EFSA scientific opinion on survival, spread and establishment of the small hive beetle (Aethina tumida)

efsa
European Food Safety Authority

Standing Committee on Plants, Animals, Food and Feed
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BACKGROUND – SHB OUTBREAK IN ITALY

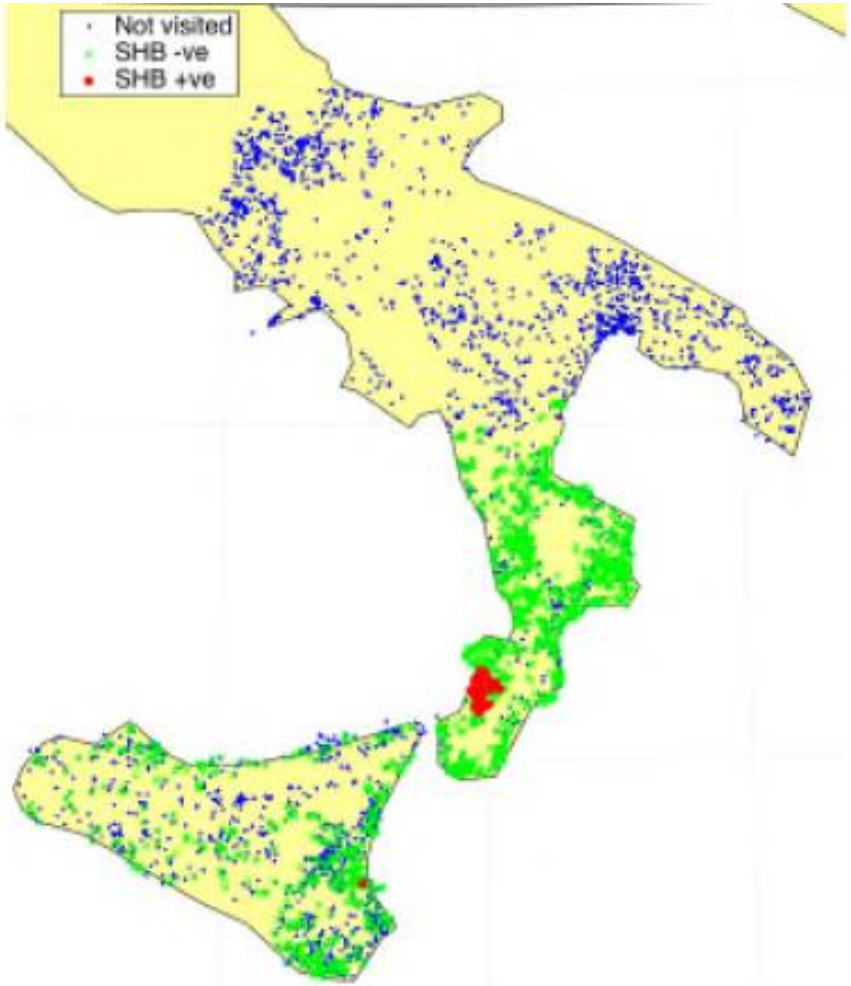


Figure 1: Spatial location of apiaries in the south of Italy with indication if SHB detection was positive or negative in the apiaries that were inspected between 5 September 2014 and 30 September 2015

TOR1: RISK OF SURVIVAL, SPREAD, ESTABLISHMENT

TOR1: the **risk of survival, spread and establishment** of SHB in and **from Calabria and Sicily into other parts of Italy and the EU** under various scenarios:

a) by natural movements of live bees (*Apis mellifera*), including feral colonies and of the SHB, under currently applicable emergency conditions, taking into account especially relevant geographical and meteorological conditions;

b) by natural movements of live bees and of the SHB and by intra-EU movement of bee colonies, queens and apiculture products and by-products from infected areas, under identified risk mitigation measures;

c) by natural movements of live bees and of the SHB and by intra-EU movement of bee colonies, queens and other products and by-products in absence of EU rules (i.e. similar as applicable to *Varroa* mites)

TOR1: MODELLING SHB SPREAD

METHOD

- 2 separate but similar mathematical models to simulate the SHB spread from infested to non-infested apiaries

a) Due to proximity to infested apiaries (**distance-only model**)

b) due to proximity and through beekeepers infesting their other apiaries through 'unintentional transfer' of the beetle (**distance and ownership model**).

CONCLUSIONS

- **Movement of an infested hive** could spread SHB **rapidly** over **large distances**
- with **natural spread alone**, the beetle alone will take more than **100 years** to reach Abruzzo from Calabria (around 250 km northwards)
- model considering the **ownership** of multiple apiaries per beekeeper indicated a **10-times-faster** spread

TOR1: ONCE INTRODUCED, SHB COULD COMPLETE ITS LIFE CYCLE IN ALL MS BETWEEN MAY AND SEPTEMBER

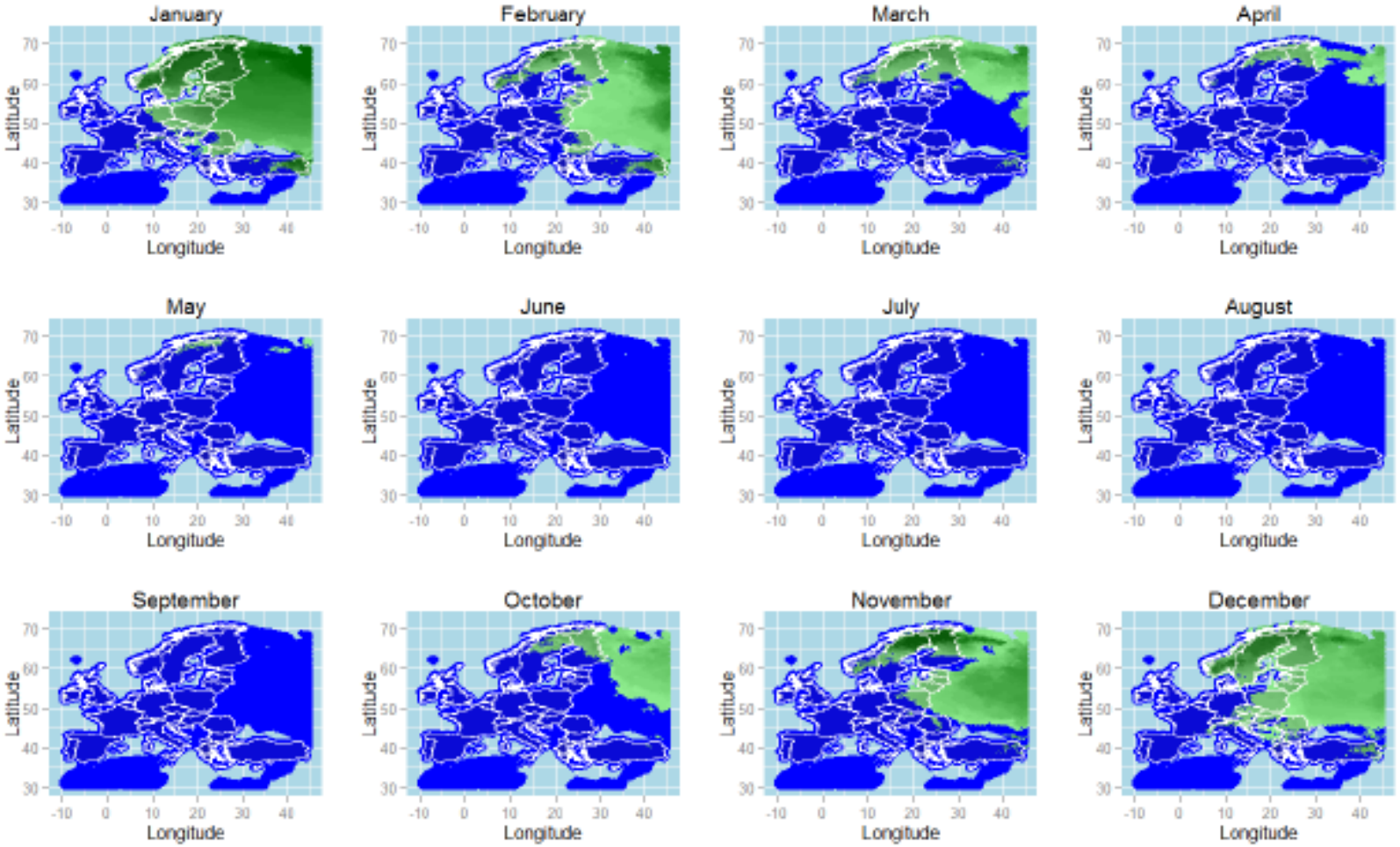
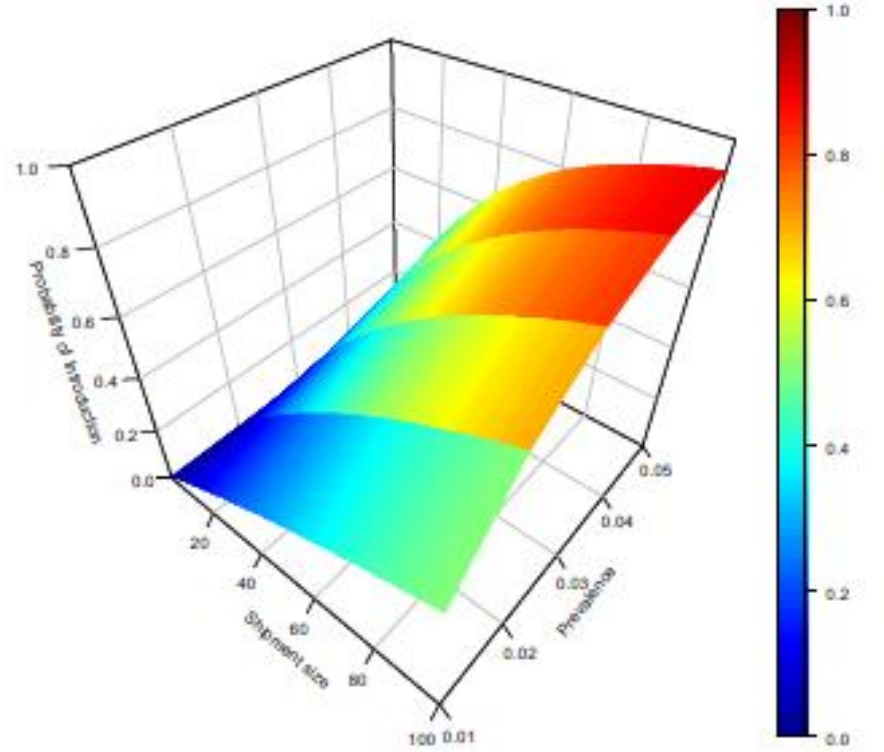


Figure 2: Maps indicating, in green, regions in Europe where the estimated maximum temperature 20 cm below ground was below –1°C on at least 1 day in the month and, in blue, regions where was not the case (assuming grassland cover for all areas of Europe and no snow cover effects)

TOR1: PROBABILITY SHB INTRODUCTION VIA EU-TRADE



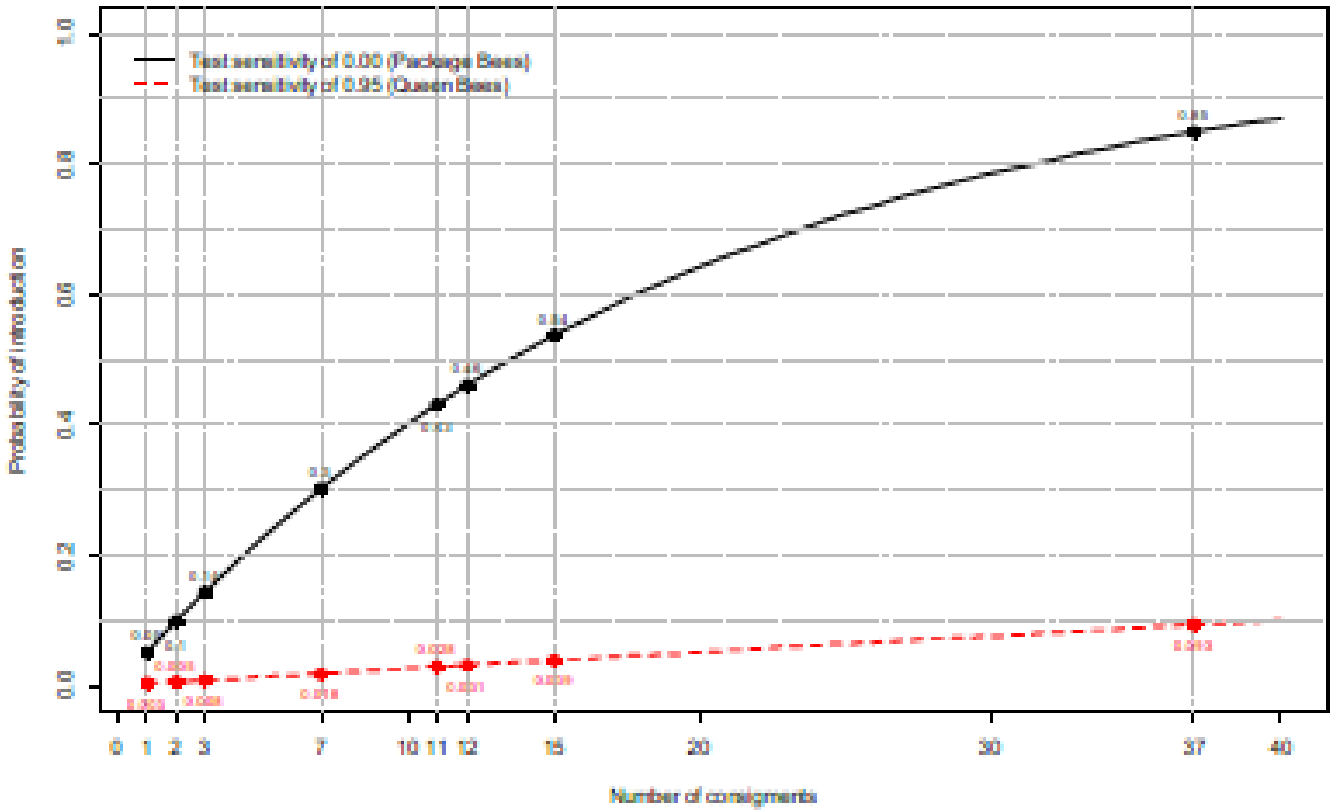
(B) Test sensitivity is equal to 0.5

The **probability of SHB introduction** is mainly dependent on the **sensitivity of the test** to detect SHB in traded consignments and the **number of shipments** arriving in a country in a given time period.

Table 2: Number of consignments that need to be moved from an SHB-infested to a SHB-free area to achieve a probability of SHB introduction of 0.95

Test sensitivity	SHB prevalence 0.01	0.02	0.03	0.04	0.05
0.00	299	149	99	74	59
0.50	595	296	196	146	116
0.95	5 934	2 938	1 939	1 440	1 140

TOR1: PROBABILITY SHB INTRODUCTION VIA EU-TRADE



Every dot on the graph represents an officially reported number of bee consignments shipped from Italy to another European country in 2014 (see Appendix C) and the number next to it represents the probability of SHB introduction assuming test sensitivity 0 (e.g. package bees; black full line) or test sensitivity 0.95 (e.g. queen bees; red dashed line).

Figure 7: Probability of SHB introduction into a SHB-free country given **SHB prevalence at the place of origin of 5%** as a function of the number of consignments and the sensitivity of the applied test

TOR1: RISK OF SURVIVAL, SPREAD, ESTABLISHMENT

RECOMMENDATIONS

- Perform **detailed epidemiological studies** on the Italian outbreak to improve **knowledge** on introduction, survival, spread and establishment of SHB in Europe.

- A **register** of the **location** of apiaries, **ownership** and **number** of hives within an apiary/area, together with **tracking information** on the travel route of shipments, is essential to facilitate epidemiological investigations in the event of an outbreak.

TOR2: RISK MITIGATION FOR INTRA-EU TRADE

TOR2: **risk mitigating factors** that could potentially be effective in **ensuring safe intra-EU trade** of live bees (both colonies and queens) and apiculture products and by-products as regards the transmission of SHB

RESULTS AND CONCLUSIONS

Table 4: Scoring of effectiveness (Eff.), technical feasibility (Feas.) and uncertainty (Unc.) of methods to monitor, isolate or treat a consignment. Measures are highlighted in green when they have a high score for effectiveness, a high score for technical feasibility and low score for uncertainty.

Risk mitigation measure	Place	Queens and attendants			Colonies/swarms or package bees			Bee products to be used in apiculture			Non-extracted comb honey			Used beekeeping equipment		
		Eff.	Feas.	Unc.	Eff.	Feas.	Unc.	Eff.	Feas.	Unc.	Eff.	Feas.	Unc.	Eff.	Feas.	Unc.
Monitoring SHB freedom in a consignment																
Visual inspection and health certificate*	O, D	H	H	L	M/L	M/L	H/H	M	L	H	M	L	H	M	L	H
Isolating the consignment																
Use of fine mesh	T	H	H	L	H	H	L	H	H-M-L	L	H	H-M-L	L	H	H-M-L	L
Treatment to prevent SHB infestation in a consignment																
Fumigants	O	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U
Irradiation (400 Gy)[a]	O	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	H	L	L
Freezing (–12°C or less at core for at least 24 hours)[a]	O	NA	NA	NA	NA	NA	NA	H	H	L	H	M	L	H	H-M-L	L
Heating (50°C at core for at least 24 h)[a]	O	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	H	H-M-L	L
Desiccation	O	NA	NA	NA	NA	NA	NA	H	H	L	NA	NA	NA	H	H-M	L

(a): Recommended by OIE Terrestrial Animal Health Code (2015).
NA, not applicable; L, low; M, moderate; H, high; U, unknown; O, place of origin; T, during transport; D, place of destination.

TOR2: RISK MITIGATION FOR INTRA-EU TRADE

RECOMMENDATIONS

- The assessment assumed *perfect implementation of visual inspection*, although this might not always be the case in practice. Therefore, it is recommended that the **SHB status of the area of origin of consignments be taken into consideration when issuing health certificates for intra-EU movement of bee consignments**, as is already done in the case of import from third countries.

- It is recommended that **movement restrictions** on the movements of honey bees, bumblebees and commodities from infested to non-infested areas be **maintained until SHB is eradicated**, to prevent spread of the pest.

TOR3: RISK MITIGATION WHERE ERADICATION IS NO LONGER THE OBJECTIVE

TOR3: risk mitigating factors and methods in apiaries, including quick diagnosis and potential treatment(s), **alternative to currently employed complete destruction** of the apiary and additional risk mitigating factors that may be applied in controlled environments for queen producing;

CONCLUSIONS

- No specific control measures are available to keep honey bee queen production free from SHB in an infested area where eradication is no longer the objective.
- There is no EU legislation in place regarding movement control of honey bees, bumblebees or commodities within an SHB-infested area where eradication is no longer the objective.

TOR3: IMPLEMENTING VISUAL INSPECTION, TRAPS, GOOD BEEKEEPING PRACTICES, HYGIENE AND SOIL TREATMENT

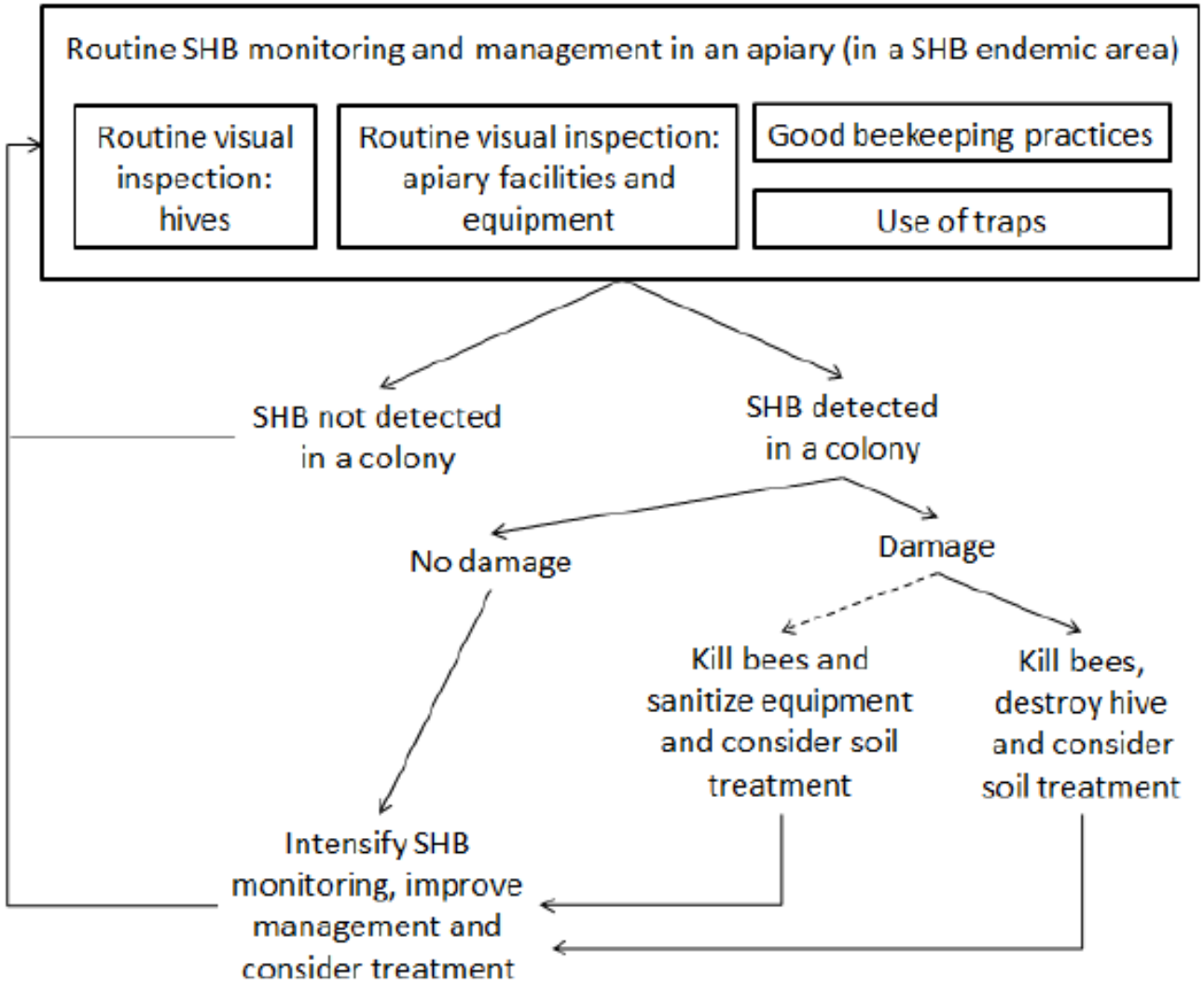


Figure 9: Overview of routine SHB monitoring and management in an apiary in an SHB-infested area where eradication is no longer the objective

TOR3: RISK MITIGATION WHERE ERADICATION IS NO LONGER THE OBJECTIVE

RECOMMENDATIONS

- **Strengthening good honey house hygiene standards and good beekeeping practices** are the most important measures to keep SHB infestation at low level in an infested area where eradication is no longer the objective.

- **Soil treatment with pyrethroids** to control SHB should be applied **only in case of comb damage** in an area where eradication is no longer the objective.

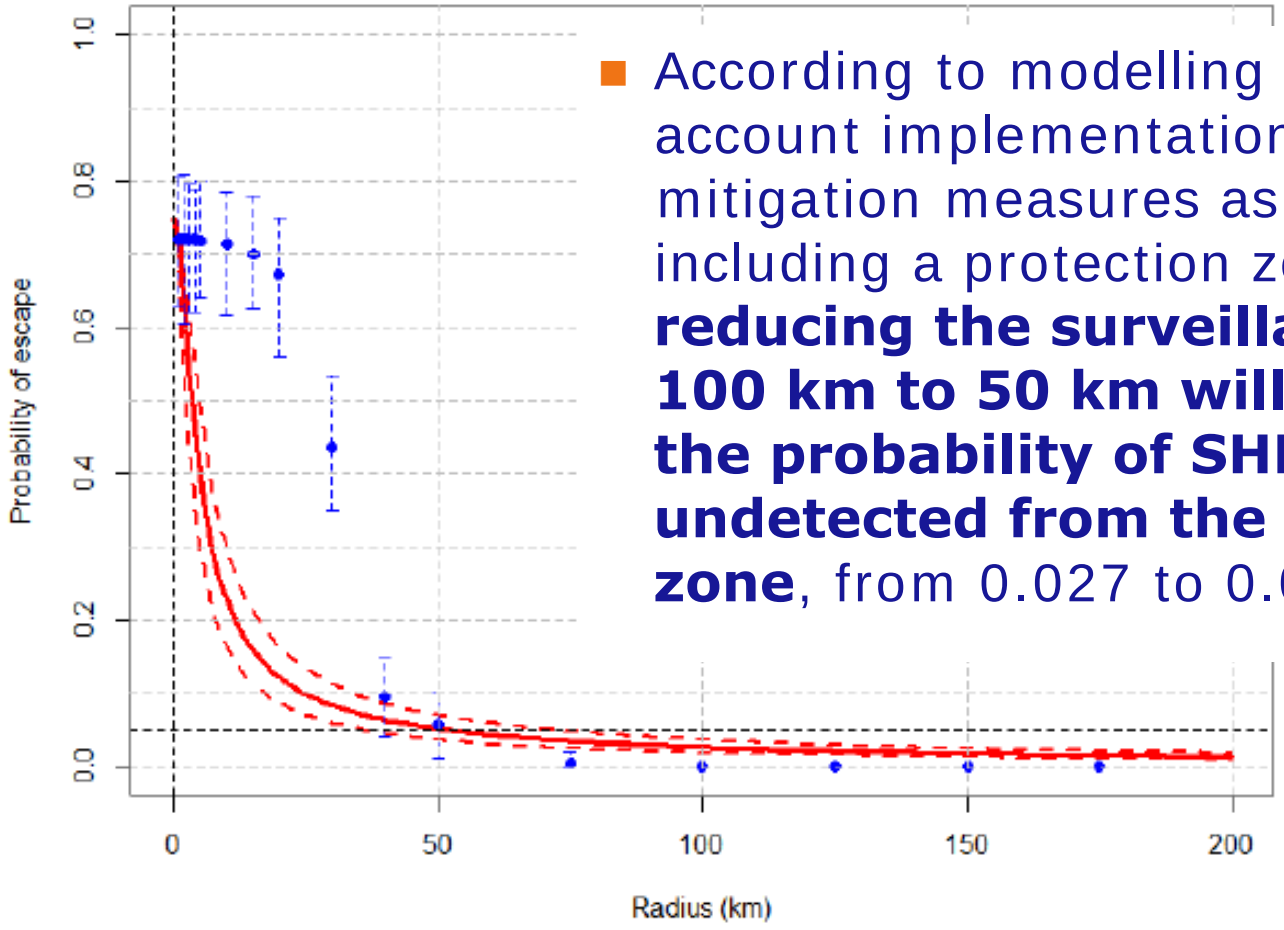
TOR4: SHB SURVEILLANCE

TOR4: surveillance (active and passive) in assessing freedom of areas from SHB including the size (radius of) of the areas to be surveyed in order to provide solid bases for regionalisation policy;

CONCLUSIONS

- The **OIE requirement** to implement a 5-year monitoring to substantiate SHB freedom is based on the current knowledge of the biological characteristics of the pest. **The 5-year period could be used until data become available as basis for a more detailed assessment.**

TOR4: SHB SURVEILLANCE



- According to modelling that took into account implementation of inspection and mitigation measures as done by Italy including a protection zone of 20 km, **reducing the surveillance zone from 100 km to 50 km will at least double the probability of SHB escaping undetected from the surveillance zone**, from 0.027 to 0.053.

Figure 10: Probability of SHB escaping a surveillance zone of a given radius using the analytical approach described by Schley et al. (2009). The solid line represents the median and the dashed lines represent the 95% credible interval. The blue circles and error bars show the median and 95% credible interval from simulations of the 'distance-only' model

TOR5: KEPT BUMBLEBEES AS A RESERVOIR FOR SHB

TOR5: susceptibility of **kept bumblebees (*Bombus terrestris*)** to SHB or their **capability to spread SHB** as vectors.

CONCLUSIONS

- A field experiment showed natural infestation of commercial bumblebee B. impatiens colonies placed next to SHB-infested honey bee hives. However, no data on SHB infestation in natural bumblebee colonies have been published.

- Food resources and conditions in bumblebee colonies are attractive to SHB and suitable for its development. Therefore, **bumblebee colonies acting as a reservoir for SHB cannot be excluded.**

TOR5: KEPT BUMBLEBEES AS A RESERVOIR FOR SHB

RECOMMENDATIONS

- **Studies** are needed on the **capacity of *B. terrestris*** occurring in Europe to act as SHB host.
- Kept **bumblebee boxes** should be **destroyed** after the pollination service

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