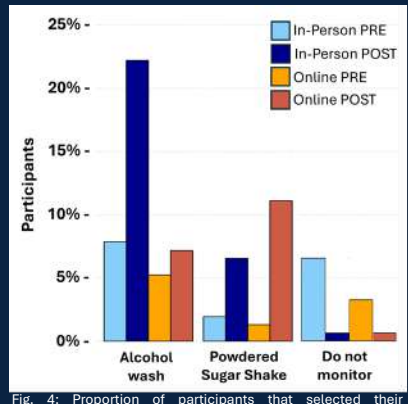

Fig. 4: Proportion of participants that selected their monitoring method of choice in a pre- and post-survey.

Participants from the in-person LE were more likely to select the alcohol wash as their monitoring method of choice ($p=0.05$), while participants from the online LE were more likely to select the powdered sugar shake ($p=0.03$) (Figure 4).

Conclusions

We showed that the powdered sugar shake can, in fact, be lethal to honey bee workers. Due to its variable efficacy and susceptibility to climate, it is a less reliable *V. destructor* monitoring method. Beekeeping educators should recommend the alcohol wash over the powdered sugar shake as a BMP. To increase adoption of BMPs, educators should hold in-person events that allow beekeepers to directly implement the presented information.

References:
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Beekeepers worldwide are experiencing significant honey bee (Apis mellifera) colony losses, caused by biotic and abiotic factors. While some factors are beyond a beekeeper's control, others can be mitigated by adopting best management practices (BMPs). Despite BMPs being widely recommended, many beekeepers do not readily adopt them. Barriers to adoption may include the scientific information not being delivered appropriately, beekeepers being skeptical of its credibility, or lacking experience. Using Varroa destructor management as a model topic, we assessed the effect of two different information delivery methods on behavior change in beekeepers. Beekeepers attending an in-person workshop were more likely to adopt the alcohol wash, the recommended, but lethal to honey bees, monitoring method for V. destructor. Participants attending the virtual training were more inclined to use an inferior practice, the powdered sugar shake, assumed to be non-lethal. In a separate experiment, we negated this assumption after evaluating the survivorship of honey bees subjected to the powdered sugar shake. Not only does the powdered sugar shake reduce honey bee survivorship, it also resulted in more variable estimates of mite infestation levels which could impact subsequent decision making by beekeepers. Understanding how to invoke behavior change in beekeepers and scientifically testing long-standing assumptions are crucial to increase the adoption rate of BMPs and the success of beekeeping operations.