

OP-270 [Pollination and Bee Flora]

Reconsidering beekeeping practices: Better-B explores how to restore harmony and balance in the bee colony and with its environment

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The post-war intensification of beekeeping has improved productivity enormously, but this has come at a cost, in particular bee colonies have become vulnerable and require frequent interventions from the beekeeper to survive. In parallel, honeybees are increasingly exposed to various forms of stress. All this leads to a devastating mix of vulnerable bees in a threatening environment, leading to colony losses and economic damage. There are, however, enough known cases where an alternative beekeeping management has helped to get honey bees back on track. A striking example is that of apiculture in Africa, which is based on natural selection and swarm catching. This way of beekeeping ensures that the harmony and balance that naturally arises is not disturbed. Major disadvantage, however, is that productivity is particularly low here. How can we get the honey bees from the intensive beekeeping of the west back out of this devastating mix? How do we combine more resilience with high productivity?

We believe that the current beekeeping practices have to be reconsidered. One way forward is to harness the power of nature to restore harmony and balance inside the honey bee colony and between the colony and the environment. This is where the Horizon Better-B project stands for. The project aims to predict the landscape pollinator capacity and the competition with wild pollinators. We want to understand the basis of resilience against different sorts of stresses like exposure to chemicals, climate change and heat stress. Do they have a molecular, ecological and/or genetic ground, or can we mitigate by changing the beekeeping practices, like improving the thermoregulation of the hive or choosing for Darwinian selection? This presentation will frame the research lines of the project and explain our approaches.

Reconsidering beekeeping practices: Better-B explores how to restore harmony and balance in the bee colony and with its environment

Dirk C. de Graaf and the Better-B Consortium



APIMONDIA 2025
Copenhagen
Denmark



How it started

Our story told in a comic strip

The Better-B *story*

Hey Mrs. B,
how are you?

Well hello
Ms. Beekeeper,
I'm dandy thanks!

Wanna learn
something about
Better-B?

Sure!

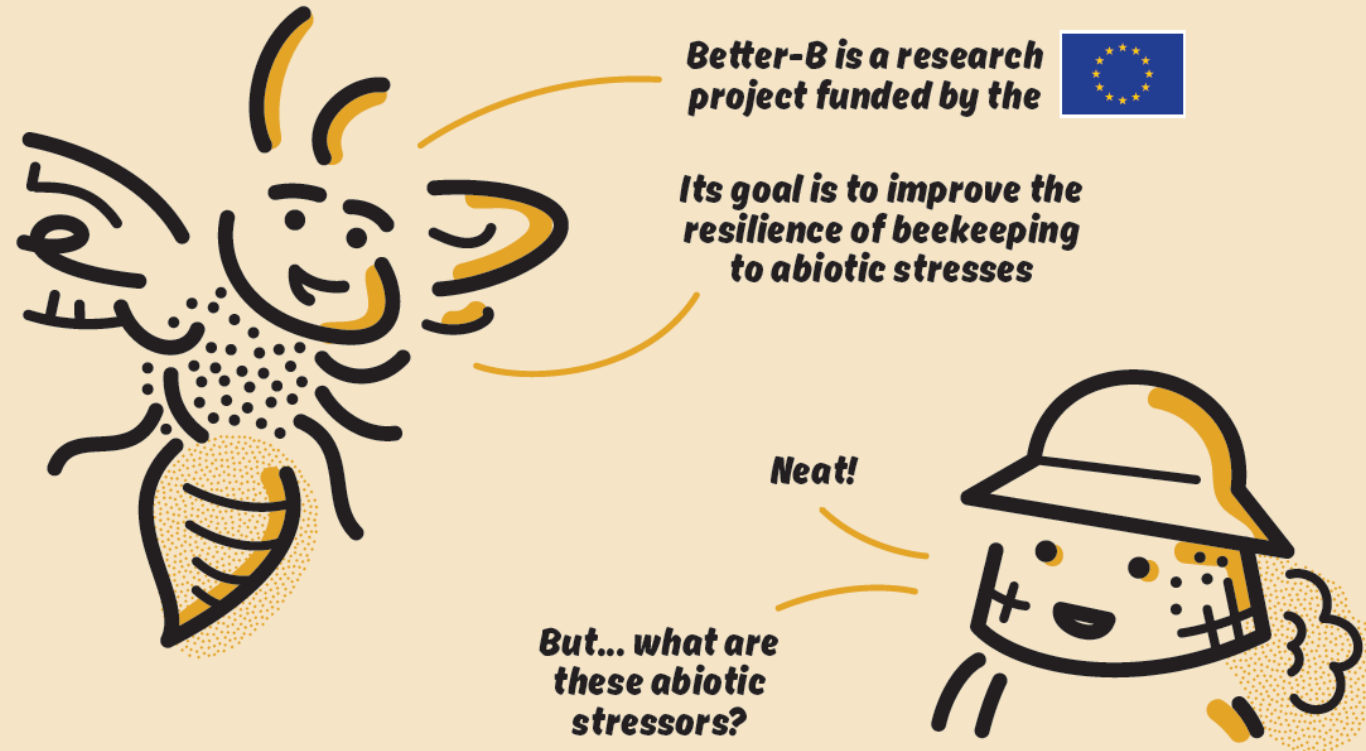


Better-B at APIMONDIA 2025

13.10.20
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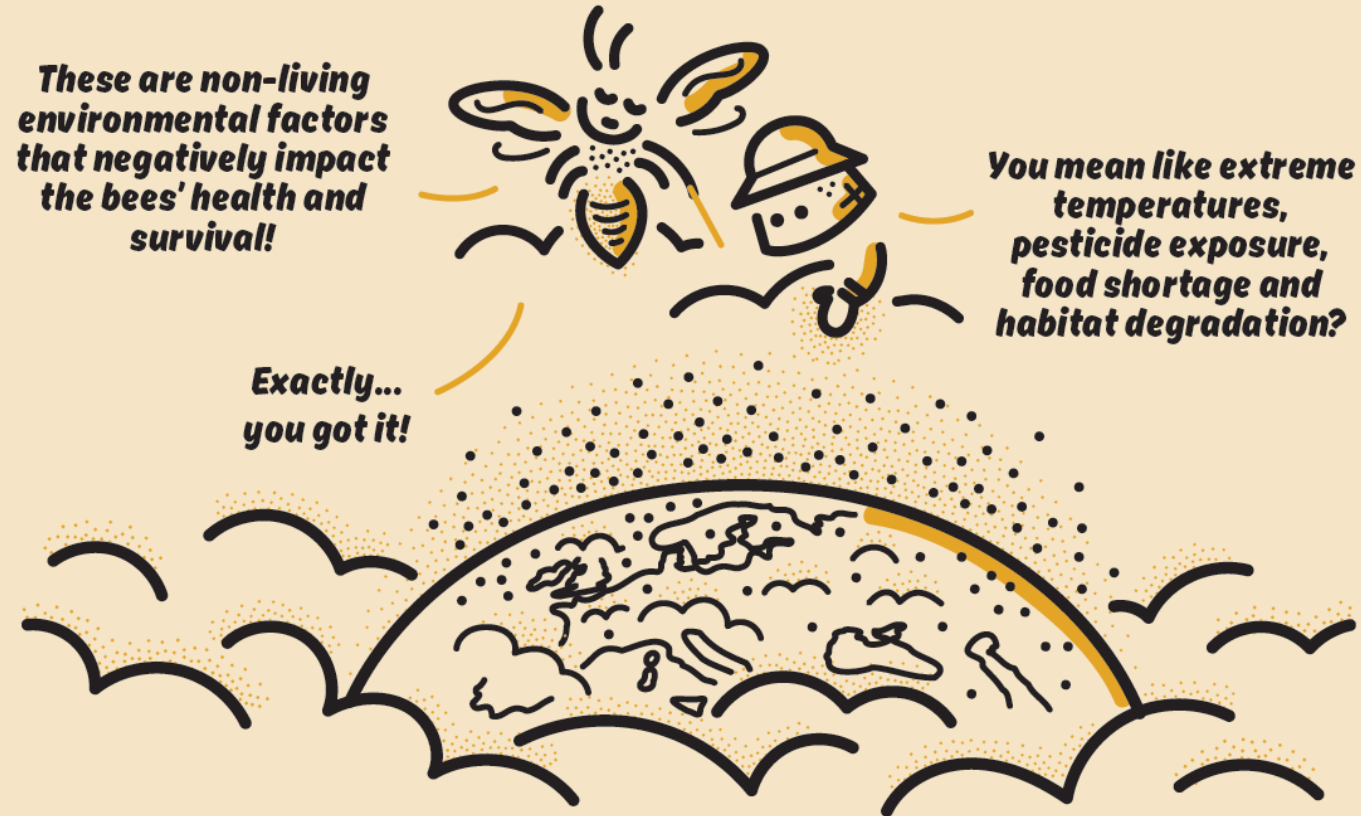
Funding, consortium and objectives

Bee: 'Wanna learn something about Better-B?'



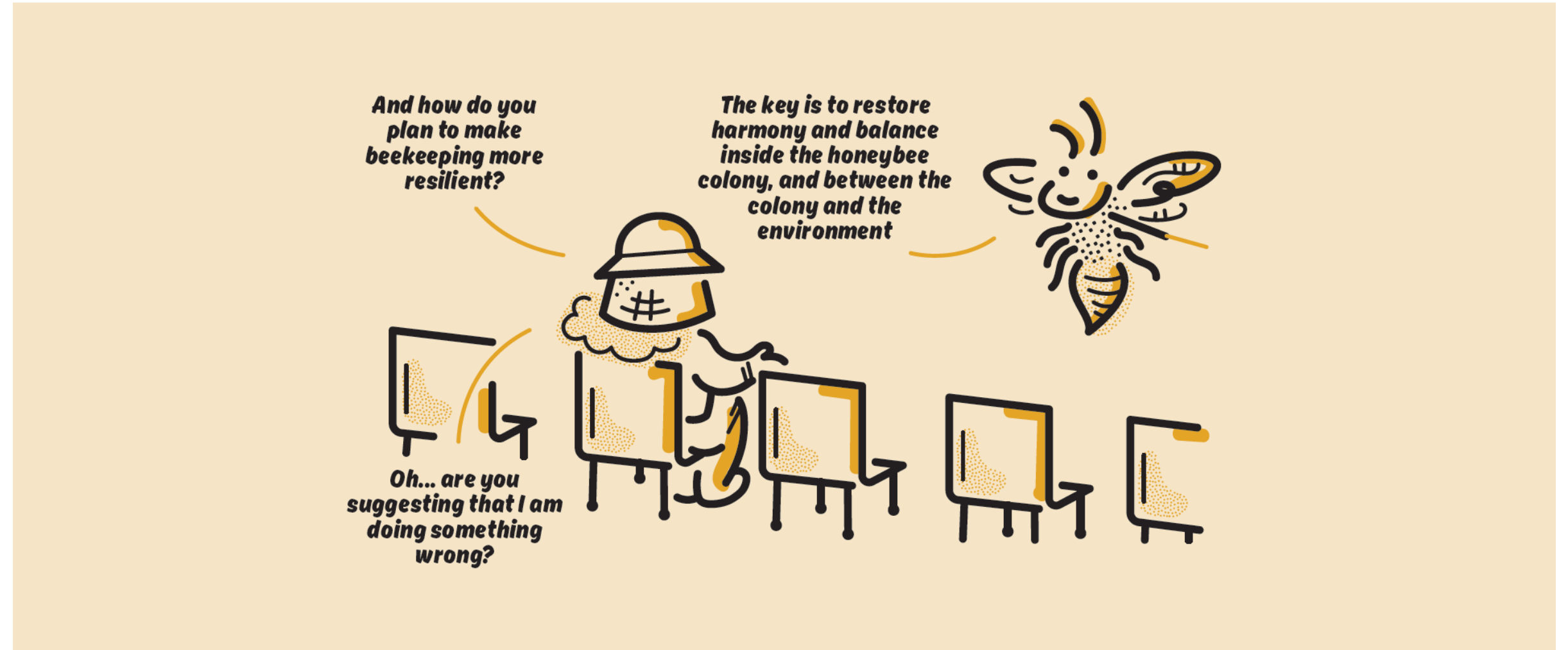
Background

Beekeeper: 'What are these abiotic stressors?'



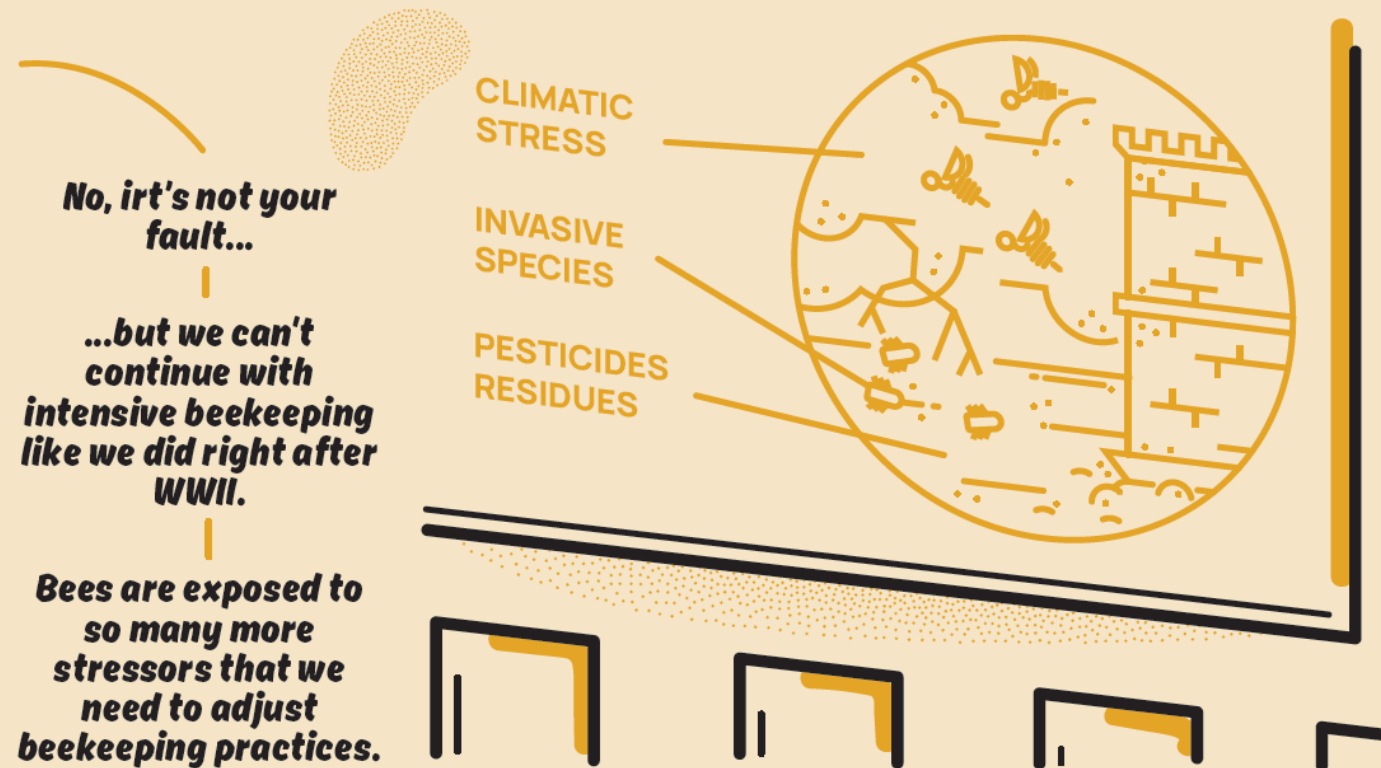
Central idea

Beekeeper: 'And how do you plan to make beekeeping more resilient?'



Something has to change

Bee: 'No, it is not your fault...'



Inspiration

Beekeeper: 'Are you sure that will work?'

**Are you sure
that will work?**

**We have the example of Africa,
where beekeeping disturbs the
harmony much less...**

**...and in many
countries, the return
to Darwinian
selection has proven
very successful!**



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Inspiration

Bees in Africa and Darwinian Black Box

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<https://doi.org/10.1007/s13592-025-01193-w>

Review article



Living in harmony with nature: the key to resilience of honeybees (*Apis mellifera*) in Africa

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Abstract – Managed honeybees play a crucial role in enhancing agricultural crop production and plant biodiversity conservation and ensuring food security. However, beekeepers, especially those in the Northern Hemisphere, are experiencing high honeybee colony losses, mainly due to the ectoparasitic mite *Varroa destructor*. This could threaten our future food security. The presence of *V. destructor* has also been reported in Africa; however, honeybees are less affected by the mite. Moreover, local beekeepers do not consider the mite as a threat to their colonies, and colonies survive without mites' treatment. Mite-resistant honeybee populations have also been reported in various parts of Europe, but they are limited in number and confined to specific regions. Therefore, understanding why mite-resilient honeybee populations are flourishing in many African countries is crucial for developing effective management strategies to improve honeybee health worldwide. Hence, this review synthesizes existing knowledge about the factors and traits that allow mite-resilient honeybee populations in Africa to flourish and aims to translate the insights gained from Africa into more effective approaches for managing the impact of *V. destructor* worldwide. The results suggest that African-derived honeybees are resilient to a broad set of threats including *V. destructor* because they live in harmony with nature. Resilience is attributed to a more bee-friendly environment, to better balanced colony densities, to beekeepers' management practices, and to the bee's behavioural adaptation and physiological and genetic traits. Nature-based beekeeping practices that allow natural selection to operate and maintain the genetic diversity of local honeybee subspecies are the key to their resilience against *V. destructor*.

African honeybees / Genetic diversity / Natural selection / Resilience / *Varroa destructor*

Biol Invasions (2019) 21:2519–2528
<https://doi.org/10.1007/s10530-019-02001-0>



PERSPECTIVES AND PARADIGMS

Darwinian black box selection for resistance to settled invasive *Varroa destructor* parasites in honey bees

Tjeerd Blacquière · Willem Boot · Johan Calis · Arrigo Moro · Peter Neumann · Delphine Panziera

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Abstract Established invasive species can pose a continuous threat to biodiversity and food security, thereby calling for sustainable mitigation. There is a consensus that the ubiquitous ecto-parasitic mite *Varroa destructor*, an invasive species from Asia, is the main biological threat to global apiculture with *Apis mellifera*. *V. destructor* has almost completely wiped out wild European honey bee (*Apis mellifera*) populations. The only remedy for apiculture, to date, is frequent control measures against the mite throughout the season, which prevents possible adaptations. While targeted breeding efforts have, so far, not

achieved the selection of tolerant or resistant bees, natural selection approaches have succeeded at least seven times. Here, we propose to take advantage of natural selection for honey bee resistance by stopping mite treatment in managed colonies. The main principles are within population mating of the colonies' own virgin queens and drones and selection based on survival and proliferous development of colonies. Being used for 10 years, it has shown to result in *grosso modo* 'normal' colonies with a high level of resistance to *V. destructor*. Here, we call for local groups of beekeepers and scientists to join a novel natural selection program that has started so far on three locations. This will eventually lead to several locally adapted *V. destructor* resistant honey bee populations around the world, and help global apiculture becoming more sustainable.

Keywords *Apis mellifera* · Honey bee · *Varroa destructor* · Natural selection · Sustainable apiculture · Resistance · Tolerance · Host parasite relationship

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More about Darwinian selection

Beekeeper: 'Darwinian selection? What is that?'

**Darwinian
selection?
What is that?**

**It refers of course to
Charles Darwin, and means
that nature itself
determines which colonies
are best adapted to
survive, without human
intervention.**



Local Adaptation by Darwinian Selection

Better-B Work Package 4



understanding the process of Darwinian selection in established (3) and new (9) Darwinian colonies

- genomic signature of survivors
- hive monitoring systems: weight, temperature, sound
- accelerometer and knocker: vibrational data
- impact of mobility

Local Adaptation by Darwinian Selection

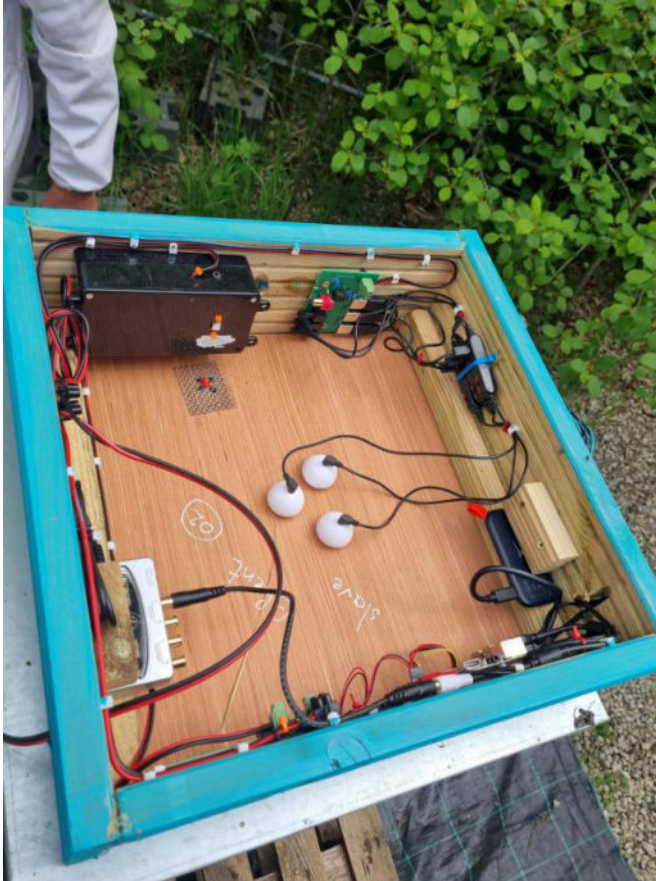
Better-B Work Package 4



- understanding the process of Darwinian selection in established (3) and new (9) Darwinian colonies
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Local Adaptation by Darwinian Selection

Better-B Work Package 4



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Local Adaptation by Darwinian Selection

Better-B Work Package 4

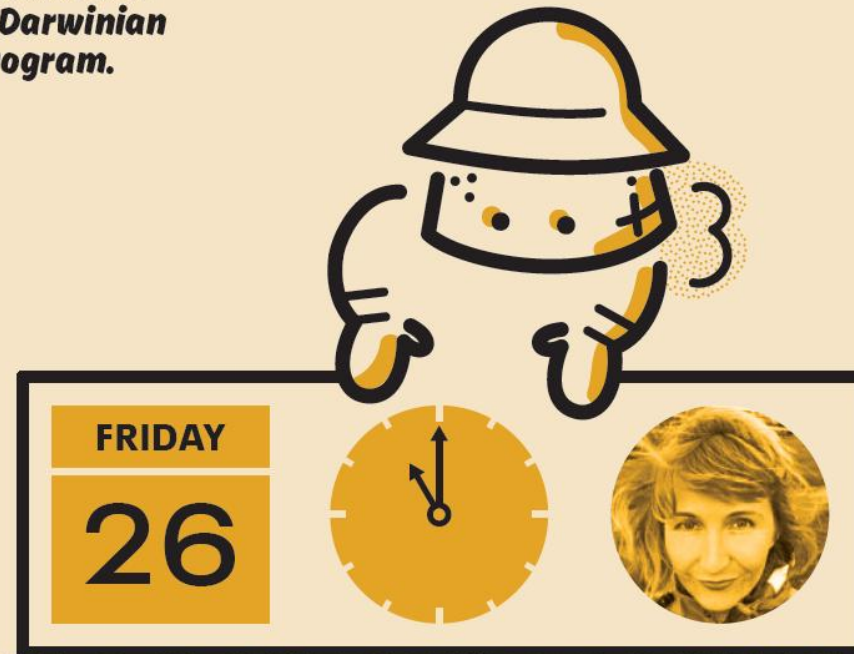
**Friday morning Martin Bencsik
will demonstrate a new device
for measuring vibrational
signals from the colony that
gives information of the stress
level of the colony.**



Local Adaptation by Darwinian Selection

Better-B Work Package 4

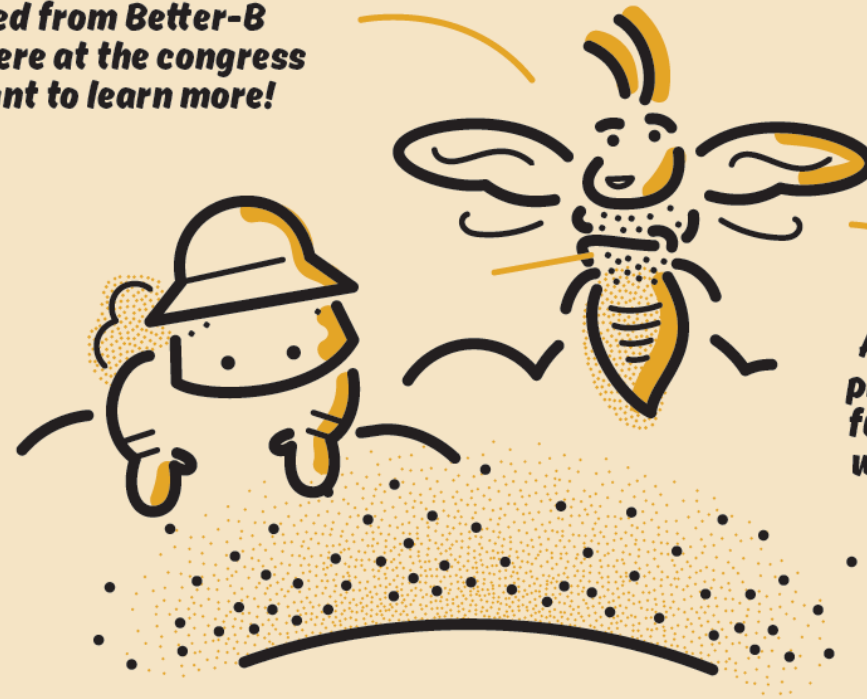
**Also Friday but at 11:00
Séverine Kotrschal will
talk about our Darwinian
selection program.**



Posters and Presentations

Bee: 'And the Better-B project goes much further than what we talked so far...'

**There are several
presentations and posters
scheduled from Better-B
partners here at the congress
if you want to learn more!**



**And the Better-B
project goes much
further than what
we talked so far...**

In balance with the environment

Bee: 'And the Better-B project goes much further than what we talked so far...'

**For example, we are
developing a tool to
determine how many
colonies you can place in
an apiary to be in
balance with the
available food...**

**...and without
disturbing the
wild bees...**



Pollinator Ecology

Better-B Work Package 1

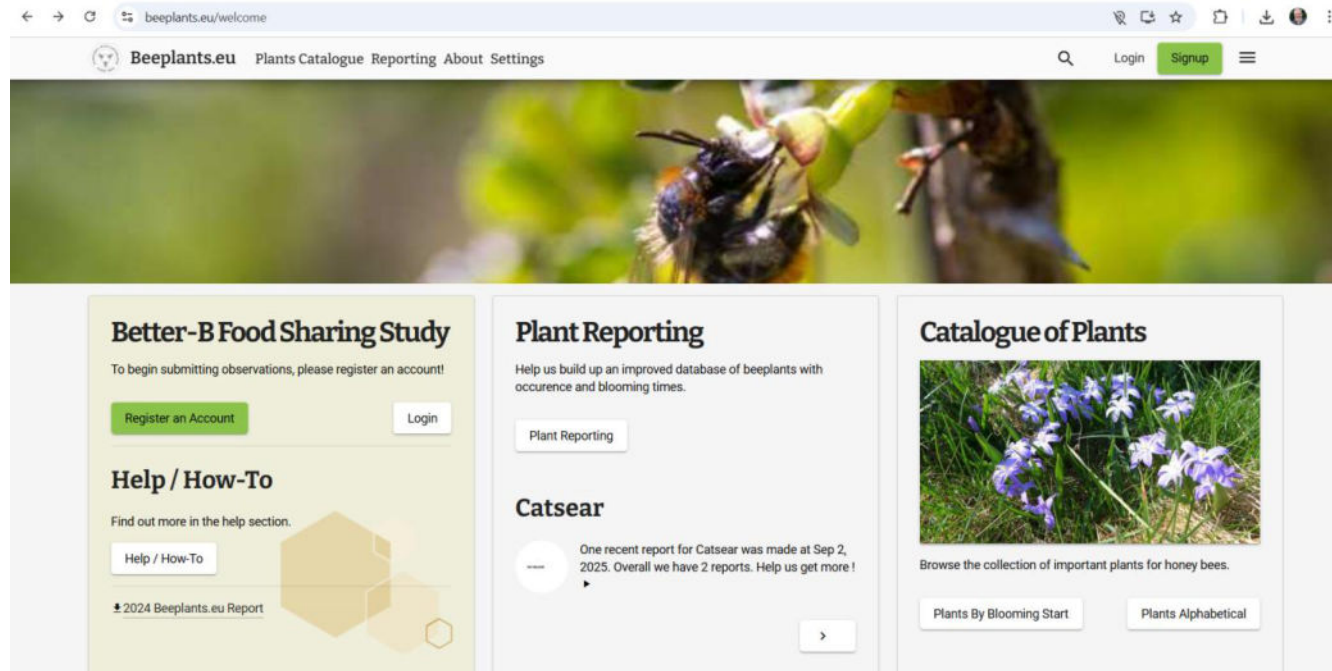


what is the carrying capacity of the landscape?

- floral resources model
 - bee friendly plants
 - factors influencing plant phenology
 - pollen choice of pollinators
- validation by a citizen science study
 - beeplants.eu
 - flowering period
 - food sharing with wild bees

Pollinator Ecology

Better-B Work Package 1

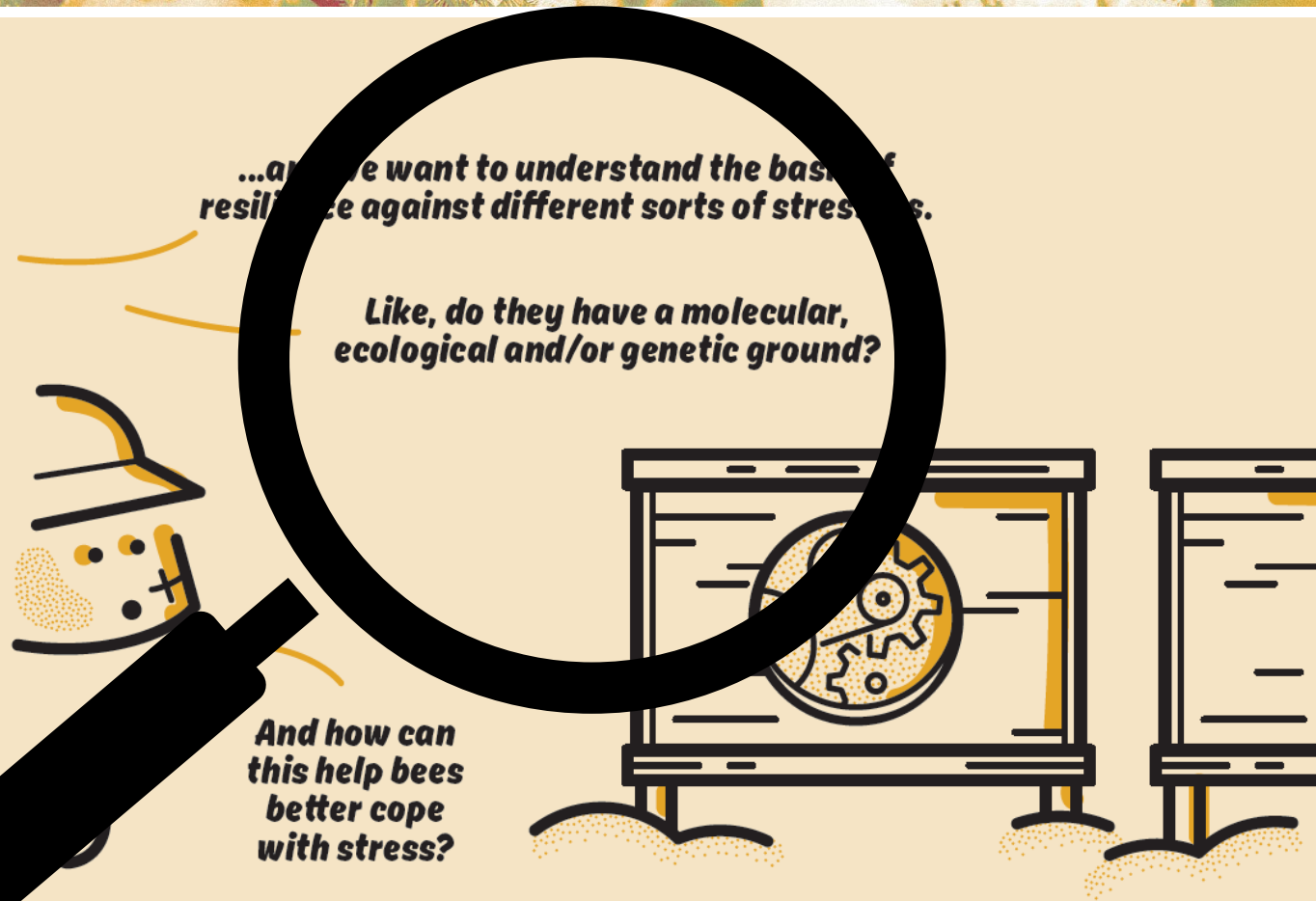


what is the carrying capacity of the landscape?

- floral resources model
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 - flowering period
 - food sharing with wild bees

Understanding mechanisms in nature

Bee: '... and we want to understand the basis of resilience against different sorts of stressors'



Resilience to Chemicals

Better-B Work Package 2



has resilience to chemicals an ecological ground?

- pesticide exposure in a gradient of ecosystem complexity

has resilience to chemicals a molecular ground?

- finding mutations insecticide target sites
- selecting those that are the most relevant
- development of a rapid laboratory test for screening

Resilience to Climate and Heat Stress

Better-B Work Package 3



has resilience to climate and heat stress a genetic ground?

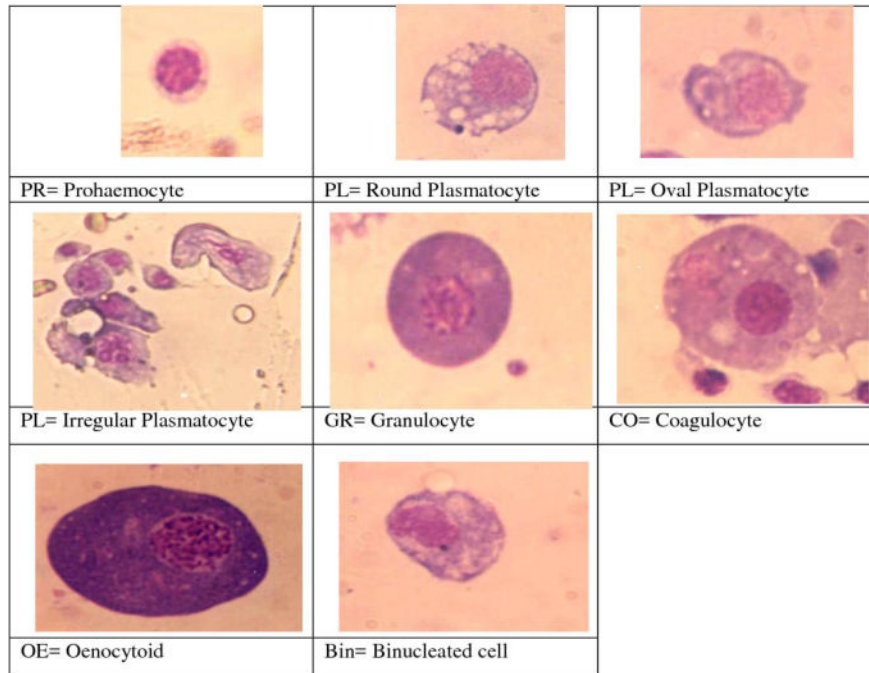
- 1500 samples for whole genome sequencing (north to south)
- genetic diversity / genes of importance for adaptation

has resilience to climate and heat stress a molecular ground?

- determining Heat Stupor Time and Chill Coma Recovery Time of different populations
- looking at gene expression profiles of the extreme ends

Immune Resilience

Better-B Work Package 5

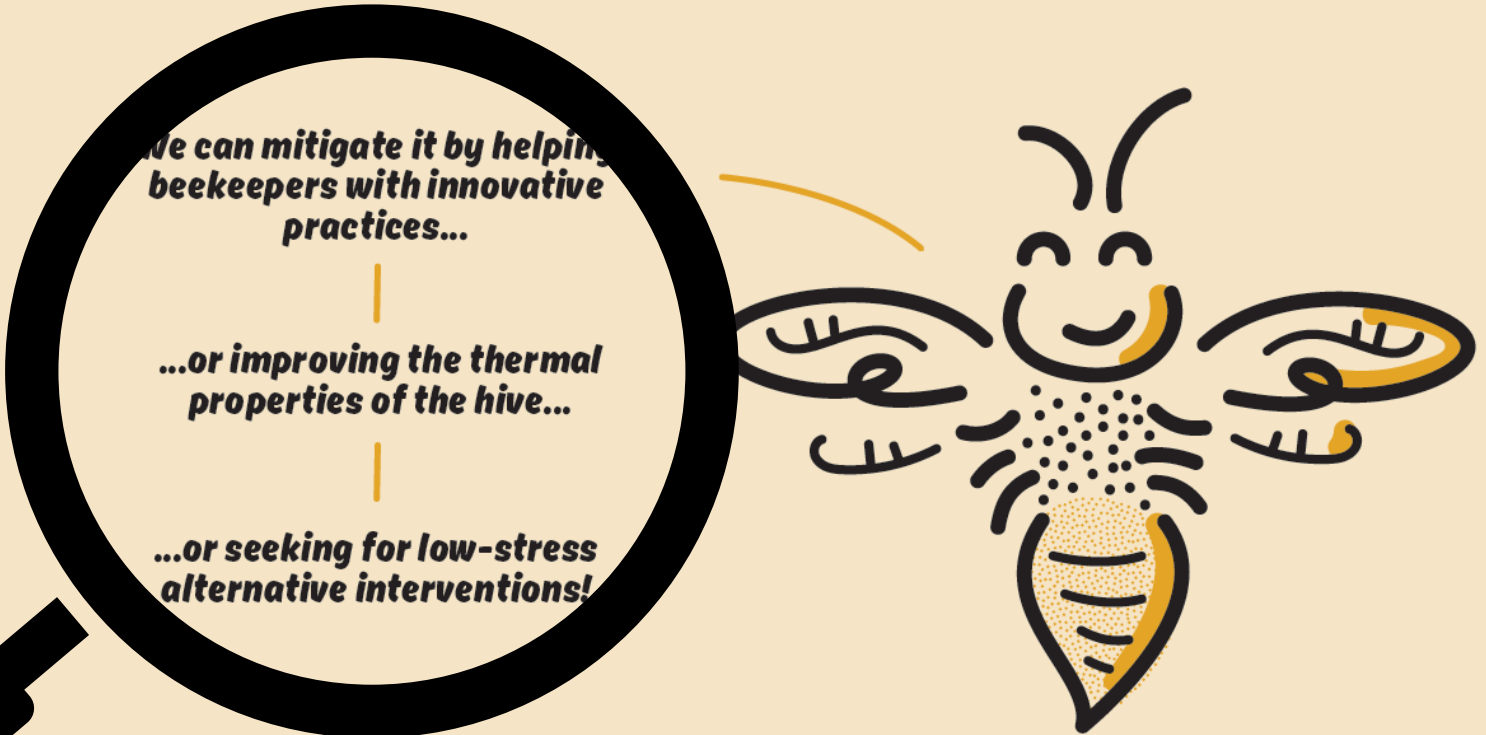


better understanding of the cellular immunity of honey bees

- finding more than 1000 proteins exposed on the surface of the blood cells
- developing monoclonal antibodies against selected markers
- developing a new typology of the blood cells

Reaching out to beekeeping

Bee: 'We can mitigate it by helping beekeepers with innovative practices...'



**We can mitigate it by helping
beekeepers with innovative
practices...**

**...or improving the thermal
properties of the hive...**

**...or seeking for low-stress
alternative interventions!**

Resilience to Climate and Heat Stress

Better-B Work Package 3



better understanding of the thermal interactions between empty hives and their environment

- interviews with beekeepers (removable white cap)
- experimental apiary (infrared cameras, °T sensors, software...)
- thermal analyses / radiative properties of coatings and paints
- hive roof insulation
- thermal modelling

Future of Beekeeping under Global Change Pressures

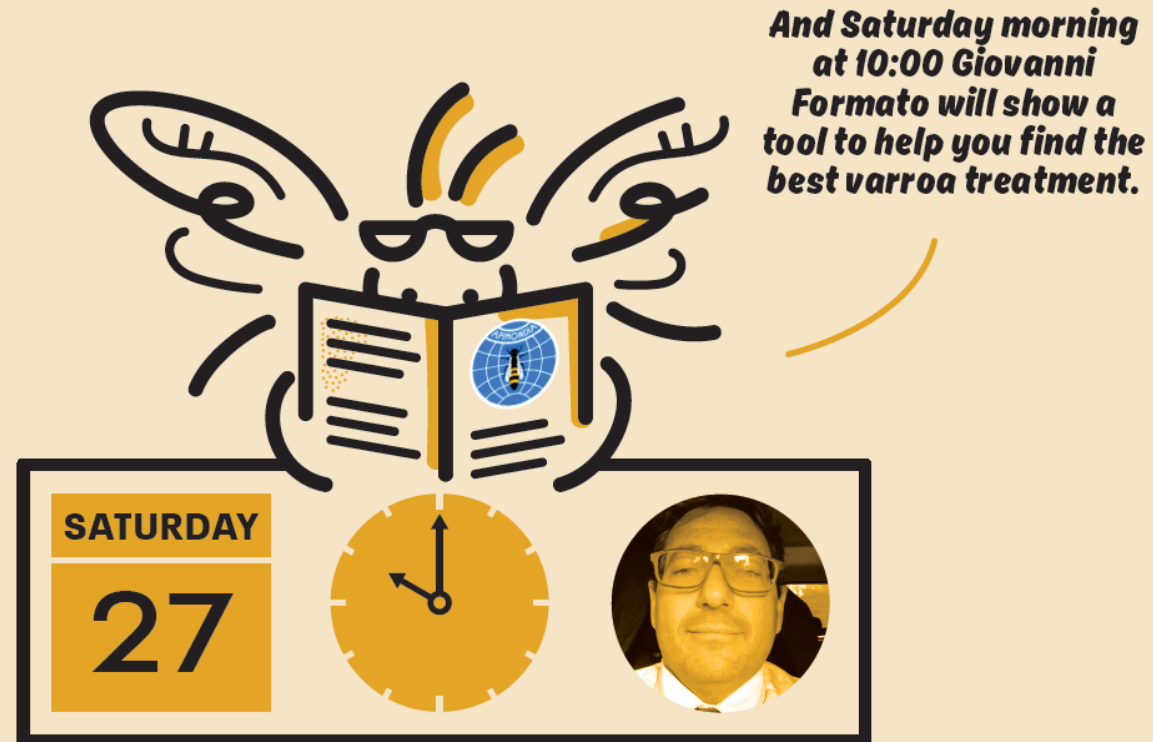
Better-B Work Package 6



- illustrated booklet for better hive construction (based on in-hive thermoregulation study)
- risk assessment invasive spp. (how will they spread?)
- contingency plan (what if...?)
- on-line tool for best varroa-treatment
- citizen science studies to test traps for *Vespa velutina* and small hive beetle
- give guidance in low-stress beekeeping

Future of Beekeeping under Global Change Pressures

Better-B Work Package 6



Follow the Better-B project

Beekeeper: 'Whow... all very exciting!'

**Whow... all very
exciting!
I will be there.**

**And don't forget to
join our Multi-Actor
Forum and follow
us on LinkeDin!**



That's all folks!

Beekeeper: 'Wow, it looks like an ambitious plan!'





Thank you for your attention!



www.better-b.eu



Better-B-project

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