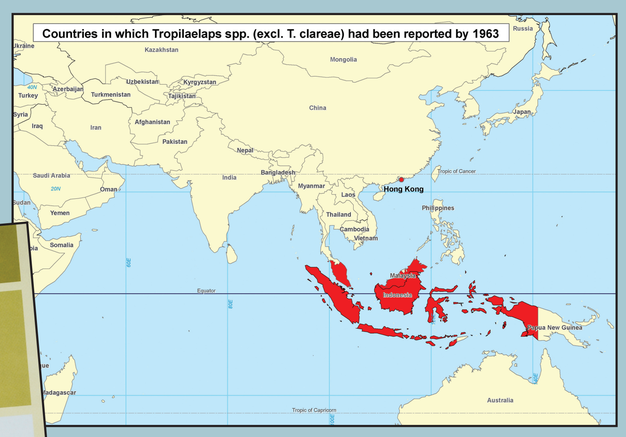
Climate Change – Predicting honey bee pest distributions – *Tropilaelaps* mites

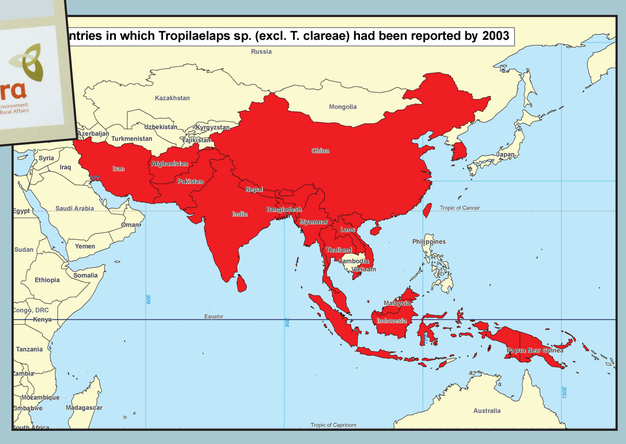
INTRODUCTION

There are approx a quarter of a million honey bee colonies across the UK, where honey production is worth in excess of £20m p.a. Of far greater economic significance, however, is the service provided by bees as primary pollinators: the value of commercial crops grown in the UK that benefit from bee pollination is ~£200m p.a. Internationally the honey industry produces some 1,381,000 tons, (worth £7.5b p.a. at UK prices) and pollination services are estimated at ~£70b p.a.).
Bee health and colony declines are matters of major international concern, not only to beekeepers, but also to food producers (who rely on the pollination services of bees), the scientific community, and to the broader public.

PARASITIC PESTS

Tropilaelaps mites affect both brood and adult honey bees. Infestation causes abnormal development, and death of hosts, leading to colony decline and collapse. In their native environments (tropical/subtropical zones) *Tropilaelaps* is responsible for very significant economic losses. In severe infestations > 50% of developing brood is lost. *Tropilaelaps* has not yet been found in the UK, but is statutorily notifiable under EU legislation. While such exotic species are recognised as posing a significant and increasing threat to UK apiculture, the extent of the true risk posed urgently needs to be quantified. This will not only maximise the effectiveness of surveillance and control programmes, but will also allow more focussed research efforts into the development of appropriate diagnostic/preventative measures.





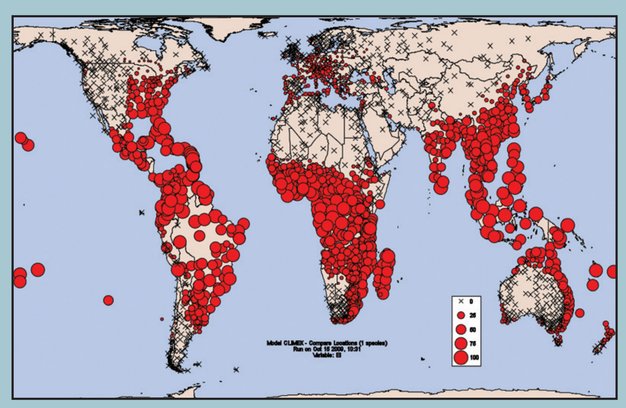
POTENTIAL SPREAD

The known geographic range of *Tropilalaelaps* has spread significantly over the last 40 years. The main factor currently limiting survival and spread of exotic mites in the UK is their dependency on a continuous, year-round food supply of immature bees within infected colonies. Under existing climatic conditions, cold winters prevent *A. mellifera* from producing brood, so any introduced *Tropilaelaps* will starve. However, even slightly milder UK winters, as anticipated with global warming will support uninterrupted brood production. This direct relationship between Climate/Host/Parasite makes the *Tropilaelaps*/honey bee model particularly relevant to CC scenarios.

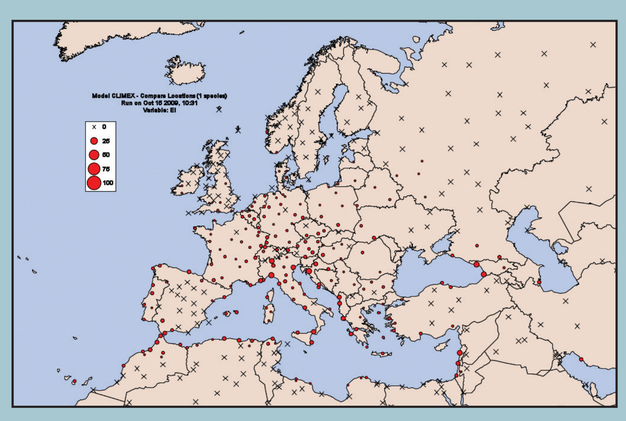
CLIMEX

is a dynamic simulation model that enables researchers to predict the potential geographic distribution of a species using climatic parameters inferred from an observed distribution. This computer program can be applied to different biological entities by selecting values for parameters that describe the candidate organism's response to temperature, moisture and light. CLIMEX thus produces predicted distribution maps for alien species in the event that they should be introduced into the UK. Details of the climate from the known distribution of an organism can help predict the potential distribution and abundance of the organism in new geographic regions:

- Since the geographical distribution of Tropilaelaps spp. is known, at least in part, this can be used to estimate parameters to determine Ecoclimatic Indices;
- These, in turn, can be used to estimate potential distribution in other, climatically similar parts of the world.



CLIMEX map - Ecoclimatic indices for *Tropilaelaps* worldwide (i.e. all areas that are climatically suitable for *Tropilaelaps* based on mites known distribution)



CLIMEX map - *Tropilaelaps* risk to Europe?

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