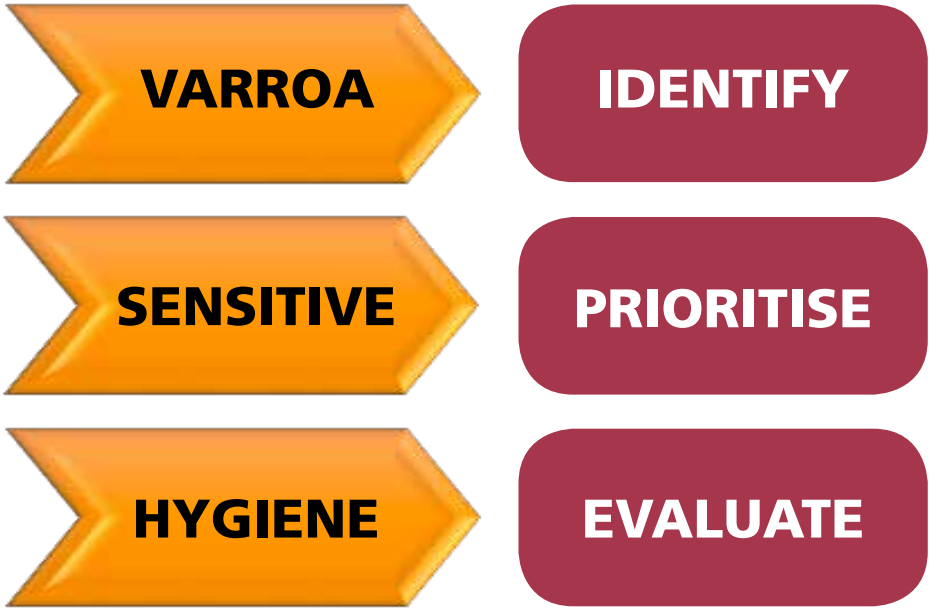
PEST AND DISEASE CONTROL

SELECTING FOR THE **VSH TRAIT**

Rae Butler, Queen Breeder at Bee Smart Breeding

This is a second in a series of articles about varroa sensitive hygiene (VSH), a behavioural trait of honey bees proven to assist VSH bee colonies to reduce levels of varroa *(Varroa destructor)*.



The bees reduce the population size of the varroa by uncapping and removing brood that is infested by varroa mites. This will cause disruption of the mite's reproductive cycle and will reduce fertility in the remaining mites, which has a snowball effect on the overall levels of mite infestation.

High VSH colonies offer the opportunity to delay the need for varroa treatments because the colony is able to keep the mite population below the threshold needed for varroa treatments.

The presence of varroa triggers the VSH trait; once the trait is established within the bee population, it is passed down to the next generations. The VSH trait has an additive genetic effect, which means that it is neither dominant nor recessive, and it has breeding value because it can be passed to the progeny.

When we breed from high VSH mothers, the consistency of the VSH value in their daughters is not known exactly but we do know that over time, VSH levels do increase naturally.

Studies on bees from museum and modern bee colonies in North America show that genetically diverse honey bee populations can recover from introduced diseases by evolving rapid tolerance while still maintaining their genetic diversity. Their diversity is maintained by queens mating with multiple drones, giving a greater capacity of the colony to adapt to changing environments, although this may be at the expense of a loss of other inherited genes.

This is important to consider when breeding for VSH. Having a robust, well-planned selective breeding programme is vital to prevent loss of other desirable traits in the line you are working with. Getting the right balance of all the desired traits so the colonies perform as honey producers and/or pollinators, whilst keeping varroa at bay, is essential to successful breeding programmes.

Queen breeders can maintain breeder lines with a high expression of VSH by using closed population mating, either by open mating in an isolated area or instrumental insemination (i.e., artificial insemination). Instrumental insemination is one of the best tools for reliable controlled mating.

Daughters from the VSH breeder lines are later outcrossed, either in a closed population mating with drones with other desirable traits or by open (hybrid) mating with an unknown source of semen.

Experiments have been conducted in the USA to use daughters of outcrossed VSH breeder lines (i.e., the granddaughters of the original VSH breeder line) to find out if the VSH trait can be passed on to a selected stock used by commercial beekeepers. This process is called introgression of a trait into another honey bee stock. Danka, Harris & Dodds (2015) found that by using their planned breeding programme, it was possible to retain significant expression of VSH in the selected commercial lines.

This shows that VSH breeding programmes can be aimed at increasing the VSH value in the honey bee stock, while at the same time maintaining desirable traits such as honey production, gentleness, pollination and bee strength.

Another method often used by beekeepers is to leave beehives with no varroa treatment and then breed from the survivors—a type of 'natural selection' process. This is a sure and fast way to pick a colony that is resistant to varroa but the question is, at what cost? The VSH breeding value may have increased but other desired breeding traits may be lost in the sacrificed hives and not transferred to the survivor populations.

Because large variation exists among different operational/regional beekeeping outfits, a need for vigilance when managing varroa with VSH bees is extremely important. An integrated Varroa Pest Management Plan is vital so that well-planned breeding programmes can lead to successful results for the beekeeper. Various methods for measuring the level of VSH in a colony are being used and each has advantages and disadvantages.

For further information, go to www.beesmartbreeding.co.nz

References

Danka, R. G., Harris, J. W., & Dodds, G. E. (2016). Selection of VSH-derived "Pol-line" honey bees and evaluation of their *Varroa*-resistance characteristics. *Apidologie, 47*, 483–490. DOI: 10.1007/s13592-015-0413-7

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