Deliverable D7.1

Targeted Interviews

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Contents

Abbreviations, Participant short names

Abbreviations

GDPR	General Data Protection Regulation
IAS	Invasive Alien Species
SHB	Small Hive Beetle
WP	Work Package

Participant short names

AU	Aarhus Universitet
COA	Co-Actions
IPB	Instituto Politécnico de Bragança
IRIAF	Instituto Regional de Investigación y Desarrollo Agroalimentario y Forestal de Castilla-La Mancha
IZSLT	Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana
KUL	Katholieke Universiteit Leuven
MLU	Martin-Luther-Universität Halle-Wittenberg
NB	Norges Birokterlag Forening [Non-governmental organisation
SCIPROM	SCIPROM Sàrl
TNTU	The Nottingham Trent University
UCOI	Universidade de Coimbra
UGENT	Universiteit Gent
UJAG	Uniwersytet Jagiellonski
UM	Université de Montpellier
USAMV	Universitatea de Ştiinţe Agricole şi Medicină Veterinară Cluj-Napoca
UU	Uppsala Universitet
VDSJ	Van Der Steen Joseph
WR	Stichting Wageningen Research

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Summary

This report details the background, objectives and methodology for a series of targeted interviews to be conducted as part of work package seven (WP7) within the Better-B project. The objectives of this study are to gain expert (both scientific and practitioner) insights and information on three topics of interest to guide project research and outputs:

- Hive designs and modifications for thermoregulation and wood protection
- Europe's vulnerability and preparedness to control (detect/manage) focal Invasive Alien Species (IAS)
  - Small hive beetle (*Aethina tumida*)
  - Yellow leg Asian hornet (*Vespa velutina nigrithorax*)
  - Tropilaelaps mite (*Tropilaelaps spp.*)
- Darwinian (natural) selection to improve the resilience of managed honey bee colonies to impacts of climate change and diseases.

Interviews are currently underway (as of October 2024) and will be analysed in early 2025. The insights, results and data gained as part of this study will be used to guide further research, and ultimately made publicly available as part of a series of informative guides covering the three topics for various audiences within the beekeeping sector.

1. Preface

This report is the first deliverable of five planned within work package seven (WP7) 'Multi-Actor Co-development'. This report describes the methodology for a series of targeted expert and practitioner interviews (the study) scheduled for the Autumn of 2024, as part of Task 7.3 'Co-development processes at EU and national levels'. This study has been planned and will be conducted in collaboration with several project partners, particularly those related to the topic areas for interviews.

2. Background

Targeted interviews are planned as part of Better-B work package seven (WP7). 'Multi-actor co-development', within Task 7.3 'Co-development'. This report describes the objectives and methodology of this study, as series of interviews to gain initial expert and practitioner (e.g. beekeeper, advisors) insights to support key project developments. The project's Executive Board, based on input from work package leaders, decided that three topics were of relevance and importance for this study.

1. Novel hive designs for thermoregulation and word protection practices,
2. Invasive species of concern for EU beekeeping sector
3. Darwinian selection to improve honey bee resilience through local adaptation

Insights gained form these targeted interviews will inform and guide the project's research, provide input for several publicly available guides, (planned as deliverables within WP6) as well as the development of two online surveys to be conducted as part of Task 7.3 (See Outputs).

3. Study objectives

The objectives for the three topic areas are different and described in the following sections. These are intended to be **exploratory interviews**, to investigate stakeholder perspectives (through research questions) that have not previously been studied in depth.

3.1 Hive designs

To gain practitioner (e.g., beekeepers) insights and information on practical modifications of beehives and their immediate environment to improve the thermal regulation of hives to benefit their bee colonies. In addition, hive material protection practices (i.e., wood coatings) is a subtopic for questioning.

3.2 Invasive species

To gain expert (e.g., scientists) and practitioner (e.g., representative of authorities) insights and perspectives on the EU / Europe's vulnerability and preparedness to control (detect/manage) focal Invasive Alien Species (IAS) of concern for the Better-B project, namely:

1. Small hive beetle (*Aethina tumida*)
2. Yellow leg Asian hornet (*Vespa velutina nigrithorax*)
3. Tropilaelaps (*Tropilaelaps spp.*)

3.3 Darwinian selection

To gain expert (e.g., scientists) and practitioner (e.g., representatives for beekeepers) insights and perspectives on harnessing natural / Darwinian selection to improve the resilience of managed honey bee colonies to impacts of climate change and diseases e.g., colony collapse due to *Varroa destructor* mite. The focus for questioning concerns the anticipated benefits and challenges of 'local adaptation' of honey bee colonies, and practical implications for beekeepers wishing to employ this method to improve the resilience of their colonies.

4. Study methodology

4.1 Participant recruitment and sampling

For each topic area an initial 'seed list' of experts and practitioners have been identified in collaboration with project partners associated with these topics. The targeted number of interviews is 20 per topic, however interview insight 'saturation' maybe achieved before reaching this target. It is apparent that research on the topic areas 'Darwinian selection', as well as 'Invasive species' are developing fields, with only a limited number of people considered to have sufficient expertise to interview. The selection of interviewees follows 'purposive sampling' methodology. This method relies on researcher judgment to identifying and selecting the individuals, that can provide the best information to achieve the study's objectives. In addition, the snowball technique will be used to gather additional contacts, if considered necessary. Snowball sampling is a low cost and relatively efficient method for locating individuals, and it can be deployed to collect data very quickly (Johnson, 2014). Individuals targeted and recruited for interview differ for the three topics areas and details are provided in the following sections.

4.1.1 Hive designs

An internal workshop was initially held with partner researchers, from several different countries, with knowledge of beehive designs to gain their input on three themes of interest.

1. Expected climate change impacts to be faced by beekeepers in partner countries.
2. Beehive designs commonly used in partner countries.
3. Typical locations of beehives/apiaries in partner countries.

The outcome of this workshop was a commitment to carry out interviews in eight partner countries, with partner researchers undertaking interviews with local beekeepers. The focus for recruitment, to gain practical insights, has been to contact beekeepers known to have experience of modifying their hives, so-called 'experimental beekeepers'. Most of interviewees have been recruited through local networks, with target number set for each country, see Table 1. Recruitment and interviews started in October 2024 (ongoing).

Table 1. Hive design interviewee recruitment plan

Country	Target no. beekeepers	Interview partner	Recruitment
France	4-6	COA	Local network
Germany	2-3	MLU	Local network
Italy	2-3	IZSLT	Local network
Norway	2-3	NB	Advert national beekeeper magazine
Romania	2-3	USAMV	Local network
Portugal	2-3	UCOI	Local network
The Netherlands	2-3	VDSJ	Local network
United Kingdom	2-3	TNTU	Local network

4.1.2 Invasive species

To gain experts insights about the three IAS of interest, the focus for interviewee recruitment has been international experts, either scientists or representatives (practitioners) from reference laboratories or animal health institutions, familiar with the species. An initial seed list was prepared in collaboration with partner IZSLT, based on personal knowledge/contacts and restricted review of published literature. A targeted number of interviewees per species and expertise type was determined, see Table 2. Snowball technique will be used to gain additional contacts, if considered necessary. Recruitment via email and interviews online conducted by AU, started in November 2024 (ongoing).

Table 2. Invasive species interviewee recruitment plan

Species	Expertise	Target no.	Recruitment
Aethina tumida (SHB)	Scientists	3-4	Personal email
Aethina tumida (SHB)	Practitioners	3-4	Personal email
Tropilaelaps mite	Scientists	3-4	Personal email
Tropilaelaps mite	Practitioners	3-4	Personal email
Vespa velutina (Asian hornet)	Scientists	3-4	Personal email
Vespa velutina (Asian hornet)	Practitioners	3-4	Personal email

4.1.3 Darwinian selection

To gain scientific and practical insights about the application of Darwinian selection within beekeeping sector. The focus for interviewee recruitment has been international and national experts, either scientists or practicing beekeepers (professional/semi-professional), who have either conducted research or are 'experimenting' with natural / Darwinian selection as a methodology/technique to improve the resilience of honey bee colonies. An initial seed list was prepared in collaboration with project partner WR based on personal knowledge/contacts and restricted review of published literature. A targeted number of interviewees per expertise group was determined, see Table 3, but limited due to individuals identified with sufficient expertise. Snowball technique will be used to gain additional contacts. Recruitment via email and interviews online, conducted by AU, started in November 2024 (ongoing).

Table 3. Darwinian selection interviewee recruitment plan

Expertise	Target no.	Recruitment
Scientists	4-5	Personal email
Practitioners	4-5	Personal email

4.1.4 Informed consent

After initial contact prospective individuals for interviewee have been provided with a study information sheet which details:

- Description and purpose of the study
- Benefits and disadvantages of taking part
- Consent and refusal to take part
- Use of information provided
- Confidentiality of information and protection of personal data

This procedure is followed to ensure participants are aware of the purpose of the study, the use and protection of their data as part of gaining informed consent. Participant consent was either gained in person

(signed a form) for interviews discussing 'hive designs' or verbally given prior to recording online interviews discussing 'invasive species' or 'Darwinian selection'. Participants were able to refuse to participate at any point, prior or during interviews. An example participant information sheet is provided in Appendix 1.

4.2 Semi-structured interview design

Interviews have been developed to follow an in-depth, semi-structured format, where the interviewer elicits information by asking sets of questions (Longhurst, 2009). Sets of interview questions were prepared in conjunction with project partners (COA, IZSLT and WR). However, as interviews were conducted using a semi-structured format, interviews usually unfolded in a conversational manner which allows participants to pursue issues they feel were important. The questions in the interview guides comprise of core questions and several associated questions related to central themes for questioning. Follow-up questions were not necessarily asked in order, as they form a unit related to a main theme. Interviewers could ask other questions that seem relevant to the interview, even if they were not listed. Interviews were intended to be in-depth and exploratory, with a semi-structured format useful for investigating complex opinions. They did not offer researchers a route to the truth but they did offer a route to insights into what people thought (Longhurst, 2009). The interview guides for each topic area are provided as appendices (Appendix 2: Hive designs, Appendix 3: Invasive species, Appendix 4: Darwinian selection).

4.3 Interview procedures

The procedures for conducting and recording interviews are different depending on the topic for discussion, but are predominantly face-to-face, for discussions about hive designs, whilst all discussions about Darwinian selection and invasive species are online. The following sections provide details.

4.3.1 Face-to-Face

Hive design interviews in each of the participating countries have been predominantly carried out in person1 with participating beekeepers. In addition, research partners were encouraged to visit each beekeeper either at their apiary, home or workshop, and intended to last between two to three hours. This time was advised to enable the visiting of hives and the collection of images of apiary setups and hive modifications. In Norway and Romania, several interviews have been conducted online, due to the long travel distances to participants.

4.3.2 Online

Interviews about Darwinian selection and invasive species are conducted online, due to participants being in several different countries. Interviews have been conducted using either Microsoft Teams or Zoom, lasting around ninety minutes. A time limit was advised, to limit interviewee fatigue and fit with participants schedules, many have restricted availability. Although, interviews could be extended if participants consent.

4.3.3 Recordings

To capture interview data effectively, recording of all interviews was considered necessary and appropriate choice for in-depth, semi-structured interviews (Jamshed, 2014). Handwritten notes during interviews are relatively unreliable, and the researchers might miss key points. Recordings make it easier for researchers to focus on the interview content and the verbal prompts. Therefore, all interviews will be recorded and transcribed to generate "verbatim transcripts". Means of recording are different dependent on contact method:

- Face-2-Face interviews: using handheld recording devices for audio recording e.g., mobile phone (microphones optional). Recording tips were provided to partner researchers (see Appendix 5), but partner researchers used their own recording devices.

[1] Online hive design interviews have been conducted in Norway and Romania, since the a number of participants lived a long distance from interviewers.

- Online interviews: using recording features of selected meeting platform (e.g., MS Teams/Zoom) for audio and visual recording. Only audio recordings will be used for transcripts and analysis.

4.3.4 Languages

Hive design interviews have been conducted in national languages, with resident or linguistically proficient researchers of each partner country involved in the study. Darwinian selection and invasive species interviews have been conducted in English, as notified and agreed with all participants by AU researchers. When interviews are done in national languages, other than English, the verbatim transcripts will be translated into English.

4.3.5 Data handling

Interviews will be transcribed, and audio records will be destroyed following transcription. Transcriptions and other material and/or data provided or consented to be taken (e.g., digital images) will be stored on secure serves under the control of research partners. All data concerning participant: emails, audio recordings, transcript, images etc. will be stored and shared between Better-B personnel in a pseudonymized format (using stakeholder ID number only) on secured institutional servers. Each participant will have a "master sheet" containing their name, contact and biographical information with a participant ID number that is securely stored only by AU.

All participant data will be managed in accordance with the General Data Protection Regulation (or GDPR) (EU) 2016/679 on the protection of personal data (GDPR of April 27, 2016), to ensure the privacy and confidentiality of participants. All participants will have followed informed consent procedures (see Informed consent).

5. Study outputs

Once analysed, the insights, results and data gained as part of this study, covering the three topic areas, will be summarised as part of Deliverable 7.2 Topical Reflections, due for publication as a public report in November 2025. In addition, insights and learning will be used to develop two quantitative surveys: 1) assessing aspects of beehive construction and modification for thermal regulation within Europe and 2) assessing the vulnerability and preparedness of European beekeeping towards invasive species and climate change. These surveys are due to be distributed by May 2026 (Milestone 15). The results of these surveys will be provided as deliverables and made available as public reports:

- D7.3 Beehive survey, due November 2026.
- D7.2 EU resilience survey, due November 2026.

Ultimately the outputs of both study interviews and quantitative surveys will provide insights, information and partial content for research partners involved in work package six (COA, IZSLT and WR) to prepare a series of informative guides for various audiences within the beekeeping sector, targeted at both scientific and beekeeper communities. These guides will be published as deliverables and will be publicly available.

- D6.1 Guidance for hive construction due May 2027.
- D6.3 Integrated Pest Management strategies for invasive species due May 2027
- D6.4 Guide to mitigate low-stress beekeeping due November 2026.

References

Jamshed, S. (2014). Qualitative research method-interviewing and observation. Journal of basic and clinical pharmacy, 5, 87-88. doi:10.4103/0976-0105.141942

Johnson, T. P. (2014). Snowball Sampling: Introduction. In N. Balakrishnan, T. Colton, B. Everitt, W. Piegorsch, F. Ruggeri, & J. L. Teugels (Eds.), Wiley StatsRef: Statistics Reference Online: Wiley.

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Appendices

Appendix 1: Participant Information Sheet (example)

The following is an example of the information sheet (master copy in English) prepared and distributed to participants in the 'Hive Design' interviews. It was provided to participants in national languages to read and sign before beginning any interview.

Similar information sheets were emailed to all participants participating in online interviews, prior to each interview. Online participants were reminded of key aspects of informed consent (e.g., protection of personal data and voluntary participation), and asked to verbally provide consent (e.g., see Appendix 3).

Information sheet for the participants

Title of the study: Beehive thermal regulation and wood protection practices

Dear participant,

You have been invited to take part this study being led in <country> by <provide name> on behalf of the Better-B consortium. Before you decide to participate in this interview, take sufficient time to read this information sheet carefully and discuss any concerns with myself or other people. Please take time to ask questions if there are any uncertainties or if you require additional information. This process is called **"informed consent"**. Once you have decided to participate in the interview, you will be asked to provide your written consent ***by signing this document***, confirming you have read this information and confirm your willingness to participate in the interview.

Read this information sheet to familiarise yourself with what you can expect by participating in this study and how the information you give during the interview will be used.

1) Description and purpose of the study

The Department of Ecoscience, Aarhus University (Denmark) and Co-Actions (France) are leading this study. It involves interviews in eight European countries. These interviews are designed to collectively gain information about practical modifications of beehives and their immediate environment to improve the thermal regulation of hives (for ex., to maintain constant temperatures). I, <insert name>, am leading the interview in <country>. This study is part of the project Better-B project (https://www.better-b.eu/) which aims advance beekeeping practices, methods and tools for resilient beekeeping.

The study is conducted in accordance with European guidelines for ethical research in social science and humanities, as well as other international standards including the Helsinki Declaration, written to protect those involved in clinical studies.

2) What will I be asked to do if I agree to take part?

You will be asked to participate in a face-to-face interview, which will last approximately **three hours.** During the interview you will be asked several questions about modifications you may have made to your bee hives and other methods you have used to protect them from the weather (e.g., hot and cold temperatures). In addition, digital images of modifications you have made to your hives will be to be taken, if you give permission to do so and for these to be used in a guide (see below).

3) Do I have to take part?

Your participation in this study is voluntary; it is up to you to decide. If you do decide to take part, you should keep a copy of this information sheet. You can withdraw from this study and participation in the interview at any time. You do not have to give a reason why.

4) What are the possible benefits of taking part?

Your participation in this study will probably not benefit you directly. However, you may benefit in the knowledge that the insights and results obtained will enable us to identify better ways to help beekeepers, through science-based guidelines and technological developments that can help beekeepers improve the thermal regulation (i.e., maintain a stable hive temperature) and weather protection of beehives.

5) What are the possible disadvantages and risks of taking part?

The risk of taking part could be that you may feel inconvenienced (ex: wasting time) by participating in this interview. However, you will be free to leave the interview at any time. You will not be paid for participating in the interview, but there will be no costs for you to participate.

6) How will the information provided at interviews be used?

At the end of the study, we will analyse all the discussions and information provided by you and digital images taken, along with all other participants'. We will write about the study and its findings in a study report, and this will be incorporated into a publicly available practical guide for beekeepers. We will send you a summary of the study report, if you wish. Some of our findings may published in an academic article, newsletter or at any relevant conferences.

7) Will my taking part in this study be kept confidential?

In accordance with the General Data Protection Regulation (or GDPR) (EU) 2016/679 on the protection of personal data (GDPR of April 27, 2016), your privacy will be respected.

If you consent to participate in this study, we will process your data in accordance with the purpose of the study. This processing of data is provided by law on the basis of Article 6, § 1, (b), (e) or (f) and Article 9, § 2 (j) of the General Data Protection Regulation.

In this study, data will collected prior to and during the interview by means of written notes (stored digitally), digital audio/video recordings of discussions and digital images of hive modifications. All information collected during this study will be pseudonymised. This means data you provide can still be linked to your personal file. However, this unique code assigned to you will only be accessible to the investigators (Better-B researchers) or to an appointed replacements.

Only pseudonymised data gain will be used for analysis and in any type of documentation, reports or publications concerning this study. Both your personal data and data concerning your views and opinions relating to beekeeping in the EU will be processed and stored for at least 20 years. All digital data will be held on a secure database on a password-protected computer and/or on password-protected secure electronic network designated for the use by the principal investigator, named below.

The controller of the data is the principal investigator of the study, Dr James Henty Williams (jhw@ecos.au.dk). His research team will have access to yours and all interview data files.

In the context of data protection, your pseudonymised data may become publicly available after the study, therefore any interested parties can have access to, process, and/or further analyse your pseudonymised data. Controller for the purposes of the General Data Protection Regulation (GDPR), other data protection laws applicable in Member states of the European Union and other provisions related to data protection is: **Better-B project,** Email: info@better-b.eu

8) How do I agree to take part?

If you are willing to participating in this study please provide your informed consent by reading, indicating your agreement. Please complete the following section and sign be before starting the interview.

.....

6. Informed consent

	Yes	No
I have read and understood the document "Information sheet for the participants" pages 1 to page 3 and I have received and kept a copy of this document. I have been informed of the nature of the study, its purpose, its duration and what is expected of me.	☐	☐
I have been informed that both personal data and data I provide during this study will be processed and stored for at least 20 years. I am aware that I am entitled to access and correct this information. As this data is processed for scientific purposes, I understand that access to my data may be postponed until after the end of the study. If I want access to my data, I will address the investigator who is responsible for the processing of the data.	☐	☐
I agree to participate in the study.	☐	☐
I agree the interview will be digitally recorded (audio and visual)	☐	☐
I agree that digital images of any modifications I have made to my beehives, or their immediate environment maybe taken.	☐	☐
I agree that any digital images taken maybe used in publication(s) (e.g., beekeepers guide), website or social media related to the Better-B project. Better-B seeks to use these images for non-commercial purposes. Better-B acknowledges that you retain full copyright of any image(s)/modification(s) and will credit you appropriately, as specified by you, in any publication or display of the image. Better-B will ensure that the image is not used beyond the scope of this permission and that it will not be shared with third parties without your explicit consent. Please inform Better-B of any further conditions or requirements you may have, before or after granting this permission.	☐	☐
I agree that my e-mail address will be used to enable my participation in this study.	☐	☐

Signature	**Date**

Appendix 2: Hive designs interview guide

The following interview guide was distributed to all partners undertaking interviews in their respective countries. This master English version has been used by all partners undertaking interviews in national languages with participants in person (face-to-face). Questions in **Bold**, indicate key questions, and subsequent questions are suggestions to stimulate further insights.

Interview guide for interviewers: Hive designs for thermal regulation and wood protection practices

Source: COA & AU
Version. v1.0 - Final
Date: 12/09/2024

2 Major Themes for the interviews:

[1] Thermal regulation practices

[2] *How do they protect the wood in their hives[2]? Hive material protection practices*

2 minor themes:

a. Invasive species
b. Reproduction/selection

Target audience:

Beekeepers known to have experience of insulating their hives (so-called « experimental beekeepers »)

Methodology:

- **Start of the interview**: **Introduce** yourself and your work (where you're from, who you are, what your objective is, the project Better-B you are working for even James and Anna background?). Then, **specify copyrights**: interview data may remain anonymous and results will be accessible to them in all cases, and made public via Better-B platform. Ask if it possible to visit the apiary with them.
- **During the interview**: **Record,** if possible (to enable us later to IA transcription), at least take your own **notes** regarding the key (highlighted) questions and **quote** literally any passage interesting (and note the time). If you visit an apiary where the hives or environment have been modified, **take photos** if permission is given.
- **After the interview**: **Small debriefing** with by web conference (2 hours) to help us understand the key issues that have come up (e.g.: easy to handle, reversible material?) in the form of learning outcomes + quotations + photos.

Later: We will ask you to distribute a nationwide online survey to confirm the learning results with quantitative data. Interview insights will be used to develop this survey.

[2] Task 3.6 is dedicated to the study of the thermo-hygro-mechanical behaviour of beehive wood, i.e. the mechanical deformations of the hive resulting from variations in temperature and humidity in the outdoor environment (beehives are mostly outdoors). Techniques used to protect beehive wood modify this thermo-hygro-mechanical behaviour. To what extent? The hypothesis is that climate change, by imposing constraints of drought and increased heat or rainfall, will influence the mechanical deformations of beehive wood.

Outcomes: In addition, and more importantly for interviewees, is that the information and insights they provide will be used to help develop an **illustrated guidance booklet** (possibly with images they provide) with practical methods and tools for improved hive construction. This is a public deliverable due at the end of the project, but it will be sent/made available to all interviewees.

Remark: The questions are not necessarily asked in order. They form a unit related to the theme of the paragraph. Do not hesitate to ask other questions that seem relevant to the interview, even if they are not listed here. The point is not to ask the questions listed one after the other, but rather to immerse yourself into this guide and let yourself be guided by the course of the interview, which will reveal singularities.

Interview Guide

Beekeeper sociography (30min-1h).
Key points:
- Personal data (age, gender, place of residence, etc.)
- Professional data and life trajectories (origins of beekeeping, training, career paths, etc.)
- Type of beekeeper (number of hives, professional, hobby, local production, network, education, etc.)

- **How long have you been a beekeeper? Why did you want to become one?**
  - Have you taken any beekeeping training courses? Where and for how long?
  - Do you subscribe to beekeeping magazines?
  - Do you keep bees alone, or are you part of a network: member of a trade union or association?
- **How many hives do you have?**
  - Would you consider yourself a professional or hobby beekeeper (= main source of income)?
  - What products do you sell? To whom?

Goals and ideals (30min-1h)
Key points:
-Ideal beehive
- Beehive market, opinion of- what's currently available
- Practice adaptation/structure

- **What do you consider a "good hive" and a "beautiful hive"?**
  - Why do you consider it a good/beautiful hive?
  - What aspects make it a good/beautiful hive?
- **Which hive would you ideally like to keep your bees in?**
  - Is the ideal hive for you as a beekeeper, or for your bees, or for both of you?
- **What do you think of hives currently sold on the market?**
  - Do you think they sufficiently protect your bees from **temperature extremes** either very hot summers or very cold winters?
  - Is there a gap between what should be done to protect hives e.g., using insulation and what is currently on the market?

- Note: the following two questions are not the focus for this study. However, beekeeper perspectives on these two topics would be useful to link with a series of expert interview we are conducting.
- As an explanation for interviewees, these questions are asked to gain general background information, if relevant. Helping us determine if these impact the beekeeping management practices (in relation thermal regulation), as they could be additional stressors**.**

- **Do invasive species play a role in your beekeeping? – how so?**
- **How do you steer reproduction / selection of the next queen?**
  - Do you buy queens(import)? – what do you consider when purchasing?
  - Do you breed the next queen/does your hive select her?

Thermal regulation practices (30min-1h)
If needed, explain what we mean by 'thermal regulation practices': modifications to beekeeper's hives or the immediate surroundings (e.g., shelters) to help protect hives and maintain stable temperatures (e.g., from hot or cold extremes).

Key points:
-Modifications techniques (hives, environment) incl. technical details, trials and evolutions
-Motivations for modifications practices (yield, personal interest, sensitivity, etc.)
-Efficiency evaluation (test, yield, observations, bee health, etc.)
-Sharing knowledge

- **What modifications have you done, either to your hives or their placement (e.g. immediate surroundings), to help regulate temperatures within your hives?**
  - What, in your opinion, are the most important aspects/factors for helping to ensure stable temperatures in your hives?
  - Are there **external aspects/factors** related to **immediate location/placing** of hives? e.g., shade, shelter, windbreak etc.
  - What, in your opinion, are the most important aspects/factors for **modifying the construction** of your hives to help ensure stable temperatures?
  - What are the advantages of your modifications?
    - Are there any disadvantages?
- **How did you come to modify/experiment with the construction of your hives for thermoregulation?**
  - What prompted the need?
  - What are you trying to protect your hive against?
  - What's your motivation for doing so (e.g. using insulating)?
  - How did you know what to try?
  - What's the benefit for the bees?

- **Have you tried different modifications/techniques (e.g., different types of insulation[3])? – did you develop any?**
  - How? by trial and error, or as part of a design process involving a thermal engineering consultancy, for example?
  - What have you tried?
  - What is the most important factor in insulating a hive?
  - Have you or do you want to (very soon) modify all your hives to the techniques have used, or not yet?
- **Did you learn these modifications/techniques from another person or group?**
  - Do you talk to other beekeepers about your modifications/experiments and your evaluations of the insulation techniques you've implemented? With whom?
  - Do you want to make more people aware of what you've initiated and experimented with?
  - What role does climate change play in your decision to experiment with insulation techniques?
- **How do you measure or evaluate the effects of your modifications (e.g. insulation techniques)?**
  - What's the benefit for the bees?
  - How do you observe the expected effects on temperature and bees?
  - How do you know if it works or not? How do you see it?
  - Do you consider these evaluation methods to be entirely reliable?
- **Have you observed any harmful effects because of your modifications? Are there any special precautions to be taken?**

Wood protection practices (1h)
<u>Key points:</u>
- Wood material for building hives (wood specie, origin of wood supply, etc.) and beehive protection techniques (walls, joints, roofs)
-Motivations for beehive protection
-Efficiency evaluation
-Sharing knowledge

- **How do you protect the wood in your hives?**
  (soaking in paraffin, paint, vegetable oil, etc.)
  - How come (motivation, function, goal)?
  - What types of joint (assembly technique: half-timber, tenons or dovetail)?
  - Do you notice any deformation or cracks in the wood of the hives? If yes, how do you react? What do you do?
  - Does this depend on the type of joint? the wood protection?
  - How often do you treat your hives? How long does it take? Is it an “expensive” task for you?
- **Do you make your own hives?**
  - What type of hive do you make –Is there a particular reason for this choice?

[3] dictionary definition, to insulate is to protect against an external element. Insulation, the act of covering something to stop heat, sound, or electricity from escaping or entering.

- **How did you come to make beehives? what was your first interest, what were your motivations? how did you learn? from whom?**
  - How have your manufacturing practices evolved (through trial and error in your woodworking and engineering processes)?
  - Is this research/engineering work (when it takes place) carried out in a biomimicry approach (copying nature)?
- **Which wood species do you use?**
  - Why, and why this one rather than another?
  - What criteria led to the choice of this or that species?
    (e.g. weight for transhumance, price for professionals, necessities i.e. availability of supply).
  - Where does the wood you use come from, who supplies it and why?

*Ask the questions below if they **don't make their own hives**?*

- ***What type of hives do you use?***
  - *Is there a particular reason for that choice?*
  - *Where do you get your hives from?*
  - *What criteria led to your choice for selecting this type of hive*

Interest in participatory research (20min)
<u>Key points</u>:
- Questions to researchers
- Scientific testing suggestions

1. **Do you have any questions for researchers? Technical questions?**
2. **Is there any question(s) you feel that has been missed, which I should have asked?**
3. **Any suggestions for tried and tested modifications that we could test together?**
4. **Would you be interested in working with us on instrumenting your hives?**

Appendix 3: Invasive species interview guide

The following interview guide was distributed to AU researchers undertaking interviews. This master English version has been used for all interviews, conducted online and in English. Questions in **Bold**, indicate key questions, and subsequent questions are suggestions to stimulate further insights.

Interview guide for interviewers: Invasives species of concern for the EU beekeeping sector

Source: AU
Version. v1.0 - Final
Date: 28/10/2024

Interview objectives:
Exploratory interviews to gain expert and practitioner insights/perspectives on the EU / Europe's vulnerability and preparedness to control (detect/manage) the three focal IAS of concern for the Better-B project, namely:

1. Small hive beetle (*Aethina tumida*)
2. Yellow leg Asian hornet (*Vespa velutina nigrithorax*)
3. Tropilaelaps mite (*Tropilaelaps spp.*)

Outputs
Insights gained from targeted interviews will inform Task 6.2: Risk assessment and contingency plan for invasive species. Interview insights will also be the basis for the development of a European wide survey to quantitively determine the "vulnerability and the preparedness of the EU beekeeping sector" for the three focal IAS.

The ultimate output (end product) of WP6 will be the development of a **contingency plan** for Tropilaelaps spp., Aethina tumida and Vespa velutina, that will consider: stakeholder awareness/engagement, adoption of early detection/prevention methods (in case of free-areas)

Targeted interviewees
Experts both scientists and practitioners representing authorities (e.g., animal health/ reference laboratories) who have either conducted research or are involved in the detection, control and development of management plans for the three focal IAS.

The snowball technique will be used to gather additional contacts, if considered necessary. It is apparent that this field of research is developing, with only a limited number of people considered to have sufficient expertise to interview. Interview insight 'saturation' maybe achieved before reaching targeted number (20) of interviews.

Interview Guide
This interview guide is divided into several question areas with a first main question and then a series of follow-up questions.

Remark: Follow-up questions are not necessarily asked in order. They form a unit related to the theme of the section. Do not hesitate to ask questions that seem relevant to the interview, even if they are not listed here. This is an exploratory interview.

Introduction

Personal introduction (researcher) and explaining the purpose of the interview.
To gain expert and practitioner insights/perspectives on the EU / Europe's vulnerability and preparedness to control (detect/manage) the three focal IAS <SHB, Vespa velutina, Tropilaelaps>, of concern for the Better-B project.

Interviewer notes: Prior to conducting this interview, the participant will have received an email with the study information and then read the following.

Introduction script:
This interview will take approximately 90 minutes to complete. To ensure that all information will remain confidential, I will not record your name. I will only use a code for this interview when noting your answers.

This interview will be digitally recorded (video and audio), however only the audio recording will be transcribed and analysed.

Your name or any details that might identify you will not be published, and transcripts of this call will be securely stored electronically. All personal information you provide will be kept confidential, anonymous and treated according to the EU regulations on personal data ownership.

Just to remind you, your participation is voluntary, and you may refuse to participate at any time and do not need to give me a reason. You will not be paid for participating in this study and there will be no cost or risk for you to participate. If you would like a copy of the summary report for this study, please let me know at the end of the interview and I will add your name to a list that I will maintain separately. If you have questions later about this study, please contact me at <insert interviewer phone number>.

Please can you confirm you have received and read the study information sheet and consent form. I would like to record this interview. Do you agree to continue and participate in this study and that this interview is recorded?

☐ Yes
☐ No (if no terminate interview)

Do you have any questions about the interview, or this conversation before we begin?

Participant consent needs to be obtained before conducting the interview.
Interviewee: …… (name and institution)
Date: ……

Suggested interview length: 90 mins total

Interviewee background (10 mins)

- **Can you briefly describe your position and area of expertise, in relation to beekeeping?**
  - What is your main area of interest / research in the beekeeping sector?
  - How many years have you been involved with the beekeeping sector industry?
  - Do you have contacts within the beekeeping sector (single beekeeper, local association or national association contacts)?
  - How frequently are you in contact with individuals / associations and for what purpose?

Awareness, preparedness and vulnerability (30 mins)

- **In your view, how prepared do you think authorities and beekeepers in Europe are for tackling outbreaks of <SHB, Vespa velutina, Tropilaelaps>?**
    - To what extent do you think authorities and beekeepers are aware or understand the threats posed by <SHB, Asian Hornet, Asian mite>?
    - What do you think the EU and/or national authorities are in raising public awareness about the threat of <SHB, Asian Hornet, Asian mite> for the environment and food security?
- **What are the key factors that make bee keeping operations in different EU countries more or less vulnerable to <SHB, Vespa velutina, Tropilaelaps>?**
    - How can risk assessments be used to identify and prioritize areas of greatest concern for <SHB, Vespa velutina, Tropilaelaps>?
    - What do you think are the most pressing research priorities for understanding the impact and controlling <SHB, Vespa velutina, Tropilaelaps>?
    - Who do you think has responsibility for supporting research and innovation to develop new tools and methods for detecting / managing <SHB, Vespa velutina, Tropilaelaps>? If needed, prompt:
        - *EU authorities, national authorities, funding bodies / research institutions?*

Monitoring, Surveillance and International Cooperation (20 mins)

- **Can you outline existing monitoring and surveillance systems in place to detect and track the spread of <SHB, Vespa velutina, Tropilaelaps> within the EU?**
    - If given, are these systems effective in providing early warnings?
    - What, in your opinion, actions could be taken to improve/enhance monitoring and surveillance within the EU?
- **How do you see collaboration within EU to address the threats of <SHB, Vespa velutina, Tropilaelaps> threat?**
    - What are the key challenges and opportunities for international cooperation?

Beekeeping sector impact, support and education (20 mins)

- **What do you consider are the potential long-term implications / impacts of <SHB, Vespa velutina, Tropilaelaps> for beekeeping sector in general?**
- **How do you think the EU and/or national authorities help best mitigate these impacts?**
    - How do you think the EU and/or national authorities can best help beekeepers and other actors implement preventive measures and recover losses (socio-economic)?
    - Do you know if the EU has conducted any assessments of the potential socio-economic impacts of <SHB, Vespa velutina, Tropilaelaps> for the beekeeping sector?
        - *Ask participants for brief details or sources for references/documentation.*
    - Are you aware of any plans to provide financial support or compensation to beekeepers affected by <SHB, Vespa velutina, Tropilaelaps>

        - *Ask participants for brief details or sources for references/documentation.*
- **Can you outline any programmes/initiatives, you are aware, for beekeeper education and training regarding prevention, detection, and response measures for <SHB, Vespa velutina, Tropilaelaps>?**
    - Are these programmes effective?
    - What, in your opinion, actions could be taken to improve/enhance these programmes?

Regulatory and Policy Framework (10 mins)

- **Can you briefly outline the current regulatory framework and/or policies for managing <SHB, Vespa velutina, Tropilaelaps> in the EU?**
    - Are you aware of any specific EU regulations or standards in place to prevent the introduction and spread of <SHB, Vespa velutina, Tropilaelaps>?
- In your opinion are these sufficient/effective to detect and manage the treats posed by <SHB, Vespa velutina, Tropilaelaps>?
    - Are you aware of plans to revise or update these regulations or standards?
        - *Ask participants for brief details or sources for references/documentation.*

Recommendation and finish

We are seeking additional experts or practitioners, familiar with 'invasive species' of concern for the beekeeping sector in the EU, and Europe's vulnerability and preparedness to control (detect/manage) these IAS <SHB, Vespa velutina, Tropilaelaps>. Could you suggest a colleague, or someone known to you?

Is their email address publicly available?

Name	Organisation	Email

- **Finally, do you have any questions for me?**
    - If unable to answer immediately, note question and state project team member will respond.
- **Would you like to receive a copy of the study report?**

- ☐ Yes (confirm email address)
- ☐ No

Appendix 4: Darwinian selection interview guide

The following interview guide was distributed to AU researchers undertaking interviews. This master English version has been used for all interviews, conducted online and in English. Questions in **Bold**, indicate key questions, and subsequent questions are suggestions to stimulate further insights.

Interview guide for interviewers: Darwinian selection to improve honey bee colony resilience

Source: AU
Version. v1.0 - Final
Date: 18/10/2024

Interview objectives:
Exploratory interviews to gain expert and practitioner insights/perspectives on harnessing natural / Darwinian selection to improve the resilience of managed honey bee colonies to impacts of climate change and diseases e.g., colony collapse due to *Varroa destructor mite*. The focus for questioning concerns the anticipated benefits and challenges of 'local adaptation' of honey bee colonies, and practical implications for beekeepers wishing to employ this method to improve the resilience of their colonies.

Outputs
Insights gained form interviews will guide and inform researchers working on Task 6.4: Guide for low-stress beekeeping practices. The ultimate output (product) of WP6 will be the development of a 'Guide to mitigate low-stress beekeeping' which is due to be published as a deliverable (public report) at end of the project (D6.4 M42).

Targeted interviewees
Experts both scientists and beekeepers (professional/semi-professional) who have either conducted research or are 'experimenting' with natural / Darwinian selection as a methodology/technique to improve the resilience of honey bee colonies.

The snowball technique will be used to gather additional contacts, if considered necessary. It is apparent that this field of research is developing, with only a limited number of people considered to have sufficient expertise to interview. Interview insight 'saturation' maybe achieved before reaching targeted number (20) of interviews.

Interview Guide
This interview guide is divided into several question areas with a first main question and then a series of follow-up questions.

Remark: Follow-up questions are not necessarily asked in order. They form a unit related to the theme of the section. Do not hesitate to ask questions that seem relevant to the interview, even if they are not listed here. This is an exploratory interview.

Introduction

Personal introduction (researcher) and explaining the purpose of the interview.
To gain expert (e.g., scientists) and practitioner (e.g., representatives for beekeepers) insights/perspectives on harnessing natural / Darwinian selection to improve the resilience of managed honey bee colonies to impacts of climate change and diseases e.g., colony collapse due to Varroa destructor mite.

Interviewer notes: Prior to conducting this interview, the participant will have received an email with the study information and then read the following.

Introduction script:
This interview will take approximately 90 minutes to complete. To ensure that all information will remain confidential, I will not record your name. I will only use a code for this interview when noting your answers.

This interview will be digitally recorded (video and audio), however only the audio recording will be transcribed and analysed.

Your name or any details that might identify you will not be published, and transcripts of this call will be securely stored electronically. All personal information you provide will be kept confidential, anonymous and treated according to the EU regulations on personal data ownership.

Just to remind you, your participation is voluntary, and you may refuse to participate at any time and do not need to give me a reason. You will not be paid for participating in this study and there will be no cost or risk for you to participate. If you would like a copy of the summary report for this study, please let me know at the end of the interview and I will add your name to a list that I will maintain separately. If you have questions later about this study, please contact me at <insert interviewer phone number>.

Please can you confirm you have received and read the study information sheet and consent form. I would like to record this interview. Do you agree to continue and participate in this study and that this interview is recorded?

☐ Yes
☐ No (if no terminate interview)

Do you have any questions about the interview, or this conversation before we begin?

Participant consent needs to be obtained before conducting the interview.
Interviewee: …… (name and institution)
Date: ……

Suggested interview length: 90 mins total

Interviewee background (10 mins)

- **Can you briefly describe your position and area of expertise, in relation to beekeeping?**
  - What is your main area of interest / research in the beekeeping sector?
  - How long have you been a researcher / beekeeper?
  - Do you keep honey bees?

If a beekeeper

- **How many hives do you have?**

- Would you consider yourself a professional or hobby beekeeper (= main source of income)?
- What products do you sell? To whom?
- Do you operate alone, or are you part of a network e.g., member of beekeeping association or trade union or?

Threats to beekeeping [brief questioning - try to limit to 10 mins)

- **What do you consider are the biggest threats to beekeeping today?**
  - What parasites/diseases are of most concern?
    - Varroa destructor (ecto-parasitic mite)?
    - Other invasive species? e.g.,
      - Small hive beetle (*Aethina tumida*)
      - Yellow leg Asian hornet (*Vespa velutina nigrithorax*)
      - Tropilaelaps mite (*Tropilaelaps spp.*)
  - Do you think **climate change** has had an impact on honey beekeeping?
    - In what ways?
      - Impacting foraging (feeding) e.g., changing seasons - earlier spring, wild winters
      - Availability of floral / food resources (nectar / pollen)
      - Frequency of parasite/disease outbreaks?
  - What impact do you think will climate change have in the future?

Definition and benefits of natural selection (20 mins)

- **Could you briefly explain how you would define 'natural selection' or 'local adaptation' when thinking about managed bee colonies?**
  - What are the key factors that ensure the fitness/survival of colonies?
  - Could you briefly explain **how it differs from current breeding programs** used within bee keeping sector?
    - E.g., targeted selective breeding
  - What do you consider are the **main advantages / benefits** for taking 'natural selection' or 'local adaptation' approach for managing honey bee colonies?
    - Maintaining genetic diversity?
      - *By keeping all surviving phenotypes (beneficial traits), including possibly rare alleles (genetic characteristics) beneficial for resistance to parasites and pathogens*

Experiences of application of natural selection in beekeeping context (20 mins)

- **Can you outline what your experiences and/or views of using natural selection / local adaption for beekeeping, to ensure healthy colonies.**
  - Scientific experiments conducted or know about
  - Practical use of (application) of natural selection in own bee colonies
    - How long have you been studying / applying natural selection as an approach for bee breeding?
- What do you think are the **key results / outcomes** of the experiment / natural selection programs you have observed?
- Adoption of natural selection as a method benefiting resilience of honey bee colonies (30 mins)
- **How do you think 'natural selection' could be exploited best in a beekeeping?**

  - What do you think are feasible and/or realistic steps for beekeepers to benefit from a natural selection approach?
  - Is there a particular method / approach you think is promising?
    - E.g., island colony / no human intervention (Gotland Experiment)
    - E.g., Darwinian Black Bee Box (DBBB) program?
- **What do you think are the main / biggest limitations for using natural selection by beekeepers, to improve colony resilience?**
  - Especially when thinking about **parasites/diseases**
    - Colony losses to great – 'strong inbreeding' amongst surviving colonies
    - Outbreeding counteracted the effects of selection (swarming and colonies dispersing)
  - What about **resilience against impacts of climate change**?
- **What would you suggest as practical ways to minimise the risk / potential consequences (e.g. colonies collapsing) for beekeepers, if they wanted to use natural selection?**
  - Use of chemical treatments to manage parasites/diseases? How would this impact natural selection?
- **What actions do you think could or should be taken by beekeeping organisations or authorities to encourage beekeepers to use natural selection.**
  - What **training or information** do you think beekeepers would need?
    - Who could provide this training / information?
    - What format could this training / information take to target beekeepers?
    - Integrated into existing training programs?
  - Could or should be incentives be used to encourage beekeepers to use natural selection?
    - What types of i**ncentives** could you envisage e.g., financial incentives for beekeepers / attending courses?
    - Who could/should offer these incentives?
    - How could they work in practice?
  - What **policy initiatives, if any,** do you think could be used encourage the adoption of 'natural selection' approaches within the beekeeper communities?
    -

Recommendation and finish

We are seeking additional experts or practitioners, familiar with 'natural selection' as a method to help improve the resilience of honey bees. Could you suggest a colleague, or someone known to you?

Is their email address publicly available?

Name	Organisation	Email

- **Finally, do you have any questions for me?**
  - If unable to answer immediately, note question and state project team member will respond.
- **Would you like to receive a copy of the study report?**

- ☐ Yes (confirm email address)
- ☐ No

Appendix 5: Recording Tips

The following guide was distributed to all partners undertaking interviews in their respective countries for the hive design interviews. It was provided to aid partners gain reliable audio recordings for use when transcribing interviews.

Recording tips for interviewers: Hive designs for thermal regulation and wood protection practices

Source: COA & AU
Version. v1.0 - Final
Date: 12/09/2024

- On a smartphone, you can use Voice Recorder (or a similar application) or a dedicated voice recorder.
- Make sure your device is fully charged, as recording can take up to 3-4 hours.
- Make sure you have enough memory space on your device (500MB-1GB).
- Remind the interviewee that the interview will be recorded as stipulated in the informed consent.
- Place the recorder on the table when you're chatting around a table, or hold it in your hand when you're at the apiary, but either way, the aim is for the interviewee to forget about the recording (to avoid *any stylistic effects*). In case of *any stylistic effects*, please indicate it in the template document (marking the minutes you have this feeling)
- Stop recording every 30/45 minutes (when you feel comfortable), save the file in the device memory and name it. Don't forget to start recording again!
- At the end of the interview, transfer the saved files onto your computer, name them in the right order and send them to us via swisstransfer. If you don't do this immediately after the interview, you risk ending up with different files.
- When you use the same device to record and take pictures (which is the case when you use a smartphone), be careful to get back to the voice recorder screen after taking pictures so that you can see that you are still recording correctly (watching the minutes tick by)
- When recording, the light of the phone can either attract the attention of the beekeeper or can even switch off, which make it difficult for you to be able to read the interview guide through while doing the interview. We can just advise you to read the interview guide, or have a printed version hidden in a note pad.