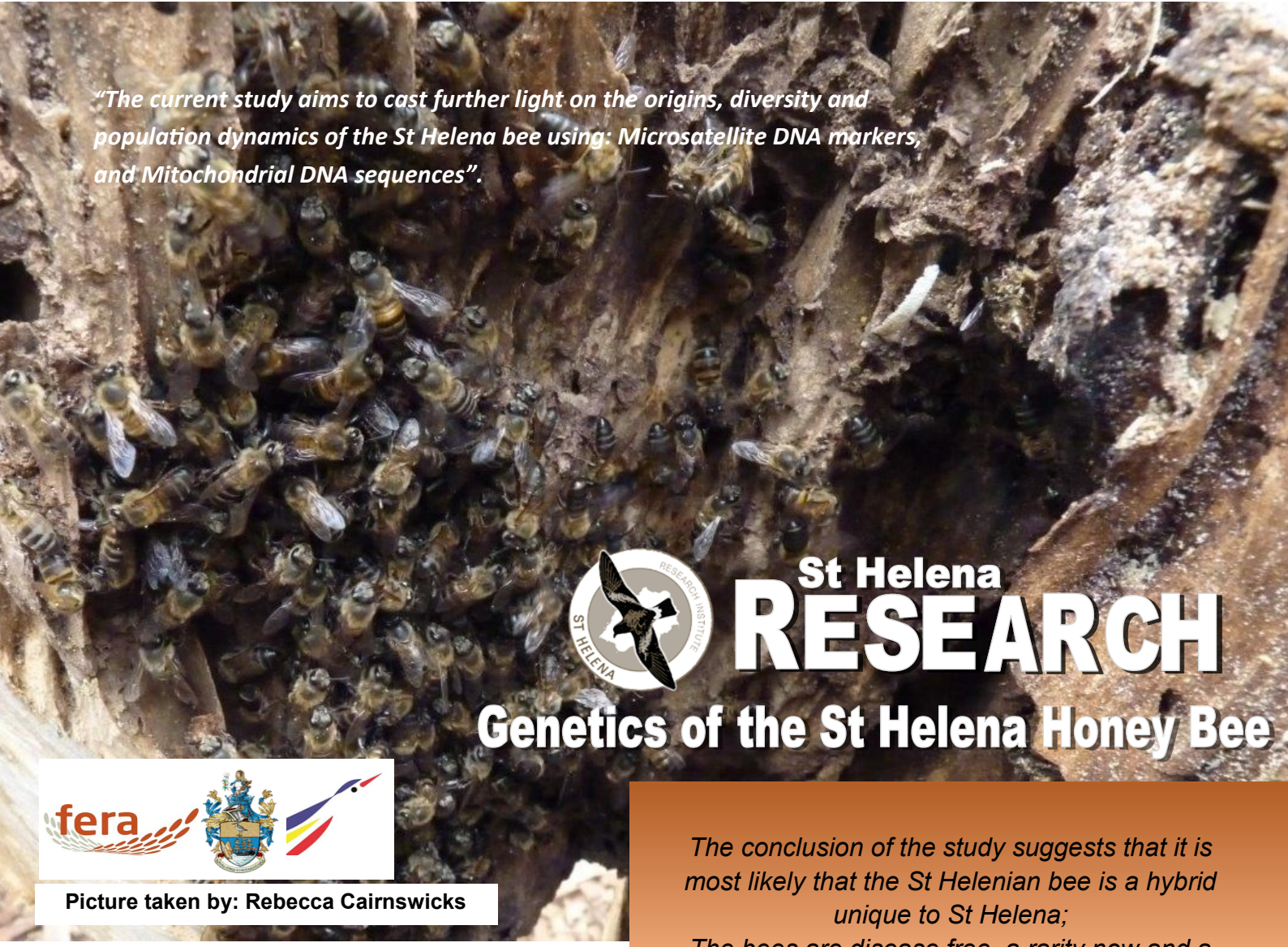

"The current study aims to cast further light on the origins, diversity and population dynamics of the St Helena bee using: Microsatellite DNA markers, and Mitochondrial DNA sequences".

St Helena RESEARCH

Genetics of the St Helena Honey Bee

Picture taken by: Rebecca Cairnswicks

Eleanor Jones, Jayne Hall. Fera Science, 2021.
(Abridged synopsis: Jonathan Hollins SVO)

The conclusion of the study suggests that it is most likely that the St Helenian bee is a hybrid unique to St Helena;
The bees are disease free, a rarity now and a status that is confined to only a few remote locations in the world;
The honey is produced from nectar bathed in the clean, fresh unpolluted air of the South Atlantic.

The primary domestic honey bee is a single species, the western honey bee Apis mellifera. It is possible that the St Helena bee is a hybrid of different bee sub-species introduced to the Island over the years.
The current study aims to cast further light on the origins, diversity and population dynamics of the St Helena bee using:

Microsatellite DNA markers: to provide an indicator of genetic diversity by assessing the variability, degree of duplication and number of different versions of the microsatellite markers. The data was also used to assess whether there was any 'structuring' in the island's bee population, seeking to answer the question: is it one population of bees or several? Two different bee sizes are evident in the Island population a 'big' bee and a 'little' bee.

Mitochondrial DNA sequences:
Are a way to examine ancestry, although it only represents a tiny fraction of the honey bee genome and can only give a partial picture. This technique was used with the aim of seeking to find out more about the origins of the Island's bees.
A total of 75 individual bees were collected in summer 2020 on St Helena from apiary owners, collecting one bee per hive (See Fig 1 – opposite page).

Microsatellite markers:
The analysis of base pairs (alleles) indicated different genes and genetic diversity. Regarding the 'Big' bee and the 'Little' bee, plotting of the microsatellite markers show no clustering indicating

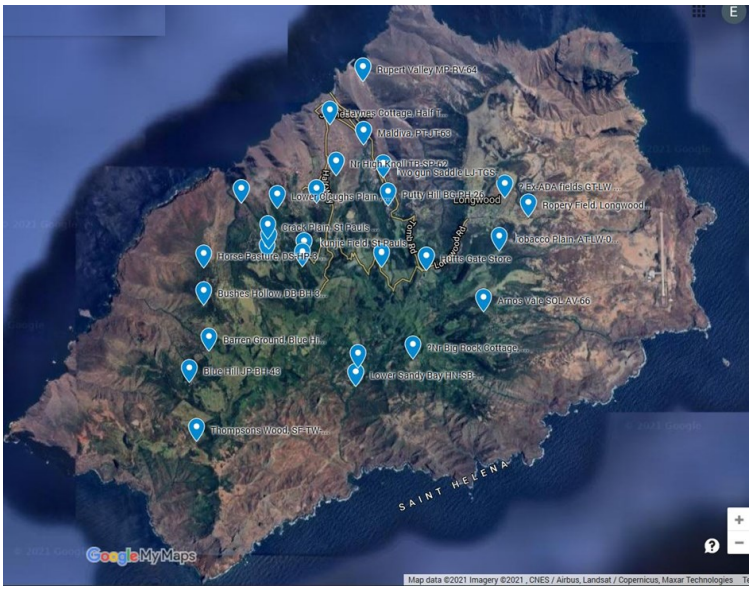

Figure 1. Approximate location of sample sites

that despite their very different appearance they are part of the same population.

A 'bottleneck' analysis was also conducted. A genetic 'bottleneck' can occur when the Island swarms are built up from just a few ancestors resulting in a high level of inbreeding. The results indicated no recent bottleneck. In other words, there is no indication of loss of genetic diversity.

The 'structure' analysis indicated that there is a single population on St Helena, not separate breeding populations, and that the 'big' bee and the 'little' bee results indicate these are simply variations of the same population and have very little or no barriers to interbreeding.

Mitochondrial DNA:

All samples from St Helena had identical sequences and fall within the Branch A (African) subspecies in the phylogenetic tree. See the 'family tree' for bees (Opposite).

Various methods were used to look for differentiation within the St Helena bee population, but none were apparent. The bees therefore appear to have a fully panmictic population, where they can freely interbreed with no barriers to mating. The big versus little trait could be a genetic trait, caused by a single gene inherited from the parents. Alternatively, this could be caused by some form of environmental trigger, for example cell size in the hive, or a factor affecting nutrition.

The genetic diversity found in the St Helena bee population was similar to that found in continental honey bee populations. Overall, this suggests that there is a reasonable level of genetic diversity on the island of St. Helena, and no evidence of a population bottleneck or founder event.

<u>The relatively high level of genetic diversity points towards a hybrid origin.</u>

The St Helenian bee's Unique Selling Points:

1. The conclusion of the study suggests that it is most likely that the St Helenian bee is a hybrid unique to St Helena
2. The bees are disease free, a rarity now and a status that is confined to only a few remote locations in the world
3. The honey is produced from nectar bathed in the clean, fresh unpolluted air of the South Atlantic.

<u>Please note</u> that this is a highly summarised synopsis of a much larger technical report. For further details or a copy of the full report please contact: andy.timm@sainthelena.gov.sh

<u>Credits:</u> Enterprise St Helena for funding the study; Eleanor Jones & Jayne Hall of Fera Science, UK; the participating beekeepers of St Helena; Andy Timm, Ken Henry and Pat Stroud for the collection of bees. Joe Hollins for preparation/ shipping of samples & report synopses.

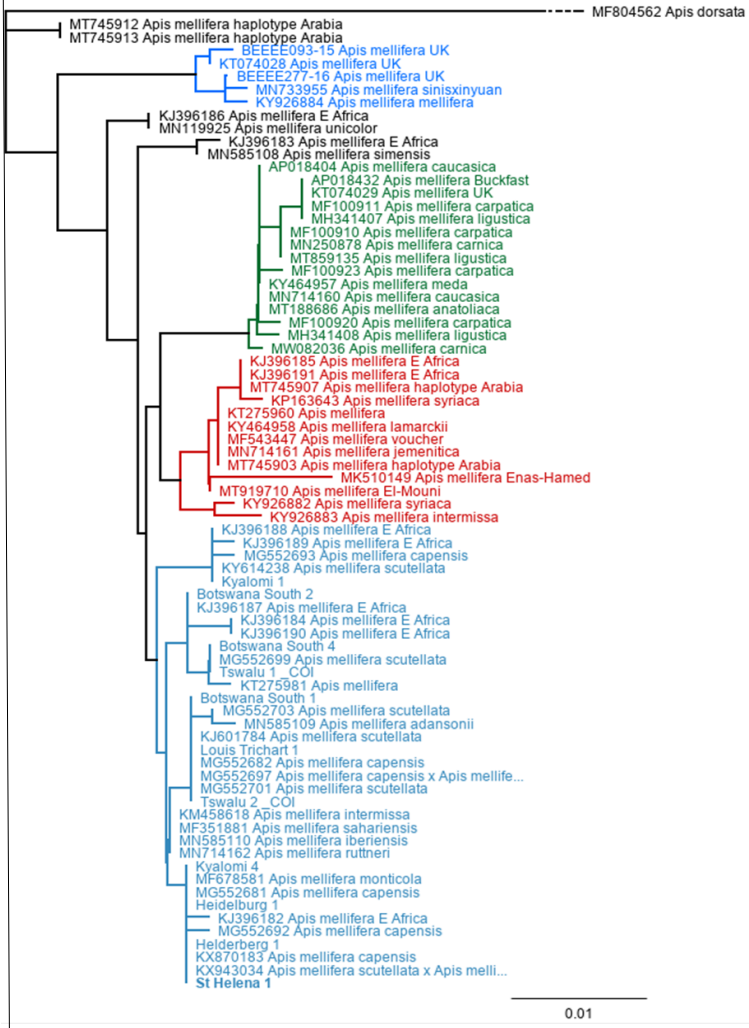

Figure 2: The 'family tree' for mitochondrial DNA haplotypes. The African group (A) of subspecies is shown in light blue, the N-W European group (M) is in dark blue, the southern European group (C) in green, and the Middle Eastern group (O) in red. St Helenian haplotype in African group in bold.