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Hawaii has long been a natural laboratory for the studies investigating the impact of the ectoparasitic mite *Varroa destructor* on Western honey bees. In this presentation we report on the changes that have occurred over a 15-year period between the honey bees, the mite, and the beekeeper's behaviour. The arrival of varroa in 2007 caused the collapse of both the managed and free-living honey bee colonies on the Hawaiian Islands of Oahu and Big Island. This forced almost all beekeepers to use chemical miticides to control varroa in managed colonies. From 2014 onwards, beekeepers started to notice the gradual return of free-living colonies. Investigations into these free-living colonies from 2019 onwards found that they had developed resistance to varroa by accurately detecting and removing varroa-infested worker pupae. That is 79% of infested worker pupae cells were recapped and 67% of worker sealed cells artificially infested with varroa were removed. This resistance mechanism mirrors what has been seen in other countries where varroa-resistant honey bee populations had appeared. Currently, the worker brood infestation rate in untreated colonies is 6.7% with an adult bee infestation rate of 4.3%, which equates to below 2500 mites in a typical sized colony and below the predicted number required to kill a colony. The dissemination of information about mite-resistance among the local producers, coupled with the early success of some beekeepers that stopped treating their colonies, helped convince most (>60%) beekeepers on Oahu to cease all varroa treatments, without any significant increase in colony losses. This is the first time that an entire population of honeybees and beekeepers have both adjusted their behaviours to benefit from natural selection processes that provides beekeepers world-wide with a permeant solution to the varroa problem.

Co-evolution of honeybees, Varroa and beekeepers over 15 years in Hawaii



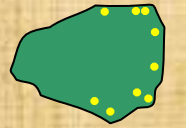
Prof. Stephen J Martin & Dr. Ethel Villalobos
Salford Univ. UK & Univ. of Manoa, Hawaii

LEVERHULME
TRUST

Project Apis m.



HAWAII



Kauai

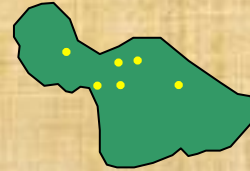
Oahu



Molokai



Maui



Lanai



Varroa absent



Varroa present



Sampled Apiary location



60 km

Big Island



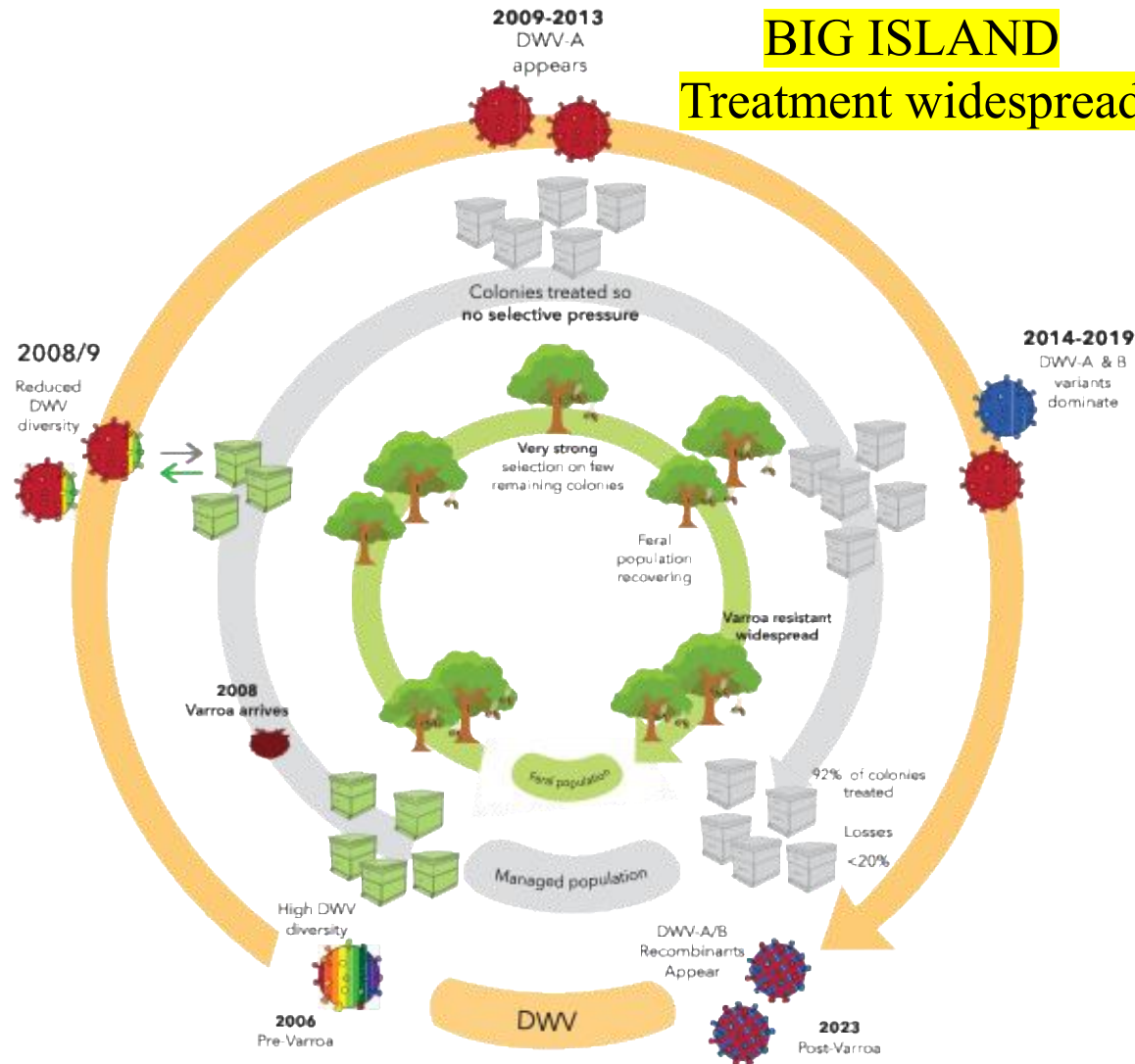
Queen rearing on Big Island

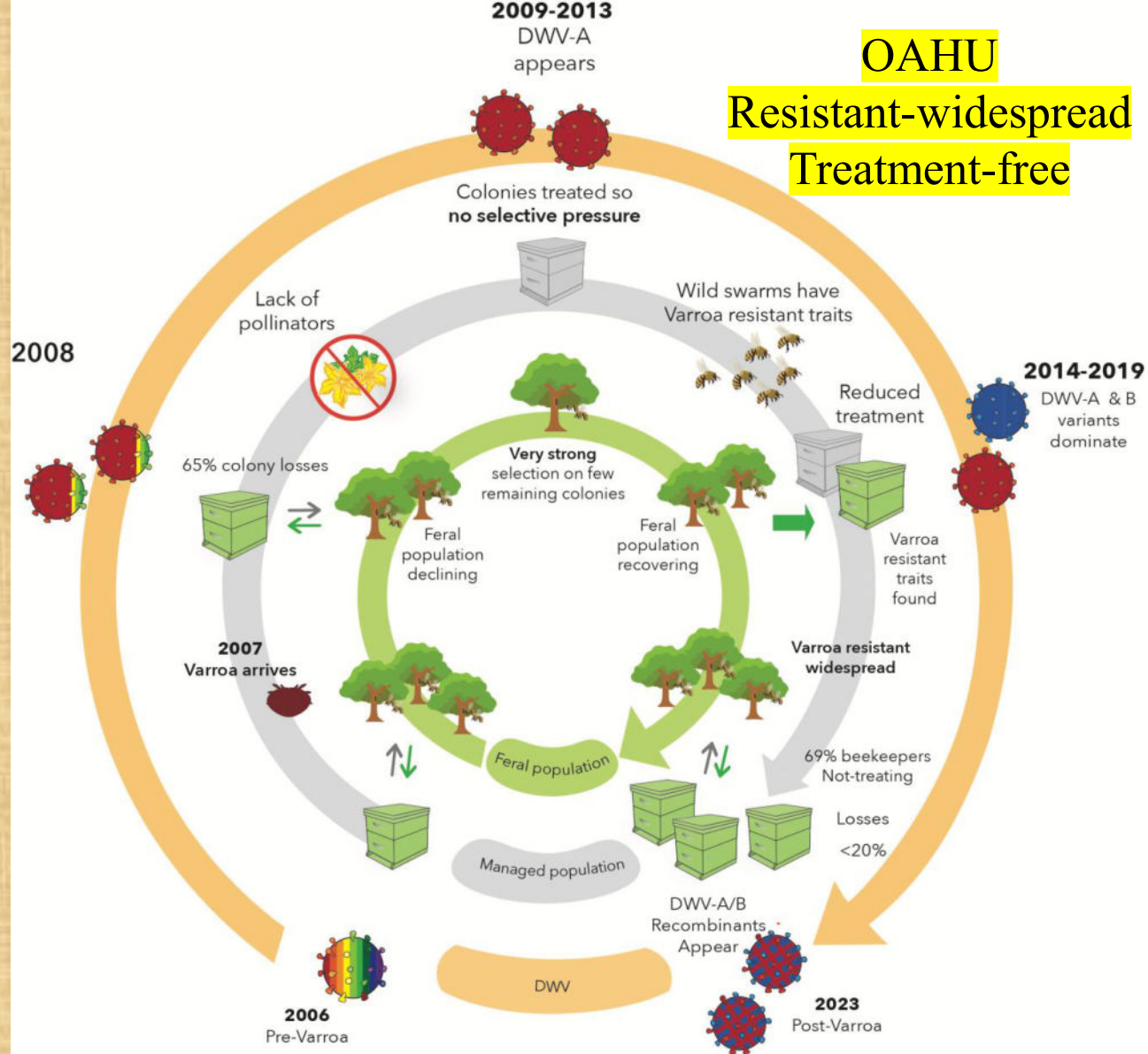
Around 500,000 queens per year



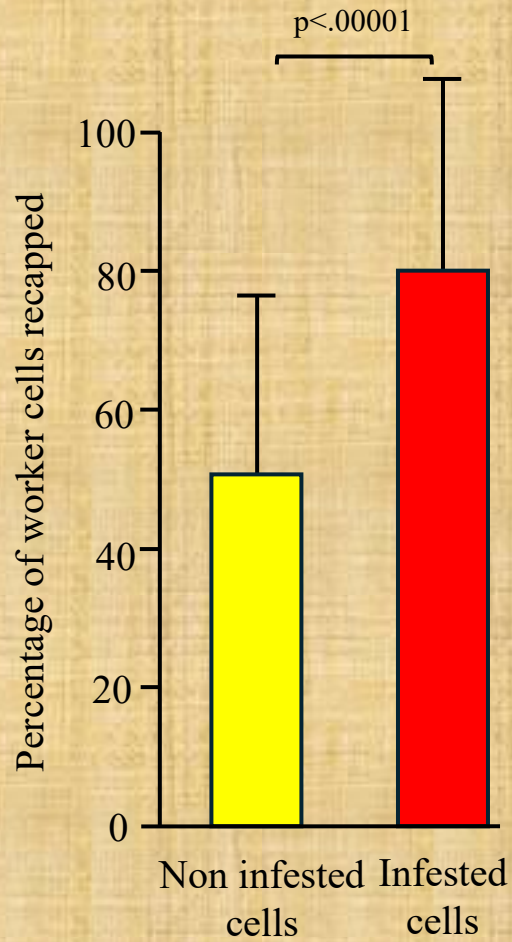
BIG ISLAND

Treatment widespread

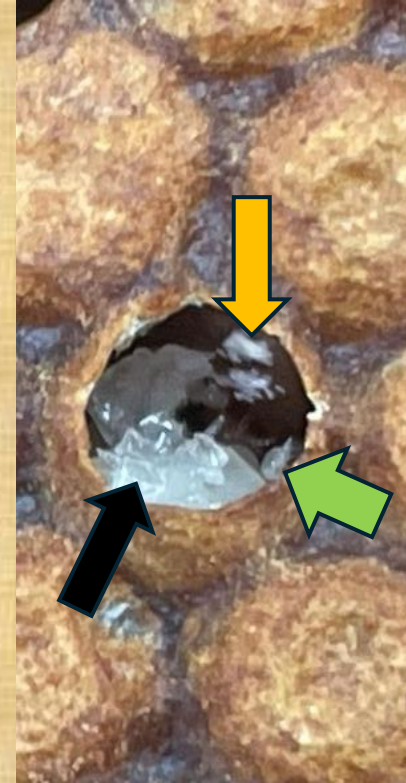
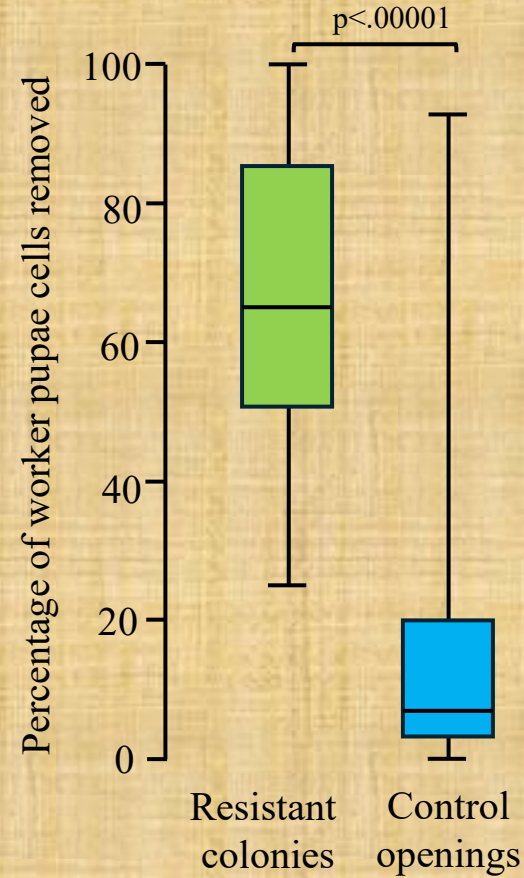




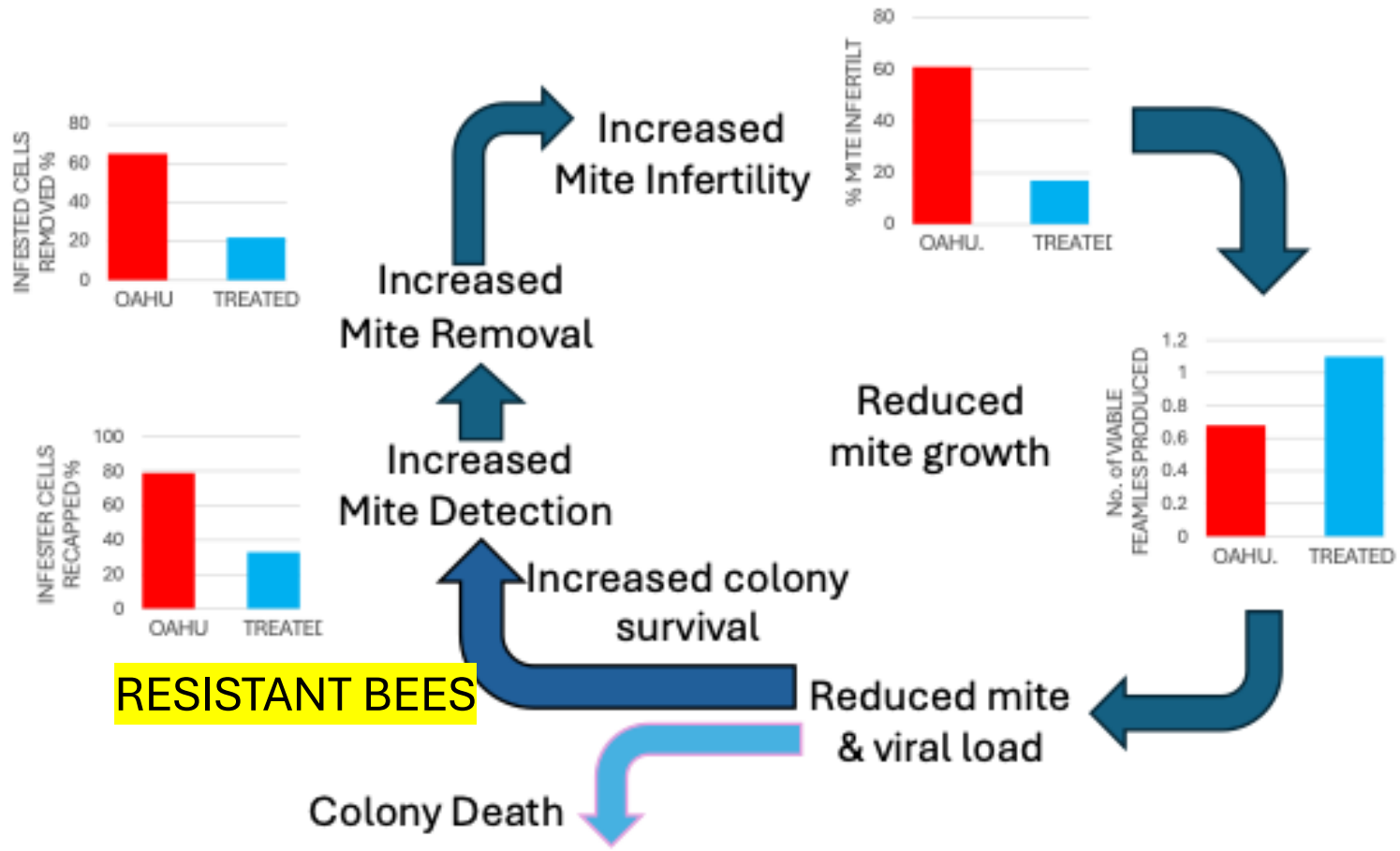
CELL RECAPPING



MITE REMOVAL



Resistance cycle lowers mite populations over time

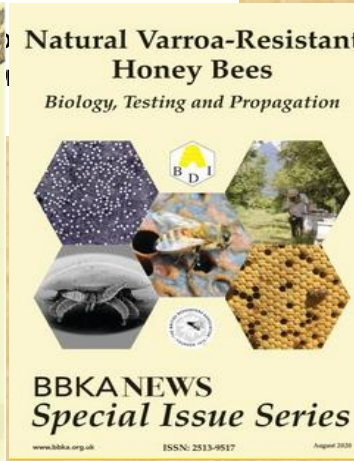
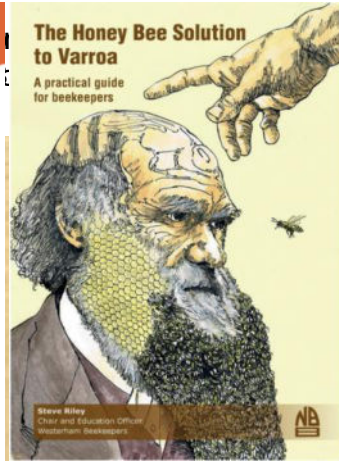
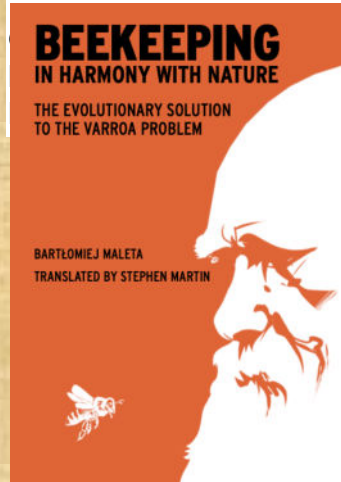


RESISTANT BEES



NON-RESISTANT BEES

Beekeeper funded scientists working for Beekeepers



Mite Calculator

Month of Monitoring:

August

Monitoring Method:

Worker Brood Infestation

Number Of Infested Cells (Worker Brood):

8

Number Of Sampled Cells (Worker Brood):

100

Estimated Number of Worker Brood in Colony:

15000

Calculate

Estimated Mite Population: 2160
Suggested Action: High mite levels, no need to treat, continue to monitor.

www.varroaresistant.uk