SCIENTIFIC REPORT submitted to EFSA

Bee Mortality and Bee Surveillance in Europe[1]

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Abstract

The bee surveillance project sought information on both the prevalence of honey bee colony losses, and the surveillance systems found in 27 European countries. Through a standardized questionnaire, data was obtained from 24 countries, relating to 25 systems. Each of the surveillance systems collecting these data was evaluated. In addition, a thorough literature search of the existing databases, as well as relevant grey literature about causes of colony losses was completed, and the literature evaluated.

The main conclusions from project activities can be summarized as follows:

- General weakness of most of the surveillance systems in the 24 countries investigated;
- Lack of representative data at country level and comparable data at EU level for colony losses;
- General lack of standardisation and harmonisation at EU level (systems, case definitions and data collected);
- Consensus of the scientific community about the multifactorial origin of colony losses in Europe and in the United States and insufficient knowledge of causative and risk factors for colony losses.

The project makes recommendations, in the following areas:

- Establishment of a sustainable European network for coordination and follow-up of surveillance on colony losses to underpin monitoring programmes;
- Strengthen standardization at European level by harmonization of surveillance systems, data collected and by developing common performance indicators.
- Build on the examples of best practice found in existing surveillance systems for communicable and notifiable diseases already present in some countries;.
- Undertake specific studies that build on the existing work in progress to improve the knowledge and understanding of factors that affect bee health (for example stress caused by pathogens, pesticides, environmental and technological factors and their interactions) using appropriate epidemiological studies (case control and longitudinal studies).
- The set up of the coordination team at European level. This is a crucial issue and the coordination team should be organized in such a way so as to ensure its sustainability and to enable effective surveillance programme activities at the European level.

Summary

The Agence Francaise de Sécurité Sanitaire des Aliments (AFSSA) set up a consortium of seven European bee disease research institutes in order to answer the European Food Safety Authority (EFSA) call **CFP/EFSA/AMU/2008/02** to assess existing surveillance systems, and to collate and analyse existing data and publications related to honey bee colony mortality across Europe. This consortium gathered partners representing the following countries: France, Germany, Italy, Slovenia, Sweden, Switzerland and the United Kingdom. The project was divided into three work packages: (i) a description and critical analysis of surveillance programmes that measured colony loss, (ii) the collection and analysis of the epidemiological datasets on colony losses, (iii) a critical review and selection of relevant literature on the possible causes and risk factors of colony losses.

Description and critical analysis of surveillance programmes

A standardized surveillance network assessment tool (SNAT) was developed to analyse the European colony loss surveillance programmes. Twenty-seven European Ecconomic Area (EEA) countries were selected to be part of the study. Twenty-five SNATs from 24 countries were completed, received and processed. Some Member States completed several SNATs, two countries had no surveillance system in place (Ireland and Portugal) and one country provided no answer (Romania). The SNAT analysis allowed the countries to be classified into four categories: those with (i) a very good level of compliance with the standards of a good operating system (1 system), (ii) an upper intermediate level of compliance (4 systems), (iii) a lower intermediate level of compliance (12 systems) or (iv) a low level of compliance (8 systems).

Eighty percent of the surveillance systems were found to comply with less than 50% of the 40 items covered by the questionnaire. This generally low level of compliance reflects a broad margin for improvement in most of the European surveillance systems considered within the project. Concerning surveillance procedures and protocols, of the 18 systems stating that they have in place active surveillance procedures, only 6 can be considered as valid active systems able to produce representative figures of the true colony loss situation for the countries in question.

It was found that colony loss surveillance systems in Europe are characterised by a variety of the approaches and operational methodologies. Nevertheless, the majority do share common aspects, in particular the weakness of the systems implemented, and the lack of representative data produced.

The project advocates the improvement of the surveillance systems and has produced a set of 20 recommendations, designed to enhance honey bee surveillance systems at the European level.

Collection and analysis of the epidemiological datasets on colony losses

Data from surveillance networks were collected and standardised in order to allow analysis at the European level. The only indicator that appeared to be commonly used was the “global colony loss rate” during the over-wintering period. Therefore, not all aspects of colony losses (such as summer losses) could be addressed through this study. Temporal and geographical analyses showed an important variability in colony losses. However, such trends are difficult to interpret considering the wide variation in the quality of the systems that produce these data.

Nevertheless, the project noted (i) a baseline colony loss rate around 10% each year at the European level and (ii) a higher rate of colony loss in some countries during the years 2003 and 2008.

This analysis clearly highlights an absence of shared epidemiological indicators, collected following common surveillance procedures and based on comparable populations. Trend analysis and mapping suggests some periods of higher colony loss rates, but these findings should not be over interpreted. They serve to illustrate the fact that existing data collection systems are not robust enough for between-country comparisons across Europe, or the analysis of trends at the European level.

Harmonisation of surveillance procedures at a European level should lead to the establishment of a consistent and robust set of epidemiological indicators, calculated following the same rules and protocols in all countries, and produced by comparable active surveillance procedures applied across comparable populations. This recommendation is essential, as this will not only allow accurate comparisons to be drawn between the status of different European countries, and thus facilitate the objective assessment of fluctuating colony losses within Europe. An appropriate tool to monitor colony losses at a European level is important since it will provide National and European decision makers, and also the beekeeping industry, with accurate figures about colony mortality which, in turn could focus control and research activities.

Critical review and selection of relevant literature

The literature review work package provided the opportunity to develop a specific methodology for literature search and analysis. The "priority 1" references selected and reviewed validated the objectivity of the literature search which is expressed through the range and diversity of topics included (none of the topics appeared to be over-represented).

The results of this work regarding risk and causative factors involved in colony losses have to be taken as a "snap shot" of the scientific community's opinion as they are today; these are "time sensitive", and evolving due to the amount of ongoing research which is likely to lead to new findings and a better understanding of the factors involved in the coming months or years.

There is a consensus amongst the scientific community that the causes of colony losses in Europe and in the United States are likely to be multifactorial (in the two aspects of this term: combination of factors at one place and different factors involved according to place and period considered). Factors implicated include beekeeping and husbandry practices (feeding, migratory beekeeping, treatments and so forth), environmental factors (climate, biodiversity, etc.), chemical factors (pesticides) or biological agents (*Varroa*, *Nosema*, etc.) which together create stress, weaken bees' defense systems allowing pests and pathogens to kill the colony (e.g. one or several parasites, viruses, etc.).

High concentrations of pesticides have rarely been identified in relation to colony losses (CCD in USA and winter colony losses in Europe) although acute events of pesticide toxicity are well described during the production season (and clearly differentiated from CCD and winter colony losses). However, the questions of possible synergistic effects of various pesticides and the effect of chronic exposure to sublethal doses of pesticides remains, and requires further investigation. Biological agents such as parasites, viruses or bacteria, alone or in combination, have clearly been

identified as important factors in colony losses. Nevertheless, there is still a lack of knowledge about the exact mechanisms and/or interactions involved, this must also be addressed. Even though the multifactorial origin of colony losses is well acknowledged, the respective role of each factor as a risk or causative agent is unknown, and no hierarchy of relative threat posed by each one has been established. These matters require further investigation using appropriate epidemiological studies (case control and longitudinal studies).

There are many inconsistencies in the ways in which "colony losses" are defined. Up to 17 different definitions for CCD exist in the literature. This means that reports may not always be referring to the same phenomenon, and this creates confusion when trying to explain the origin of what has been identified in the field. The described pathology is varied, with authors using the same descriptions for different sets of circumstances. A specific study should be undertaken to clearly categorise and quantify the various expressions of colony losses in the field. This study should be closely linked to the strengthening of surveillance systems.

Conclusion

The main conclusions from project activities can be summarised as follows:

- General weakness and high variability of most of the surveillance systems in the 25 systems investigated;
- Lack of representative data at country level and comparable data at EU level for colony losses;
- Consensus of the scientific community about the multifactorial origin of colony losses in Europe and in the United States and insufficient knowledge of causative and risk factors for colony losses.

From these finding the consortium makes the following recommendations:

1. Implementation of a sustainable European network for coordination and follow-up of surveillance, and research on colony losses to underpin monitoring programmes;

2. Strengthen standardization at European level by harmonization of surveillance systems, data collected and by developing common performance indicators;

3. Build on the examples of best practice found in existing surveillance systems on communicable and notifiable diseases already present in some countries;

4. Undertake specific studies that build on the existing work in progress to improve the knowledge and understanding of factors that affect bee health (for example stress caused by pathogens, pesticides, environmental and technological factors and their interactions) using appropriate epidemiological studies (case control and longitudinal studies);

5. The set up of the coordination team at European level. This is a crucial issue and the coordination team should be organized in such a way so as to ensure its sustainability and to enable effective surveillance programme activities at the European level.

Key words:

Honey bee mortality, colony losses, colony collapse disorder, CCD, overwintering mortality, surveillance system, passive surveillance, active surveillance, risk factors, causative factors, Europe, assessment, SNAT, bee diseases, Varroa, Nosema, Acarapis, viral diseases, fungal diseases, beekeeping practice, pesticides, neonicotinoids, environmental factors, climatic factor, pollen quality, multifactorial, literature search method, epidemiological indicator, nutrition, weakening, migration, immunosuppression

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Background

Beekeeping is an ancient skill, and honey bees (*Apis mellifera* L.) have been managed in Europe for several millennia[2]. They contribute to our wealth and wellbeing, not just directly, through production of honey, but indirectly by providing essential pollination services to a wide range of crops and wild plants. Honey bees are amongst the most specialised, and are arguably the most dominant, pollinators of the world's quarter million angiosperm species. Without the foraging activities of honey bees, our diets would lack an array of the nutritious fruits, seeds and vegetables required for good health[3], and many wild animals would be deprived of their food sources and habitats. It has been estimated that in excess of eighty percent of the European Union's crops depend, at least in part, on insect pollination[4]; honey bees are the easiest to manage, and thus appear to be the most important overall crop pollinators[5,6,7]. The Millennium Ecosystem Assessment project estimates the global annual monetary value of pollination to be many hundreds of billions of dollars[8]. In view of their outstanding economic and ecological value, there is a need to monitor and maintain healthy honey bee stocks, not just locally or nationally, but on an international scale[9].

Since 2003 there have been reports in Europe and America of serious losses of bees from beehives. In 2006 the term Colony Collapse Disorder (CCD) was first used to describe this phenomenon. CCD is characterised by the rapid loss from a colony of its adult bee population. No dead adult bees are found inside or in close proximity to the colony[10]. At the final stages of collapse, a queen is only attended by a few newly emerged adult bees. Collapsed colonies often have considerable capped brood and food reserves. In America a survey of bee keepers reported an average loss of 38% of colonies during the winter period of 2006-2007[11]. The cause of CCD has not been determined; however, many theories have been postulated including starvation, viruses, mites (*Varroa*), electromagnetic radiation or pesticide exposure[12,13]**.** In March 2008, EFSA was contacted

[2] Crane E. (1999) Recent research on the world history of beekeeping. *Bee World* **80**, 174-186.
[3] Buchmann, S.L, Nabhan, G.P. (1997) The forgotten pollinators. Island Press, Washington DC, USA.
[4] Williams, I. H. (1994) The dependence of crop production within the European Union on pollination by honey bees. *Agricultural Zoology Reviews* **6**, 229-257.
[5] McGregor, S.E. (1976) Insect Pollination of Cultivated Crop Plants. U.S. Department of Agriculture–Agricultural Research Service, Washington DC, USA.
[6] Delaplane, K.S., Mayer, D.F. (2000) Crop Pollination by Bees. CABI Publishing, UK.
[7] Buchmann, S.L, Ascher, J.S. (2005) The plight of pollinating bees. Bee World, **86**, 71-74.
[8] M.E.A. (2005) Millennium Ecosystem Assessment. Ecosystems and human wellbeing: Biodiversity synthesis. World Resources Institute, Washington DC.
[9] Potts, S.G., Roberts, S.P, Dean, R., Marris, G.C., Brown, M., Jones, R., Neumann, P., Settele, J. (2009). Declines of managed honeybees and beekeepers in Europe. *Journal of Apicultural Research, in press*.
[10] Cox-Foster, D. L., Conlan, S., Holmes, E. C., Palacios, G., Evans, J. D., Moran, N. A., Quan, P. L., Briese, T., Hornig, M., Geiser, D. M., Martinson, V., Vanengelsdorp, D., Kalkstein, A. L., Drysdale, A., Hui, J., Zhal, J. H., Cui, L. W., Hutchison, S. K., Simons, J. F., Egholm, M., Pettis, J. S. & Lipkin, W. I. (2007) A metagenomic survey of microbes in honey bee colony collapse disorder. Science, 318, 283-287.
[11] Vanengelsdorp, D., Underwood, R., Caron, D. & Hayes, J. (2007) An estimate of managed colony losses in the winter of 2006-2007: A report commissioned by the apiary inspectors of America. American Bee Journal, 147, 599-603.
[12] Hayes, J. (2007) Colony collapse disorder - Research update. American Bee Journal, 147, 1023-1025.
[13] Kievits, J. (2007) Bee gone: colony collapse disorder. Pesticides News, 3-5.

by the "Mortality, collapse and weakening in bee hives" working group of Agence Francaise de Securite Sanitaire des Aliments (AFSSA), who sought information on the following topics:

- monitoring of chemical residue levels in honey within the Member States
- surveillance programmes monitoring collapse, weakening and mortality in bees active within the EU
- data on levels of honey production in the Member States

Directive 96/23/EC sets out the requirements for national monitoring for certain residues and substances in live animals and animal products including honey. Regulation 396/2005 came into force in September 2008 and extends the requirement for chemical residue monitoring in honey to include certain plant protection products. All Member States report the results of the national residue monitoring plans.

To address the second and third points, EFSA distributed a short questionnaire to Member States through the EFSA Focal Point network requesting information on surveillance programmes, literature relating to colony collapse, weakening or mortality in bees and estimates of the bee population in member states for 2006-2007. The information from the questionnaires was collated in the report Bee Mortality and Bee Surveillance in Europe. Twenty-one member states and Norway completed and returned the questionnaire. Seventeen bee surveillance programmes in sixteen countries were identified that are relevant to assess aspects of collapse, weakening and mortality. Ten member states provided references for reports produced from surveillance programmes or research programmes addressing the issue of colony collapse and bee mortality. To follow on from the survey EFSA plans to launch an EU-wide collective study in the area of CCD. This requires an EU-wide review of literature on the topic and description of active surveillance programmes to facilitate an objective assessment of all possible causes of CCD. The resulting work from the study will prepare the grounds and orientate research towards identified gaps in scientific knowledge.

Terms of reference

EFSA is seeking

- a description of study design for bee surveillance programmes active in Europe;
- the compilation of a dataset of historical nominators and denominators for colony collapse, weakening and colony mortality from the surveillance programmes described;
- a review of relevant published scientific literature and reports from surveillance programmes for possible causative factors of CCD.

The outcome of the project would be to facilitate future EU level epidemiological research and surveillance programmes addressing the phenomenon of colony collapse.

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Introduction and objectives

Following a question raised by a working group on "Mortality, collapse and weakening in bee hives" of AFSSA (France), EFSA implemented a short survey on the surveillance programmes in 24 European countries. Some literature references related to honey bee colony collapse, weakening or mortality in bees and estimates of the honey bee population in member states for 2006-2007 were also provided. This survey enabled to identify 17 surveillance systems in 16 countries and gather relevant publications. In order to follow on from this survey, EFSA decided to launch a project targeted on the assessment of existing surveillance systems and collation of existing data and publications related to honey bee colony mortality. Therefore, EFSA published a call for proposals on "Bee Mortality and Bee Surveillance in Europe" (CFP/EFSA/AMU/2008/02) in September 2008.The overall objective of the project was to facilitate future EU level epidemiological research and surveillance programmes addressing the phenomenon of honey bee colony collapse.

AFSSA set up a consortium of seven European bee disease research institutes in order to answer this call. This consortium gathers partners representing the following countries: France, Germany, Italy, Slovenia, Sweden, Switzerland and United Kingdom (See Appendix 1 for detailed partners description), and committed to the implementation of the following work packages (WP) as described in the project document:

- WP1: description and critical analysis of surveillance programmes; recommendations for the improvement and harmonisation at the European level;
- WP2: collection and analysis of the epidemiological datasets on colony collapse, weakening and mortality, stemming from the existing surveillance programmes;
- WP3: critical review and selection of relevant literature on the possible causes of honey bee colony collapse, weakening and mortality.

The consortium was notified the acceptance of its proposal in December 2008, and the AFSSA coordination team met with EFSA in Parma on January 26 2009 to officially launch the project. The project ended in October 2009. During the course of the project, all partners of the consortium met twice: one time in Zagreb on March 2009 and a second time in Paris in September 2009. Two interim reports followed by two interim meetings were organised in Parma between AFSSA and EFSA (in May and September 2009). Appendix 2 summarizes the global agenda of the project and appendix 11, 12 and 13 present the minutes of the meetings held in Parma.

Project methodology and all results are presented in this report for each work package. All achievements are summarised in a general conclusion. All materials gathered through the project have been uploaded to the EFSA web platform and a CD has been burned to gather the same material, as well as all databases developed during the project.

During the course of the project, a parallel survey on colony collapse disorder has been undertaken by the COPA-COGECA in June 2009 on colony losses in Europe. Unfortunately, due to the fact that the project methodology was already fixed and all questionnaire already distributed, it has not been possible to harmonize the methodologies of the two studies. The conclusions of this study were received two days before the closure of the project and it was therefore not possible to take them in consideration in our conclusions. Conclusions of the COPA-COGECA survey are nevertheless added in appendix 14 and 15.

1 WORK PACKAGE 1: ASSESSMENT OF SURVEILLANCE PROGRAMMES

Several terms are found in the literature about the phenomenon of honey bee mortality: CCD for colony collapse and depopulation, colony mortality, colony weakening, colony depopulation. In order to encompass all aspects of colony mortality, and avoid excluding any causative or risk factor or any situation, the consortium decided to exclusively use the term "colony losses" to name the phenomenon targeted by surveillance systems and literature.

The objective of this work package was to describe and critically analyse honey bee surveillance programmes in European countries, through a standardized assessment method, in order to develop recommendations for their improvement and harmonisation at a European level.

This section describes the specific tool designed to implement the assessment of the surveillance programmes, the way it has been applied in those countries that took part in the project, and how results were managed and analysed. It also provides a description of the surveillance systems and general figures for the analysis and interpretation of colony losses in each case.

Findings generated by this work package allowed the consortium to develop recommendations for the improvement of the surveillance system in Europe, and the follow-up at the European level.

1.1 Material and methods

1.1.1 Conception of the assessment tool

Assessment of surveillance networks needs the collection of all data related to the organisation, operation and results of the system. The Surveillance Network Analysis Tool (SNAT) is the result of a common work started in 2005 and undertaken by a group of international veterinary epidemiologists coming from three different regions: Caribbean, North Africa and Indian Ocean. This tool has been specifically designed to assess national surveillance systems. It has been used in the Caribbean region within a project aimed to support national animal diseases surveillance systems in the frame of the regional network "Caribvet". More than 15 countries have been assessed, and some of the national results can be accessed on the website of the regional network (www.caribvet.net). Considering that all surveillance systems have to operate following similar generic standards to be efficient, it was been decided to adapt the SNAT for the use of the bee surveillance project.

The SNAT is built according to two logical steps: The first draws up a detailed inventory of the structures and procedures of the epidemiological surveillance network for animal diseases. The second presents a summary of the progress of the network for its principal fields of activity, through a summary table. The description of the surveillance system is organised following a detailed inventory of the 10 items constituting a classic surveillance protocol:

- Objectives and scope of surveillance;
- Central institutional organization;
- Field institutional organization;
- Diagnostic laboratory;

- Formalisation of surveillance procedures;
- Data management;
- Coordination and supervision of the network;
- Training;
- Restitution and dissemination of information;
- Evaluation and performance indicators.

In order to simplify the understanding of a surveillance network, the SNAT captures a high level outline through to the detailed description of the network. The first part presents a one page summary of the overall results of the SNAT, displaying the level of compliance for each one of the 10 completed sections of the questionnaire. The second part is the detailed questionnaire, which includes all the necessary questions that must be addressed in order to obtain a precise description of the network for each one of the 10 sections. At the end of each section, a summary of findings and specific comments are presented, based on these results. The summary part of each section of the questionnaire is always presented in the form of four criteria that may or may not have been satisfied by the network under study; If the criterion is satisfied, established through completing the relevant section of the questionnaire, the box corresponding to the criterion is ticked. Otherwise it is left blank. Levels of compliance are indicated by corresponding pie charts.

The consortium worked together to adapt and validate the SNAT for use with assessing honeybee surveillance systems.

The final Bee SNAT is annexed in Appendix 3.

1.1.2 Methodology for completion of the SNAT questionnaire

Considering the results of the original EFSA report (no questionnaire received for Bulgaria and Cyprus, no surveillance system identified for Latvia and Lithuania), 27 European countries were targeted to be part of the study meaning that all country considered to possibly have a surveillance system for bee colony losses have been integrated. The questionnaire was completed using data that was already available (extracted from the EFSA report[14]). Questionnaires were sent to appropriate contacts in each country by consortium members, having first completed the questionnaire for their own country, to check that they had understood all questions. The SNAT questionnaire was then sent to their neighboring contacts, defined in the request form. Once the contact person had completed the questionnaire, it was sent to the consortium member for initial validation before being sent to AFSSA Lyon for processing and a second validation. Any further questions that needed clarification from each completed SNAT were addressed in subsequent follow up enquiries, to help finalise the SNAT.

[14] EFSA (2008) Bee Mortality and Bee Surveillance in Europe - A Report from the Assessment Methodology Unit in Response to Agence Francaise de Securite Sanitaire des Aliments (AFSSA). Report EFSA-Q-2008-428. 11 August 2008. 28 pages. http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1211902584688.htm

1.1.3 Quality of the SNATs

A quality scoring system was applied to display the overall quality of the completed SNAT questionnaires. A score from 0 to 4 was attributed according to the following criteria:

- 4: Good level of compliance to the SNAT format, good communication with and participation of the person in charge of SNAT completion,
- 3: SNAT formalized correctly but some unconvincing answers given to the questions sent to the person in charge of SNAT completion ,
- 2: SNAT completed but no possibility of further communication, or of obtaining answers to the questions raised by the results with the person in charge of SNAT completion,
- 1: SNAT completed using the «expert opinion» of someone not belonging to the country
- 0: Not possible to have any information from the country or any expert opinion
- NA: «Not applicable» because no surveillance system thus no SNAT.

1.1.4 Data entry and management

The information gathered through the SNATs was entered onto a database. It holds the following data:

- All summary information per section, that was used to draw up pie-charts;
- Some of the important questions within the sections that were considered interesting to allow comparisons at a European level.

Specific queries were developed to allow data extraction and to draw graphics for data interpretation as follows:

- A query to allow automatic production of the summary table of pie-charts (see below);
- A query to allow a transversal interpretation of the summary questions of the sections at the European level (see below);
- A query to allow data interpretation of other specific data integrated into the database.

All data entry was centralised and realised by AFSSA, after validation of the SNATs.

Note: The database described above was developed for the specific needs of the project but could also be used in the future to regularly update information about the surveillance systems in place. This would allow EFSA or any other organisation to follow-up progress and changes of the surveillance networks in each country.

1.2 Results

1.2.1 Responses to the questionnaire

Twenty-five SNATs from 24 countries were completed, received, validated and processed (Figure 1). Some countries with several surveillance systems provided more than one SNAT (i.e. France and the United Kingdom). Two countries with no surveillance system did not complete the SNAT questionnaire (Portugal and Republic of Ireland) and have been excluded from the general analysis of the surveillance systems. One country with a surveillance system was not able to provide answers to the questionnaire, despite trying to reach the appropriate person to obtain useful information on their system (Romania).

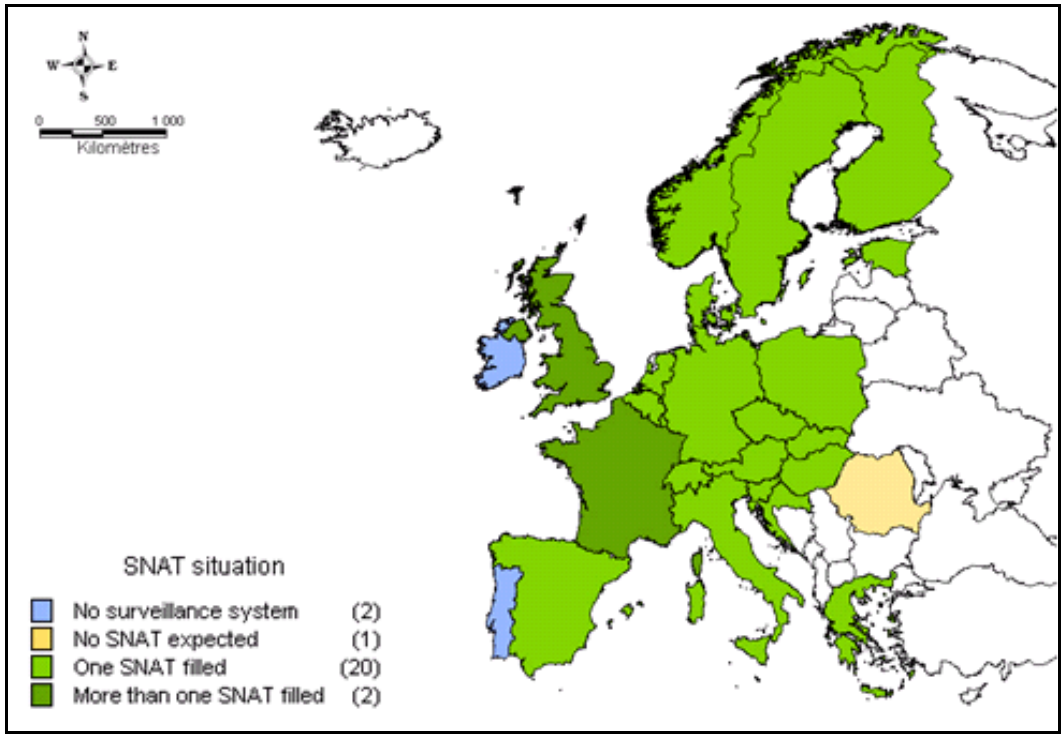


Figure 1. **SNAT situation map**

1.2.2 Quality of the SNATs

The results of quality scoring of all the completed questionnaires are presented in Figure 2.

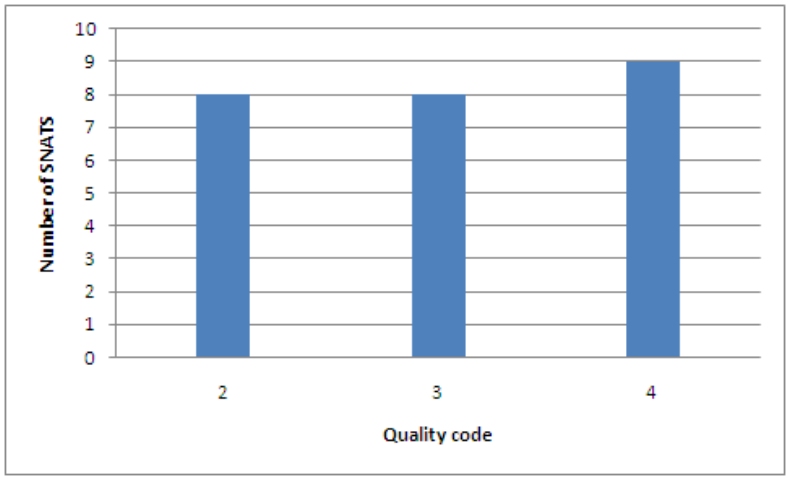


Figure 2. **Quality scoring of the filled SNATs**

Of the 25 completed SNATs, 68% can be considered to be of good or very good quality. For 8 SNATs (32%) it was difficult to obtain the detailed information from the person in charge of the surveillance programme.

No SNATs had a quality score of 1. All participating countries that completed questionnaires were attributed a score of either 2, 3 or 4. No statistically significant link was found to exist between the quality scoring of the SNAT and the quality of the surveillance programme. This is shown by a representation of the average number of questions ticked in the SNAT (out of 40) for each completed quality category (Figure 3). This meant that all SNAT results with quality scores over 1 could be analysed together.

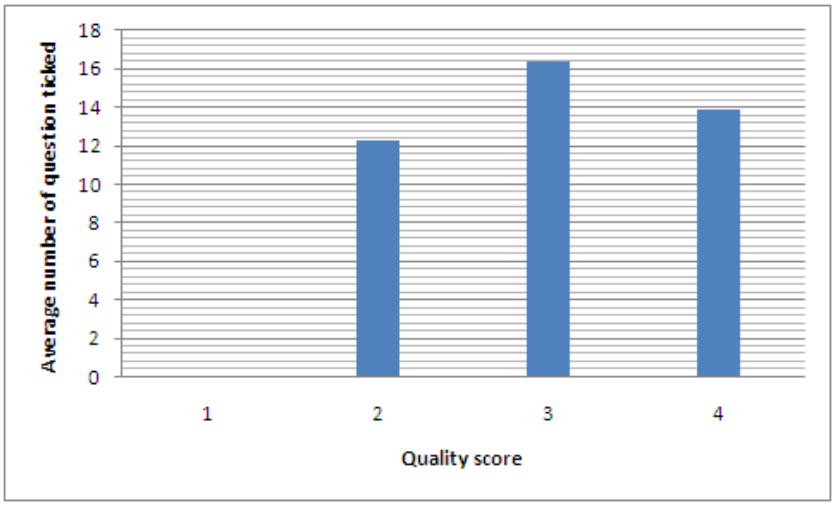


Figure 3. **Average number of ticked questions out of 40 by quality scores**

1.2.3 Validation of the questionnaire

The results displayed in Tables 5 and 6 (see below) and in Figure 7 show a great variety of answers to the questionnaire and to the 40 questions used to provide the overall assessment of each surveillance system. The number of questions ticked showed an almost regular distribution of responses from 1 to 40. This suggests that the questionnaire was appropriately designed to express the diversity of the systems investigated (Figure 4). The surveillance system with the highest score (40 ticked questions) was also recognised by the consortium to be the best operating surveillance system, suggesting that the questionnaire was capable of successfully identifying the strengths and weaknesses of the surveillance systems.

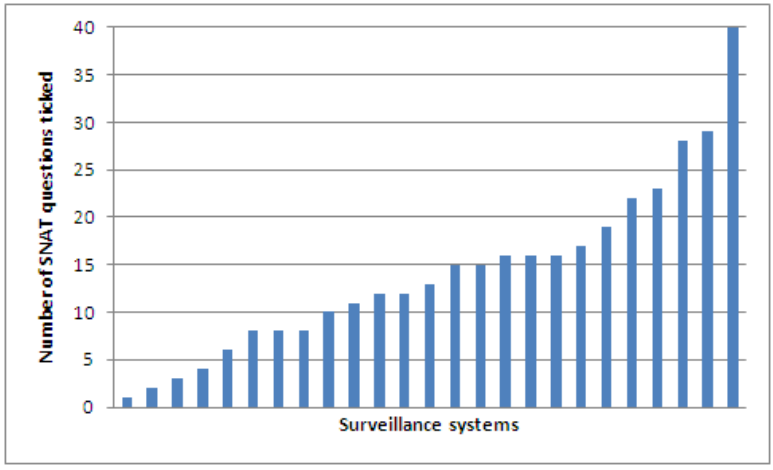


Figure 4. **Number of ticked questions per system**

1.2.4 Limitations of the SNAT

Certain biases must be borne in mind when analysing the SNAT results:

- The questionnaires were completed by the persons in charge of the surveillance systems. Although a validation process was implemented including peer review of the answers by an expert with detailed knowledge of the country (consortium members), and by an expert with an external view of the system, in order to identify discrepancies in the answers, some systems may still have been over or under estimated;
- The decision whether or not to tick a summary question or not is always a subjective process, even when every effort is made to avoid uncertainty as much as possible. The validation process sought to reduce this subjectivity, but final results should be taken as providing an overall view of the systems in question, rather than specific answers to detailed questions;

- Whilst the original veterinary-based SNAT questionnaire was adapted for analysis of honey bee surveillance systems, it should not be considered as finalised. Some sections or questions certainly require further work to optimise their fit to honey bee surveillance systems. The improvement of the SNAT methodology should be considered as an ongoing process which can include improvements by the specialists in this field;
- The SNAT addresses only the operation of the system and no formal link is made with the results of the systems and their intrinsic quality indicators (such as sensitivity, specificity, timeliness and so forth). This part requires further developments of its methodology.

In spite of the above limitations, given that the sections and summary questions are designed to link with the quality of the surveillance systems (as supported by the SNAT results of the better operating systems), the results of the SNAT should be accepted as a totally valid basis on which to make recommendations for their improvement. In addition, SNAT results can also be properly used to estimate the representativeness and precision of the results produced by the surveillance systems.

1.2.5 General presentation of the results

Figures 5-1 and 5-2 show an overview of the SNAT results for all countries for which at least one questionnaire was completed.

		AT	BE-Fl	CH	CZ	DE	DK	EE	ES	Fl	FR-Pbl	FR-Pro	GB-E&W	GB-Sco	GB-Nir
1	*Objectives and scope of surveillance*														
2	*Central institutional organization*														
3	*Field institutional organization*														
4	*Diagnostic laboratory*														
5	*Formalization of surveillance*														
6	*Data management*														
7	*Coordination and supervision of the surveillance system*														
8	*Training*														
9	*Restitution and dissemination of information*														
10	*Evaluation and performance indicators*														

Figure 5-1. **SNAT results**

		GR	HR	HU	IT	LU	NL	NO	PL	SE	SI	SK
1	*Objectives and scope of surveillance*											
2	*Central institutional organization*											
3	*Field institutional organization*											
4	*Diagnostic laboratory*											
5	*Formalization of surveillance*											
6	*Data management*											
7	*Coordination and supervision of the surveillance system*											
8	*Training*											
9	*Restitution and dissemination of information*											
10	*Evaluation and performance indicators*											

2 21 Figure 5-2. **SNAT results (cont.)**

These pie charts present the results of the 40 questions (4 summary questions per 10 sections). The aim of the project was not to rank the countries or the systems, although it would be possible to give a numbered result per country (number of questions ticked per country). This would not have a precise meaning, considering that each question did not have the same "weight" regarding the impact on the surveillance system efficiency. For this reason, individual results of this type have not been presented. However, to gain a broad idea about the level of compliance to the questionnaire, and to estimate the work thus required to improve the performance of the networks, the systems were divided into four classes. These classes were as follows:

- Very good level of compliance: 1 system,
- Upper intermediate level of compliance: 4 systems,
- Lower intermediate level of compliance: 12 systems,
- Low level of compliance: 8 systems.

Results of this classification are shown in Figure 6. Eighty percent of the surveillance systems had implemented less than half of the 40 components considered important for an effectively functioning surveillance system. This suggests quite a low level of compliance, and implies a broad margin for improvement in most of the European surveillance systems in this study.

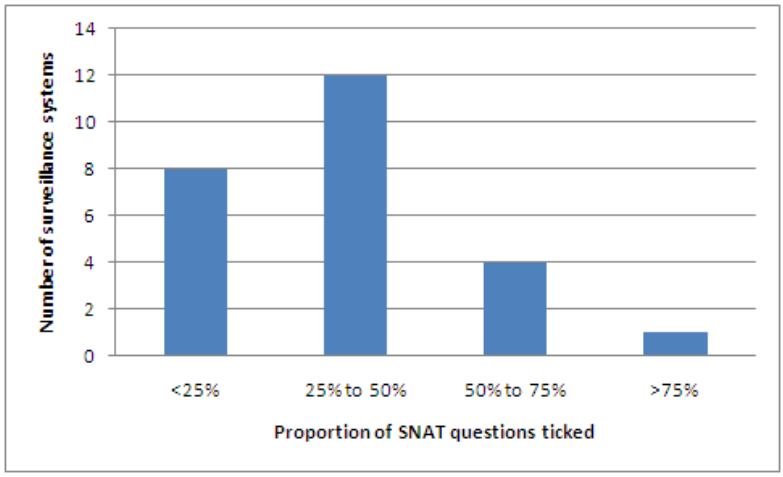


Figure 6. **Level of compliance of the systems to the 40 items of the questionnaire**

Considering the limitations and the subjectivity of the questionnaire, even those systems that complied with the 40 items in the questionnaire may have room for improvement, as recognised by the surveillance programme coordinator. This assumption cannot be considered as a weakness of the SNAT because, by detailing the operation of the system, these gaps are easily identifiable from responses to the questions in the various sections of the questionnaire.

1.2.6 Interpretation per section

The number of questions ticked for each section differed little between sections, apart from section 1 (high number of questions ticked) and section 10 (very low number of questions ticked) (Figure 7).

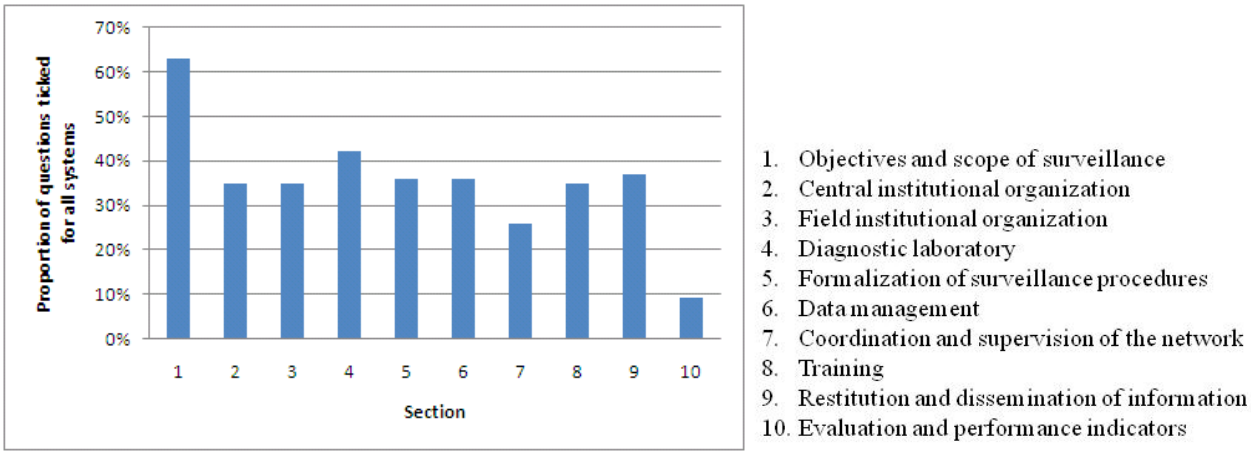


Figure 7. **Number of ticked question per section**

A detailed interpretation of each section is given below.

1.2.6.1 Section 1 : Objectives and scope of the surveillance programmes

This section assesses the objectives and scope of the surveillance programmes in terms of diseases and syndromes under surveillance, the control activities implemented and identification of partners expectations.

This section revealed a good general level of compliance compared to the other sections of the SNATs, with nearly 25% of the systems with a full pie chart (Figure 8). However, half of the systems still have room for improvement in the important area of the relevance of their surveillance objectives. Considering that appropriate objectives have a direct impact on the effective operation of any system, this should be considered very carefully (Figure 9).

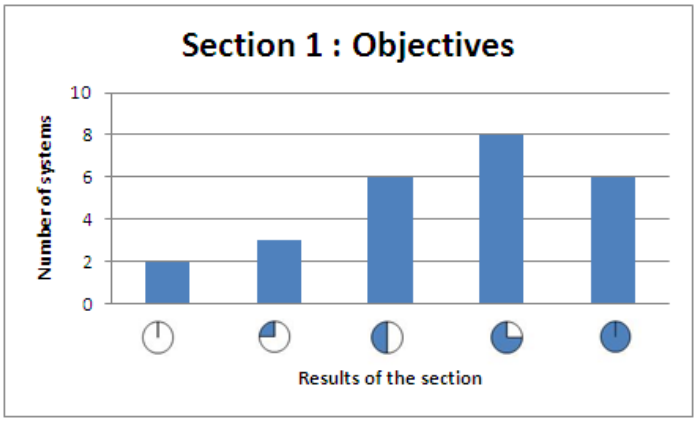


Figure 8. **Summary results of SNAT section 1**

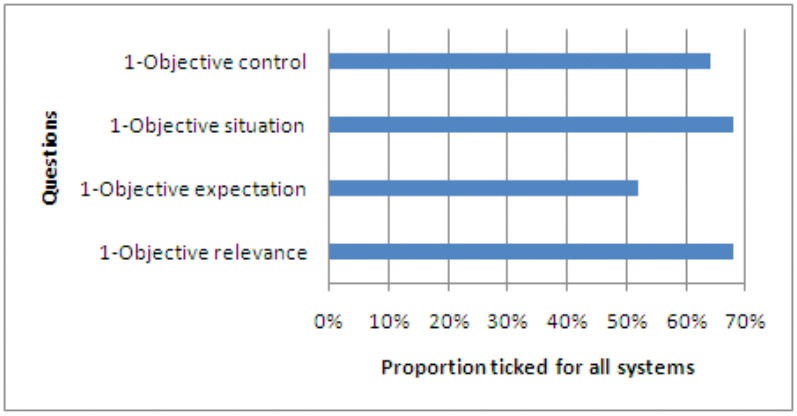


Figure 9. **Detailed results of SNAT section 1**

Considering the scope of the surveillance programmes, all systems (**25)** expressed an intention to target colony losses. Out of these systems, 71% (17) are targeting compulsory notifiable diseases and 50% (12) are also targeting other pests and diseases and other aspects of bee health, e.g. beekeeper training (Table 1). This shows that a great majority of the systems are not solely oriented to colony losses, and some of the mixed systems state an orientation towards colony losses although they are not really able to provide any consistent data. Systems can therefore be divided into two types:

- Those who really target colony losses (solely or mixed) (70%),
- Those who are not really targeting colony losses, and lack specific procedures to detect and estimate this phenomenon (30%).

The majority of pests and diseases (P&Ds) targeted by the surveillance systems are notifiable, for example AFB, EFB, *Tropilaelaps spp*., and the Small hive beetle (*Aethina tumida*). Other pathologies such as Varrooasis, Acarapisosis or Nosemosis are also monitored in a high proportion of countries. GMOs were not mentioned as an origin of colony losses, but neither are they targeted by any of the surveillance systems within this study. Viral diseases are only monitored in a small number of the countries.

For the 23 systems for which information was given, the institutions implementing the surveillance appeared to be very diverse (Table 2): the majority (36% [10 systems]) are managed by research institutes or universities; 24 % (6 systems) by the State alone; and 20% (5 systems) by beekeepers' associations. The remaining 20% (5 systems) are managed by a combination of these.

Table 1. **Surveillance and situation of bee diseases in the studied countries**

	Number of surveillance systems mentioning the disease							
	Under surveillance[1]	Absent[2]	No information[3]	Present[4]	Present high[5]	Present medium[6]	Present low[7]	Total Disease situation[8]
Colony losses								
Colony losses	**23**			**11**	**1**	**10**	**1**	**23**
Bacteria								
AFB	**19**	**1**	**1**	**7**		**8**	**7**	**24**
EFB	**17**	**6**		**7**	**2**	**1**	**8**	**24**
Acarian								
Varroasis	**20**		**1**	**9**	**6**	**4**	**4**	**24**
Acarapisosis	**13**	**12**	**1**	**3**		**1**	**5**	**22**
Tropilaelaps	**11**	**23**						**23**
Other parasites								
Small hive beetle	**12**	**23**						**23**
Exotic hornet	**1**	**1**						**1**
Fungi								
Stonebrood	**1**	**1**						**1**
Chalkbrood	**4**			**1**	**1**	**1**	**1**	**4**
Protozoan								
Nosemosis	**12**			**4**	**4**	**3**	**2**	**13**
Amebiasis	**1**						**1**	**1**
Poisoning								
Bee poisoning incident	**5**			**2**		**4**	**2**	**8**
Pyrethroid resistance	**1**			**1**				**1**
Acaricide poisoning	**1**				**1**			**1**
GMO	**0**	**4**						**4**
Viruses								
Virus infection	**2**			**1**	**1**	**2**		**4**
SBV	**6**			**1**	**2**	**1**	**2**	**6**
ABPV	**5**			**1**	**1**	**2**	**1**	**5**
CBPV	**5**	**1**				**2**	**2**	**5**
BQCV	**4**	**1**			**1**	**1**	**1**	**4**
IABPV	**3**	**3**					**1**	**4**
KBV	**3**	**1**		**1**		**1**	**1**	**4**
DWV	**3**			**1**	**1**		**1**	**3**

[1] Number of systems declaring this syndrome or disease under surveillance.
[2] Number of systems declaring this syndrome or disease absent of the country.
[3] Number of systems giving no information about this syndrome or disease.
[4] Number of systems declaring this syndrome or disease present in the country.
[5] Number of systems declaring this syndrome or disease present in the country with a high prevalence.
[6] Number of systems declaring this syndrome or disease present in the country with a medium prevalence.
[7] Number of systems declaring this syndrome or disease present in the country with a low prevalence.
[8] Total number of systems mentioning this syndrome or disease.

Table 2. **Institutions implementing the surveillance programmes**

	Number	%
Institution implementing the surveillance		
Beekeepers association	**5**	**20%**
Mixed	**5**	**20%**
Research Institute	**5**	**20%**
State	**6**	**24%**
University	**4**	**16%**
Total	25	100%

1.2.6.2 Section 2: Central institutional organisation

Section 2 assesses the central institutional organisation by assessing the presence and operation of a steering committee, a technical committee, a central unit and a their financial means.

This section had a low level of compliance, with very few systems ticking more than one question (Figure 10). Less than half of the systems were found to have a steering committee, which is an important decision making level in the monitoring of any surveillance system, and necessary for ensuring collaborative management practice (Figure 11). This applies equally to the central unit, essential for ensuring good day-to-day management of the system. Finally, the lowest level of compliance was found in the (lack) of any existing technical committee, crucial for the development of appropriately adapted surveillance procedures.

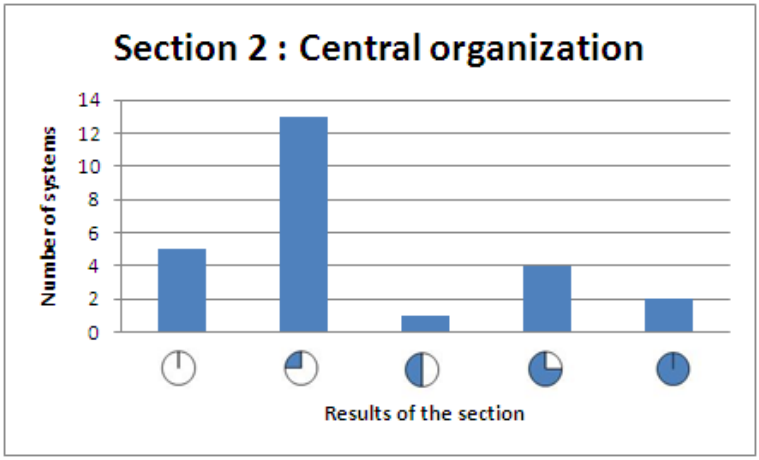


Figure 10. **Summary result of SNAT section 2**

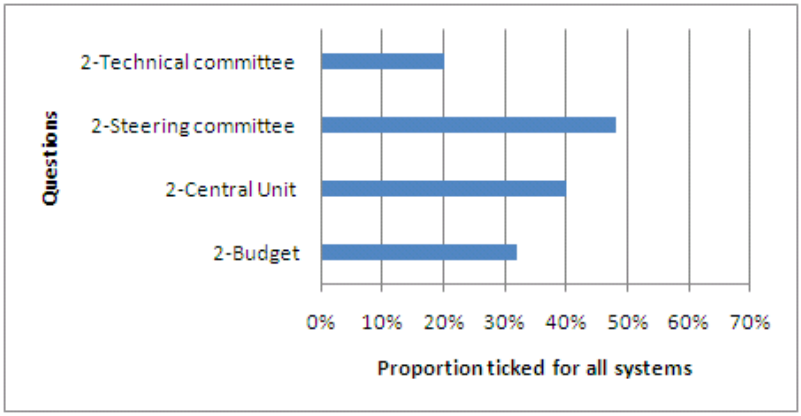


Figure 11. **Detailed results of SNAT section 2**

Most of the surveillance systems appear to have a small human resources input. Of the 17 systems for which this information was available, 12 (BE, NL, CH, LU, PL, HU, GB-Nir, GB-Sco, SI, DK, GR, SK) have less than 8 persons with more than 5 years relevant experience/study, 3 have between 10 and 20 (FR, DE, EE) and 2 have 80 (GB-E&W, CZ).

1.2.6.3 Section 3: Field institutional organisation

Section 3 assesses the field institutional organisation by assessing the presence and the operation of provincial units, field agents and their material means.

The weakness of field organisation (only around 30% of systems were found to have dedicated field agents or provincial units) highlights marked limitations that many surveillance systems may have in terms of thoroughness and timeliness of monitoring. Systems that rely on only limited field surveys may not be sensitive enough to detect trends or qualitative changes, or to locate specific "problem areas". (Figures 12 and 13).

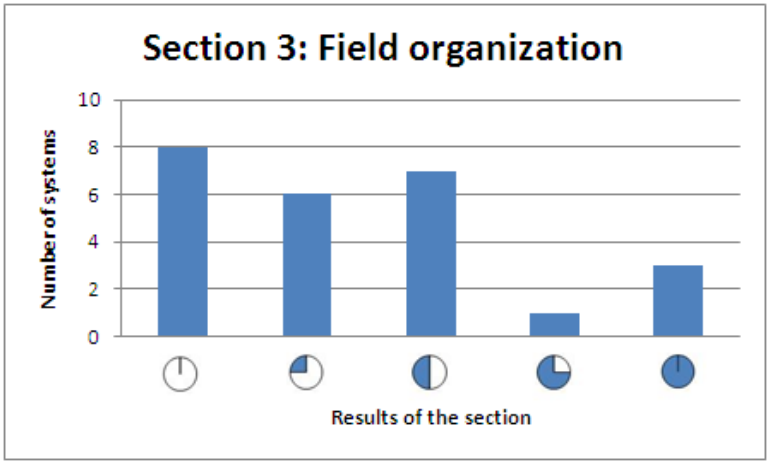


Figure 12. **Summary result of SNAT section 3**

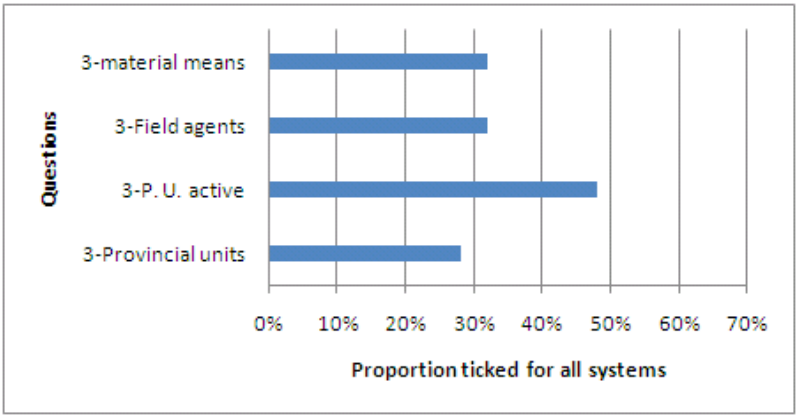


Figure 13. **Detailed results of SNAT section 3**

Regarding those field agents involved in the surveillance, 44% (11 systems) are using trained beekeepers to detect and notify of colony loss events. In most cases (80% (20 systems)), field veterinarians are generally not used as field agents for surveillance of bee diseases. Knowledge of at risk bee populations is weakened by the facts that beekeeping is a compulsory notifiable activity in only 54% (13) of the countries investigated, and databases gathering population data are only present in 48% (12) of the countries. Surveillance pressure can be estimated by the ratio of colonies and beekeepers per field agent. For the 10 countries that provided any figures about this ratio, one can see a great variation in the results (Figures 14 and 15). Countries with the highest ratio may face problems with surveillance sensitivity.

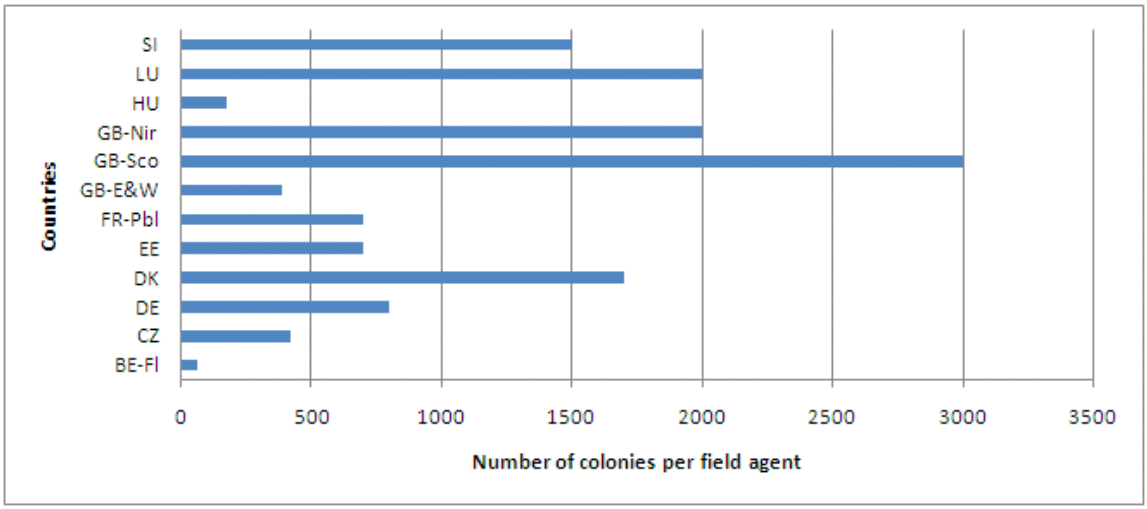


Figure 14. **Number of colonies per field agent**

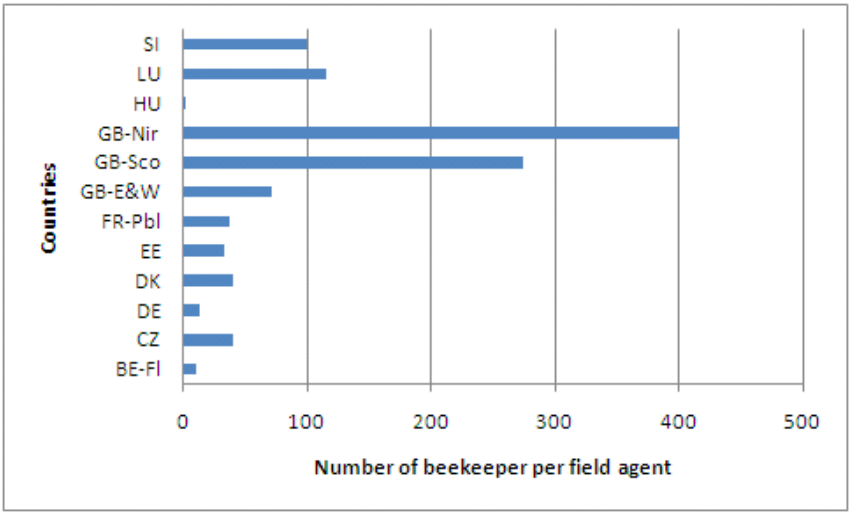


Figure 15. **Number of beekeepers per field agent**

1.2.6.4 Section 4: Laboratory

Section 4 assesses the integration of laboratories in the surveillance activities including their human and material resources and their level of quality assurance.

Over one third of surveillance systems covered by this study (nearly 36% (9 systems)), were found to have no laboratory facilities to support them. This is a critical point regarding the efficiency of the systems and their power to identify the cause(s) of colony losses (Figures 16 and 17).

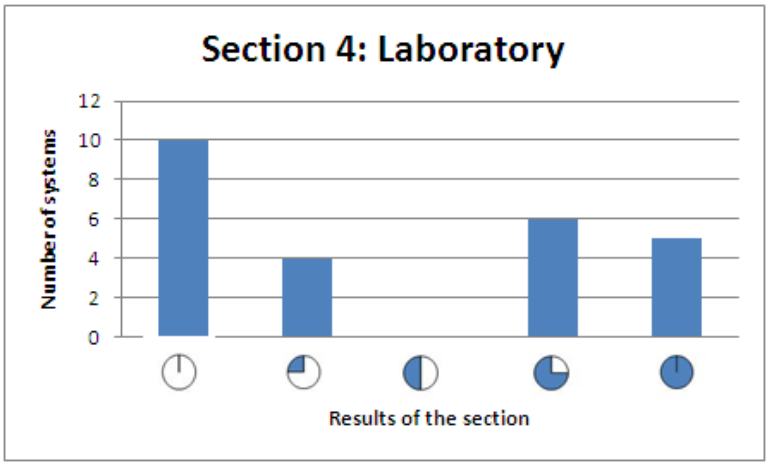


Figure 16. **Summary results of SNAT section 4**

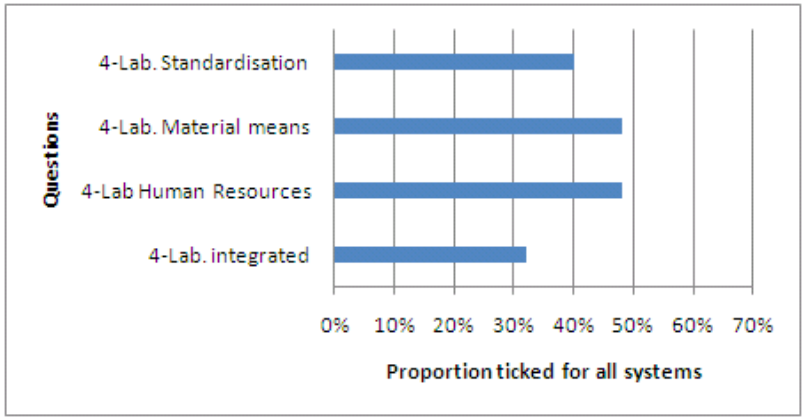


Figure 17. **Detailed results of SNAT section 4**

While 24% (6) of the systems are supported by one laboratory, Table 3 shows that 40% (10) are supported by more than one laboratory (from 2 to 11 laboratories).

Table 3. **Number of laboratories supporting the surveillance programmes**

	Number of systems	%
Number of laboratories involved		
0	**9**	**36%**
1	**6**	**24%**
2	**3**	**12%**
5	**1**	**4%**
6	**2**	**8%**
9	**3**	**12%**
11	**1**	**4%**
Total	25	100%

Figure 18 displays the kind of analysis performed for the 14 systems having given an information laboratory analysis. The most common disease analysis capabilities are AFB, EFB, Varroasis and Nosemosis. Five systems (36%) declare being able to analyse pesticides residues.

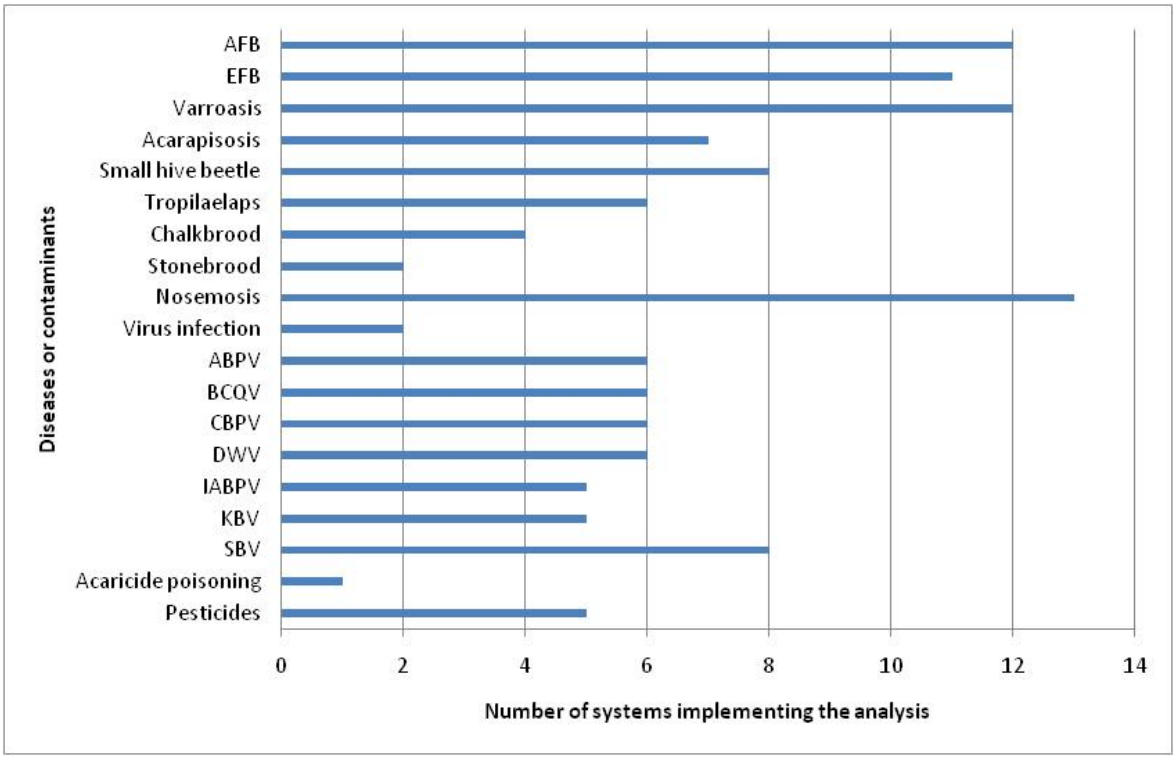


Figure 18. **Diseases or contaminants analysed by the laboratories**

1.2.6.5 Section 5: Formalisation

Section 5 assesses the existence and the quality of a surveillance protocol, including surveillance methodologies implemented (active and passive), and the level of formalisation in official texts.

Formalisation of surveillance procedures can be considered to be at an intermediate level of compliance, given that around 55% of systems do have formalised surveillance protocols (although only a minority of these can be considered as complete), and do have official texts integrating surveillance activities (Figures 19 and 20).

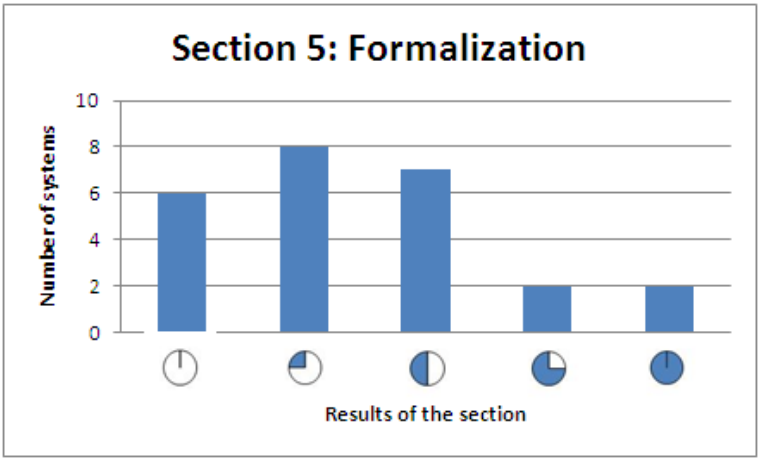


Figure 19. **Summary results of SNAT section 5**

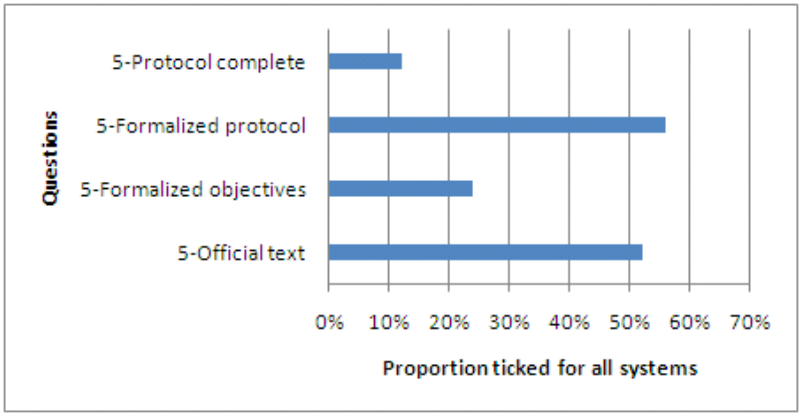


Figure 20. **Detailed results of SNAT section 5**

The majority of surveillance systems (68% (17)) lack a consistent definition of what constitutes "colony losses". Linking with the findings of the third work package, on the variety of definitions for colony losses, this highlights the diversity of the cases that all systems are gathering in Europe and the cautiousness one should adopt when interpreting the results given by these systems.

Only 28% (7) of the systems declare having standardised data collection forms for recording colony loss episodes and for collecting samples (examples of these are provided some in Appendix 4). This shows how difficult it is to draw firm conclusions about risks or possible causative factors, because of the lack of descriptive data on the episodes.

Sixty-three percent of the systems (15) were found to be implementing passive surveillance procedures, while the vast majority (>80% (20 systems)) implement some form of active surveillance. Passive surveillance is based on the spontaneous notification of cases or suspicions to a central processing unit (The nature, the number, location and date of data collected are not known before they are collected). Active surveillance is based on an organized and planed collection of data on diseases under surveillance (The nature, the number, location and date of data collected are known before they are collected).Table 4 shows that 38% of the surveillance systems implement only active procedures.

Table 4. **Passive and active surveillance procedures**

	Number of systems	%
Surveillance system		
Only active	**9**	**38%**
Only passive	**4**	**17%**
Both	**11**	**46%**
Total	24	100%

1.2.6.5.1 Passive systems

Passive surveillance methods are detailed in Table 5. The main methods of surveillance were found to be in response to calls from beekeepers, and by visits to honey bee apiaries. Detection of cases during programmed visits should be considered as effectively being active surveillance. Eighty percent of passive systems stated that they implement motivation-keeping activities (usually

communication activities). Although such surveillance methods may have an exhaustive coverage of the bee population, with an exhaustive declaration of cases (high sensitivity), passive systems cannot be considered as providing representative information on colony losses. This has to be kept in mind when interpreting the results obtained by work package 2.

Table 5. **Passive surveillance activities**

	Number of systems	%
Passive surveillance		
Systems implementing passive surveillance	**14**	**56%**
Methods of detection		
On beekeepers call out	**14**	**93%**
During programmed visits	**9**	**60%**
During visits for other reasons	**10**	**67%**
Other modalities	**4**	**27%**
Communication		
Organization of motivation keeping activities	**12**	**80%**

1.2.6.5.2 Active systems

Of the 20 systems implementing active surveillance, 55% (11 systems) were found to achieve this through a questionnaire survey distributed to beekeepers. In almost all of these systems (10), this is the only active procedure used (some of the collected questionnaires are given in Appendix 4). Closer scrutiny of questionnaire-based surveillance procedures reveals that, for nearly all systems using them (3 exceptions), the questionnaire is broadly distributed in a variety of different ways (meetings, internet, mail), with a very limited response rate (usually just a few percent). In these cases, questionnaire surveys should be considered as passive procedures, due to the absence of representativeness of the answering population. Two surveillance systems use questionnaires sent to a sample of beekeepers, with focused follow-up to ensure that answers are collected. One system distributes its questionnaire to a wide audience of beekeepers, but achieves a high response rate (more than 50%). These cases can be considered as active systems, with a certain level of accuracy in the results. Of the 8 systems implementing active procedures that are not based on a questionnaire survey, 2 were found to implement active procedures which are not specifically targeted at monitoring colony losses. Three systems did not provide any detailed information about their respective surveillance procedures, and 3 describe a representative active system.

In conclusion, of the 20 systems that stated they are implementing active colony loss surveillance procedures, only 5 of these can be considered as valid active systems, able to produce a representative figure of the situation in the country (Germany, Denmark, Finland, England & Wales and Italy (but Italy is just starting the system)).

It is important to note that even if the country does not have an organised and well-operating surveillance network, very accurate data about colony losses can still be collected through well-designed surveys when these are carried out on a representative sample of beekeepers (Finland for example). If these surveys are undertaken under the umbrella of well-organised surveillance systems, this gives them sustainability, offering the possibility of achieving detailed investigation and real monitoring of colony losses. This situation has to be kept in mind when interpreting the

results of work package 2. The geographic distribution of passive and/or active surveillance is summarised in the following maps (Figures 21, 22 and 23).

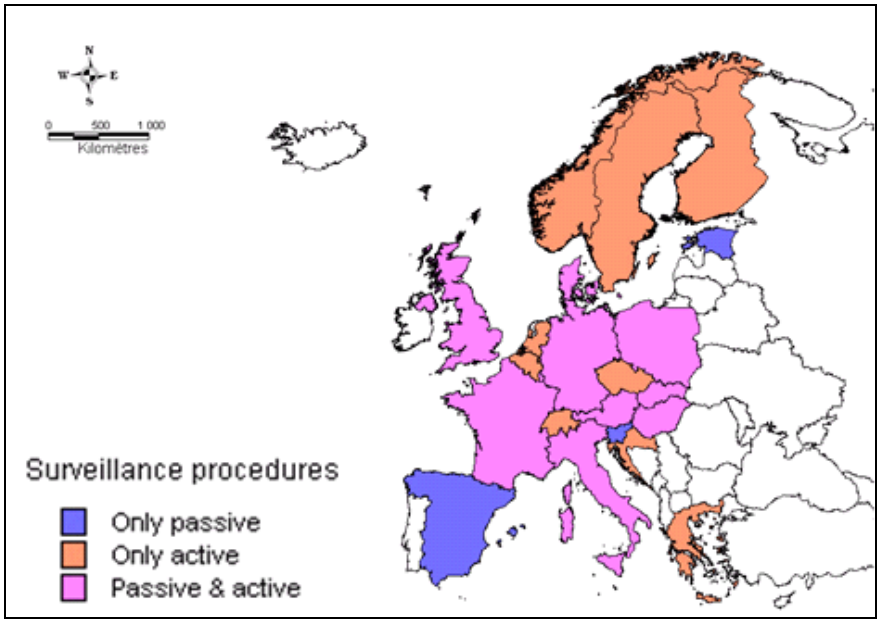


Figure 21. **Surveillance procedures in Europe**

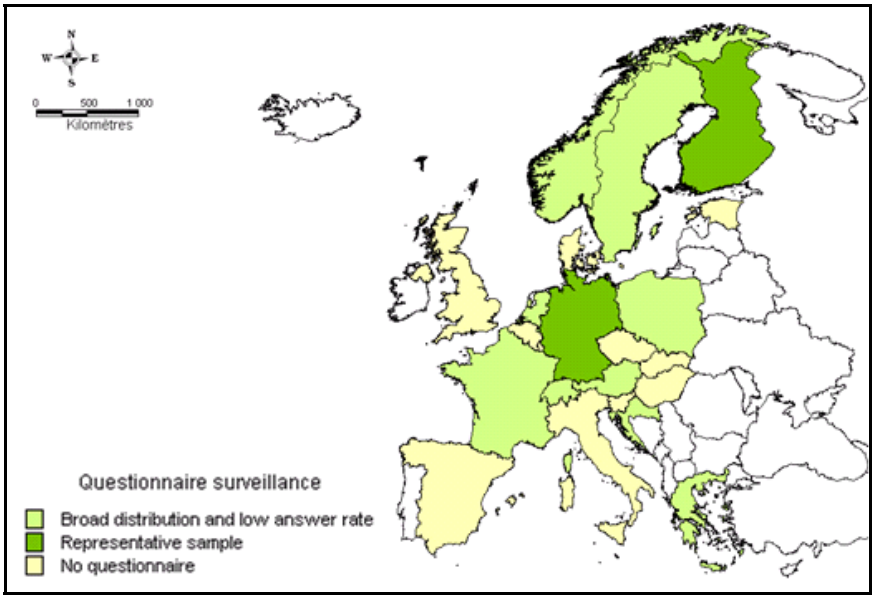


Figure 22. **Questionnaire surveillance in Europe**

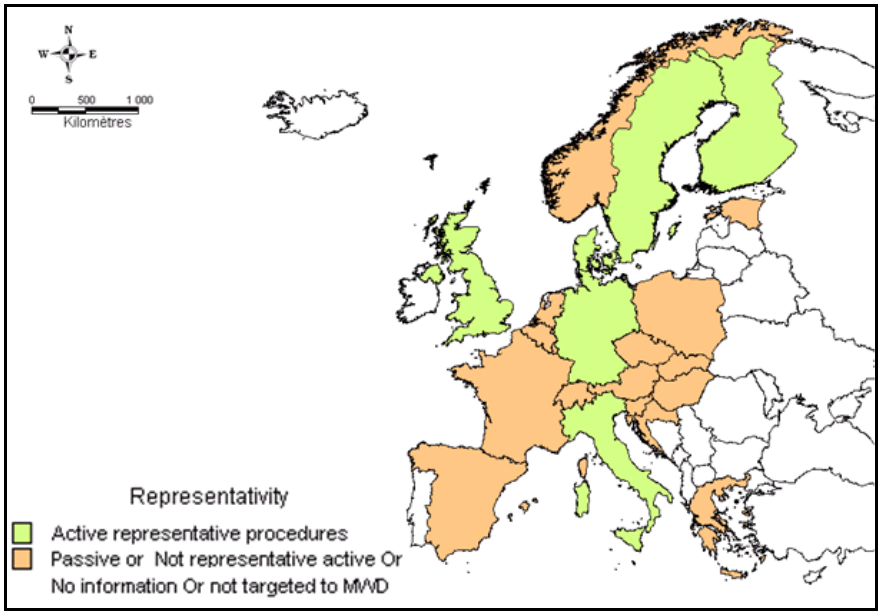


Figure 23. **Representativeness of the surveillance in Europe**

1.2.6.6 Section 6: Data management

Section 6 assesses data management capabilities and procedures implemented for the surveillance.

The majority of surveillance systems appear to have some kind of data management system, but these were generally found to have only low levels of data manipulation and analysis capabilities (Figures 24 and 25).

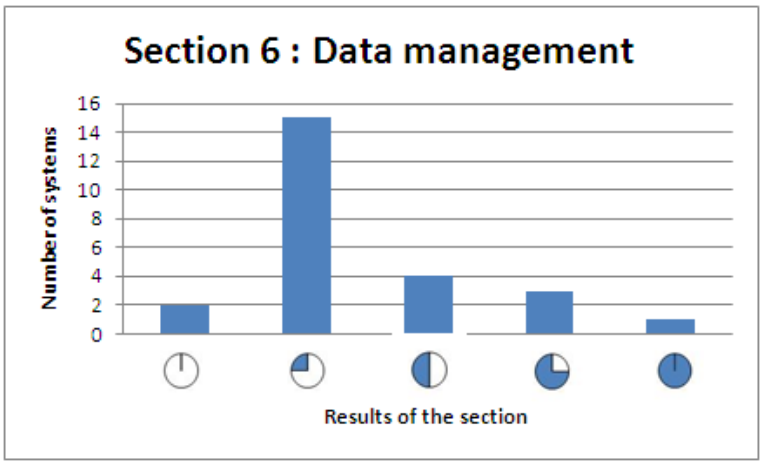


Figure 24. **Summary results of SNAT section 6**

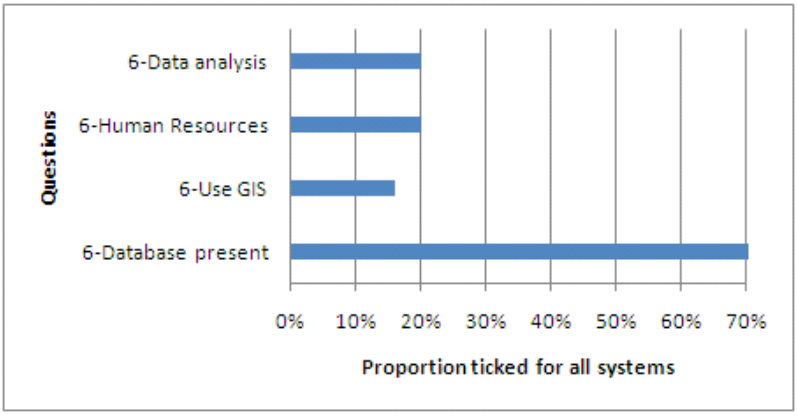


Figure 25. **Detailed results of SNAT section 6**

This quasi-systematic presence of databases has to be moderated by the fact that, for the purposes of this project, a data management system on a spreadsheet was considered to be a "database". The existence of real relational database systems within the community will, in fact, be lower than presented in Table 6: spreadsheets otherwise appear to be the most common data management system, adopted by 59% (13) of the surveillance programmes, suggesting a fairly low level of data management possibilities.

Table 6. **Data management systems**

	Number of systems	%
Mean		
Relational database	**6**	**24%**
Specific software	**7**	**28%**
Spreadsheet	**14**	**56%**

Only one third of the systems have a high frequency dataset updates. However, this may be linked directly to surveillance procedures, which may not require a higher update rate of their databases (Table 7).

Table 7. **Data management systems**

	Number of systems	%
Frequency of data entry		
No information	**7**	**28%**
It depends	**2**	**8%**
Once a year	**6**	**24%**
Several times a year	**2**	**8%**
Monthly	**1**	**4%**
Weekly	**1**	**4%**
Real time	**6**	**24%**
Total	25	100%

1.2.6.7 Section 7: Supervision

Section 7 assesses the activities implemented for the supervision of the provincial and field agents of the surveillance system, including the coordination meetings organised with them.

Supervision appears to be one of the weakest sections. At the European level, the majority of the surveillance systems are considered to achieve only a low level of implementation of surpervision-related activities (Figures 26 and 27).

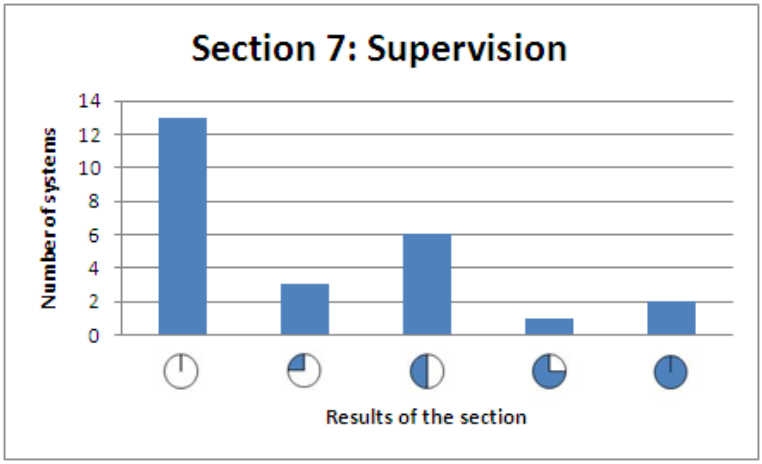


Figure 26. **Summary results of SNAT section 7**

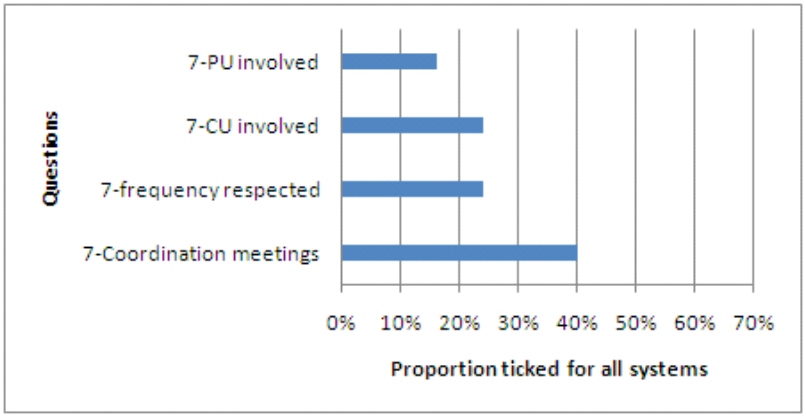


Figure 27. **Detailed results of SNAT section 7**

1.2.6.8 Section 8: Training

Section 8 assesses training activities implemented in relation with the surveillance programme for staff at field and central level.

It is clear that the level of training for field staff is very low (with only 14% of surveillance systems implementing it), even though this is a very important activity to ensure their efficiency (Figures 28 and 29). This relatively low level of satisfactory training for key staff (31%), indicates a possible weakness in the day-to-day system management.

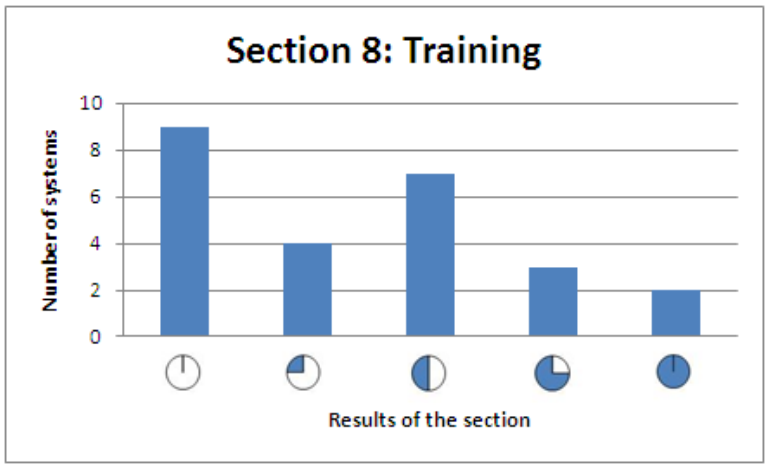


Figure 28. **Summary results of SNAT section 8**

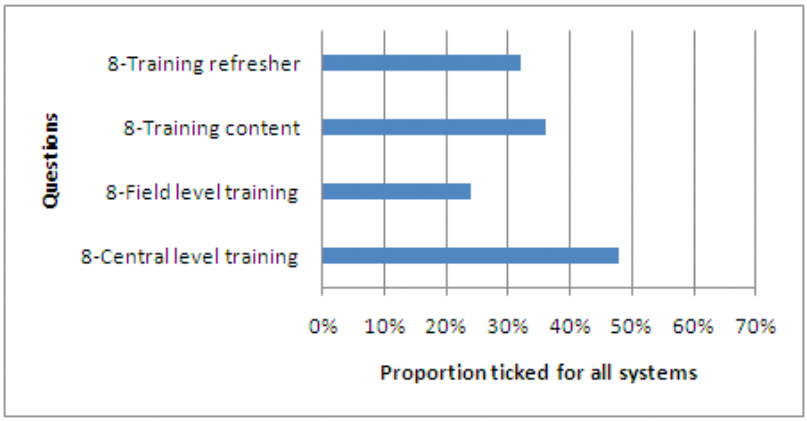


Figure 29. **Detailed results of SNAT section 8**

It was found that the number of persons at central and intermediate levels trained in epidemiology and bee production and diseases differed greatly between countries (Figures 30 and 31). Although this may reflect differences in the interpretation of those SNAT questions related to training, this situation does indicate a lack of training in these two fields.

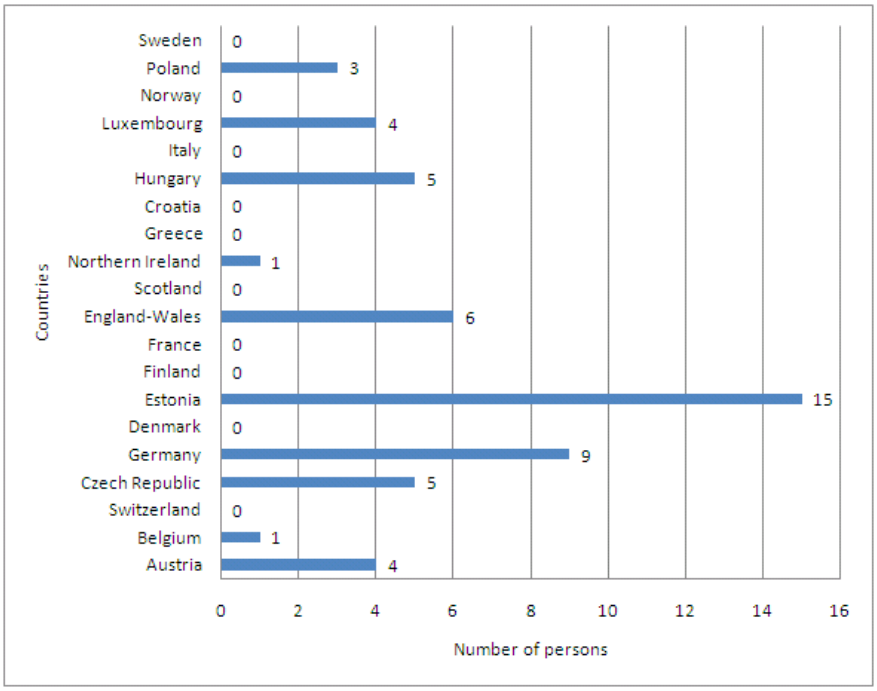


Figure 30. **Number of trained persons in epidemiology at central and intermediate**

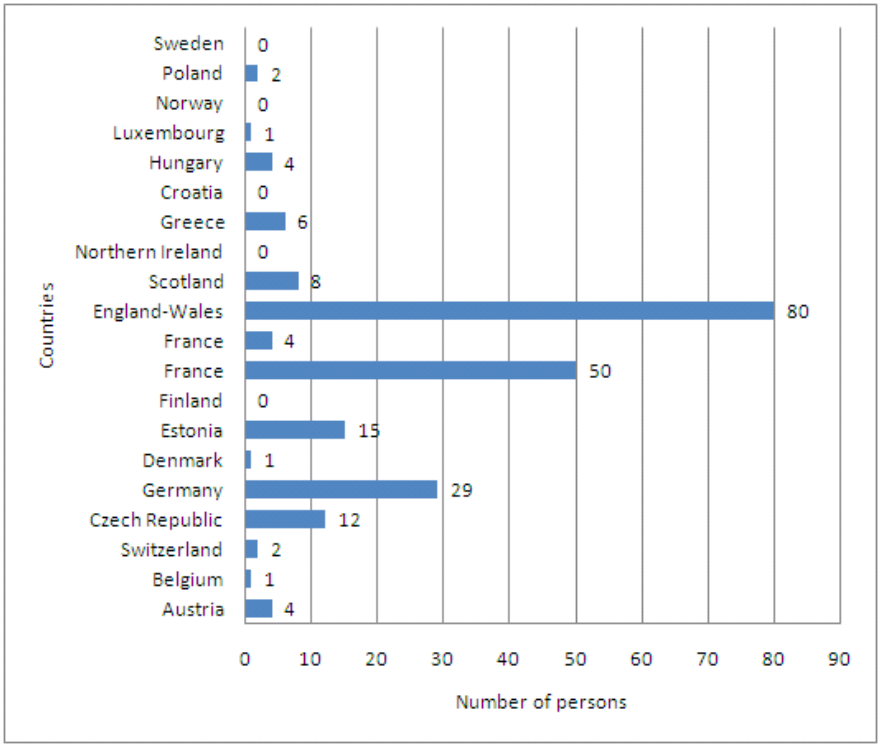


Figure 31. **Number of trained persons in bee production and diseases at central and intermediate**

1.2.6.9 Section 9: Communication

Section 9 assesses the communication activities of the system by assessing internal and external communication and accessibility to communication means.

Critical factors for effective communication were found to be internal and external distribution of information. Internal distribution of information, for example, appears far too low to be providing sufficient information to field agents (Figures 32 and 33). Table 8 shows the variety of communication means adopted by the surveillance systems.

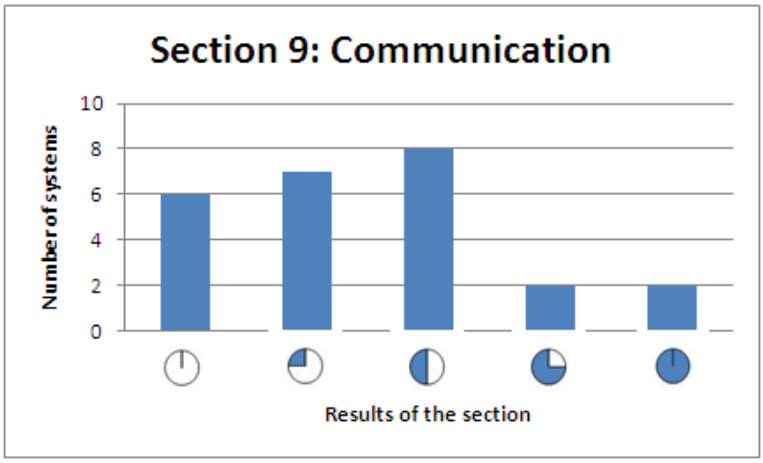


Figure 32. **Summary results of SNAT section 9**

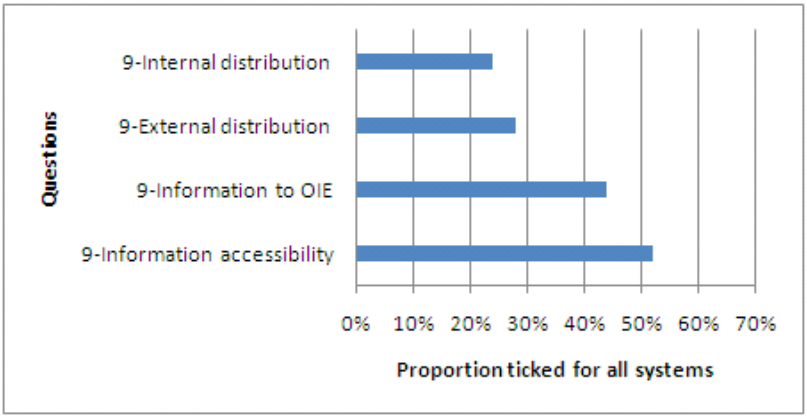


Figure 33. **Detailed results of SNAT section 9**

Table 8. **Communication means among the surveillance systems**

	Number of systems	%
Means of information		
Laboratory result	**13**	**52%**
Information meetings	**14**	**56%**
Review reports	**12**	**48%**
Information bulletin	**7**	**28%**
Information leaflet	**5**	**20%**
Web site	**11**	**44%**
Other means	**13**	**52%**

1.2.6.10 Section 10: Evaluation and performance indicators

Section 10 assesses external evaluation activities implemented and the use of their results and the presence and use of performance indicators to assess the operation of the surveillance.

This part of the SNAT questionnaire was found to be the weakest of all sections (Figure 34). Although some surveillance systems have started implementing performance indicators (2 or 3 systems), most of them have never undertaken any evaluation (Figure 35). Clearly it would be beneficial to implement evaluation activities at the European level.

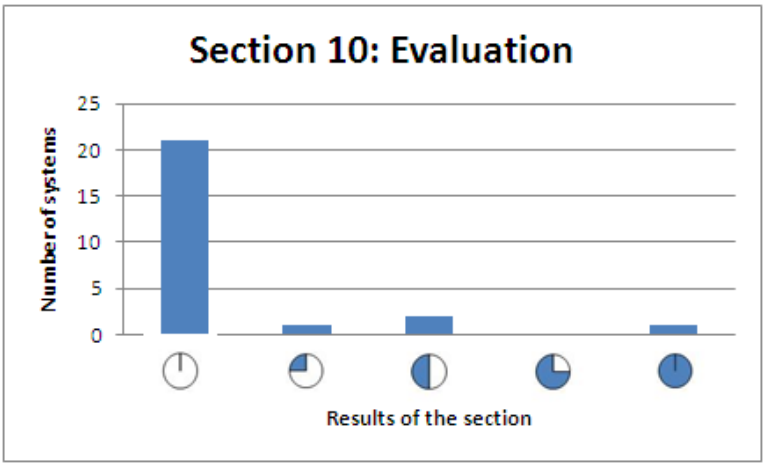


Figure 34. **Summary results of SNAT section 10**

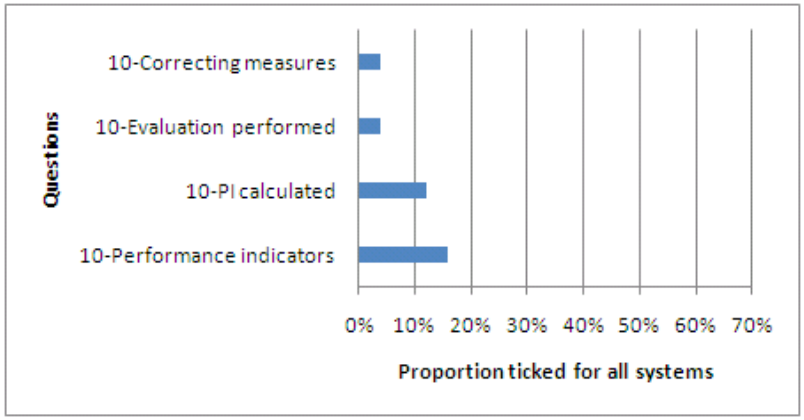


Figure 35. **Detailed results of SNAT section 10**

1.2.7 Interpretation per country

The list of contact persons and contact information for all systems investigated are given in appendix 16.

1.2.7.1 Austria

A governmental surveillance system, focused on regulatory diseases and specific survey system dedicated to colony losses. The survey system implemented by the research institute is not organised following a network structure. Existence of good laboratory support for surveillance activities. Passive surveillance system for regulatory diseases, and questionnaire survey for colony losses.

1.2.7.2 Belgium

Only the questionnaire for Flanders has been received. Another system exists for Walloon region & Brussels-Capital region, but no completed questionnaire has been received.

In Flanders, the system is takes the form of a survey, part of a bigger EU project dedicated to recording overwintering mortality in an active system (two counts a year). The system relies on the assistance of especially-trained beekeeper who collect data in each region. There is no information available on the rate of beekeepers answering the questionnaire. No passive data collection is implemented to identify specific events or investigate causative factors.

1.2.7.3 Switzerland

The surveillance system is oriented to recording overwintering mortality. No specific field agents are identified, so the system relies on technical assistance from beekeepers' associations and scientific support. No diagnostic activities are implemented within the surveillance system, and no causative factors are investigated. The system is based on semi-active/passive collection of questionnaires (COLOSS questionnaire), completed by the beekeepers who provide information about any losses they had during the winter. Only 4% of the beekeepers have completed the

questionnaire. No passive system is implemented to identify specific events or investigate causative factors.

1.2.7.4 Czech Republic

The surveillance system is a general system dedicated to mortality and the main bee diseases. All activities are managed by a steering committee (no central unit and no technical committee). A wide field system with provincial units (veterinary services) and field agents (mainly trained beekeepers). No specific procedure for colony losses count or investigation given. Strong field system, but weaknesses exist in system formalisation, training, supervision and communication.

1.2.7.5 Germany

The surveillance system is based on a sample of beekeepers (125 beekeepers with 7000 colonies) distributed across 80% of the country's provinces, with active collection of data on overwintering mortality and in-depth investigation to identify causes.

1.2.7.6 Denmark

Wide and strong field surveillance system with a dense network of field agents. System oriented to general bee diseases and also to mortality. Strong involvement of the laboratory in the system. Passive and active surveillance systems implemented.

1.2.7.7 Estonia

The national system is based on passive procedures dedicated to all bee diseases, with no specific active or passive investigation for colony losses.

1.2.7.8 Spain

The national surveillance system is based on passive procedures regarding all notifiable and priority diseases of bees. A well-structured system, implemented for all diseases, but not specifically dedicated to bees and, furthermore not to colony losses. The system relies on field veterinarians but colony loss events are not reported by field vets but by beekeepers' associations.

1.2.7.9 Finland

System relies on a yearly survey implemented on a 7% sample of the beekeeping population. No procedures implemented for case notification or causative factor investigation for colony losses.

1.2.7.10 France

Two questionnaires completed: one for the public surveillance system, and one for the system managed by the beekeepers' association.

- For the public sector: A broad field system with field agents and provincial units for passive case notification and active surveillance on a randomly selected sample of beekeepers. Some

colony losses cases reported passively, and the active system is not specifically oriented towards colony losses. Weak central organisation.

- For the beekeepers association sector: The surveillance is based on a yearly questionnaire survey about colony losses directed towards professional beekeepers (21%) in 90% of the French regions. No investigation on causative factors.

1.2.7.11 Great Britain

Three questionnaires were completed for this nation, based on geographical division:

- One for England & Wales: the best operating system in all the SNATs completed during the project. Strong central and broad field system based on central, provincial and field units. Passive notification system and active oriented risk based surveillance. Good involvement of laboratory, training and supervision activities. Strong online communication about all results of the system. Evaluation and performance indicators performed.
- One for Northern Ireland: Passive system for diseases notification and active survey performed for winter 2008/2009 on overwintering mortality.
- One for Scotland: The surveillance system is not focused on colony losses, but mainly on regulatory diseases according to the actual epizootic situation. A clear organization of the field system.

1.2.7.12 Greece

This is not a surveillance system in the true sense, but an initiative of a bee research institute that, with the assistance of a beekeepers' association, implements a general survey. Over the previous two years a questionnaire has been sent out to 10% of beekeepers, with approximately 3.5% response rate.

1.2.7.13 Croatia

This is not a surveillance system, but a study implemented in 2008 on 4 counties (out of 19). However, Croatia plans to extend this to the rest of the country in the future. No central organisation of the system and no involvement of the laboratory.

1.2.7.14 Hungary

The SNAT has been completed for a system which collects data on colony losses and tries to identify the causes of the phenomenon. The state supported system is broader based. Active data collection on mortality and sample collection in 0.6% of the country's apiaries.

1.2.7.15 Republic of Ireland

No surveillance system identified.

1.2.7.16 Italy

A passive surveillance system for notifiable diseases and an active system on selected apiaries all over the country to assess colony mortality (system under construction).

1.2.7.17 Luxembourg

Active and passive surveillance system, oriented mainly on regulatory diseases, with samples taken from selected apiaries. Good general organisation of the network, facilitated by the small size of the country.

1.2.7.18 The Netherlands

A questionnaire-based survey (COLOSS questionnaire) is implemented through 66 beekeepers' associations asked to fill the questionnaire following a telephone interview. A more developed network, different from the one implemented by COLOSS, will be implemented in 2009-2011.

1.2.7.19 Norway

System relies on a yearly questionnaire survey sent to all beekeepers with 10% to 20% response rate. No other system for case notification or causative factor investigation for colony losses.

1.2.7.20 Poland

This is not a real surveillance system. Small scientific project that will end at the end of 2010.It is based on passive collection of samples and data on winter mortality events, and on a questionnaire survey (with 1% to 3% participation).

1.2.7.21 Portugal

No surveillance system identified.

1.2.7.22 Romania

It was not possible to get any answer from this country.

1.2.7.23 Sweden

System relies on a yearly questionnaire survey sent to all beekeepers, with about 50% response rate. No other system for case notification or causative factor investigation for colony losses. There is also a national surveillance system, implemented by the national inspection service, but colony mortality is not recorded.

1.2.7.24 Slovenia

Passive surveillance of colony losses events. The beekeepers' association works with the veterinary services. When they identify a suspicion of infectious disease, they call veterinary services for further investigation and implementation of control activities. Veterinary services also implement an active surveillance with sampling, but it is not really part of the surveillance system on mortality.

1.2.7.25 Slovakia

Little information given on the operation of the surveillance system based on passive and/or active procedures.

1.2.8 Summary of results

Table 9 summarises the main results of the surveillance network assessments performed in the European countries.

Table 9. **Summary of SNAT results in the European countries**

	SNAT Quality	Strong points	Weaknesses	Data Represen-tativeness
Austria	4	Questionnaire survey and laboratory support	Surveillance of colony losses not organized as a network	No
Belgium (Flanders)	2	Survey on colony losses	Surveillance not organized as a network	No
Switzerland	2	Questionnaire survey	Level of answers and Organization of the surveillance as a network	No
Czech Republic	2	Strong field system	Only passive surveillance	No
Germany	2	Active system collecting representative data	Risk on evolution of the representativeness (same population of beekeepers every year)	Yes
Denmark	3	Active system collecting representative data	Data management system	Yes
Estonia	3	Strong field system	Surveillance not targeting colony losses	No
Spain	3	Organization as a network	Only passive surveillance not targeting colony losses	No
Finland	3	Representativeness of the collected data	Surveillance not organized as a network	Yes
France (Public)	4	Good field system with trained actors	Only passive system not representative of the situation	No
France (Professional)	3	Active collection of data	Representativeness could be improved	No
England & Wales	4	Very strong field system. Very good surveillance organization	Harmonization of colony losses counting with other European countries	Yes

	SNAT Quality	Strong points	Weaknesses	Data Represen-tativeness
Scotland	3	Organization of the field system	Only passive surveillance	No
Northern Ireland	2	Recent active survey	Only passive surveillance	No
Greece	4	Questionnaire survey	Surveillance not organized as a network	No
Croatia	2	Recent active survey	Surveillance not organized as a network	No
Hungary	2	Active data collection	Link with the State based field surveillance	No
Italy	4	Good organization and representativeness	Young system that have not produced data already	Yes
Ireland	NA	No surveillance system implemented		
Luxembourg	3	Good surveillance system for regulatory diseases	Surveillance not focused on colony losses	No
The Netherlands	4	Questionnaire based survey	Surveillance not organized as a network	No
Norway	3	Regularity of the questionnaire based survey	Surveillance not organized as a network	No
Poland	4	Questionnaire based survey	Surveillance not organized as a network	No
Portugal	NA	No surveillance system implemented		
Romania	0	Impossibility to get any information		
Sweden	4	High level of answer to the national questionnaire	Surveillance not organized as a network	Yes
Slovenia	4	Organization of the network	Active surveillance procedures	No
Slovakia	2		Passive system	No

NA: Not applicable

1.2.9 Conclusions, recommendations and perspectives

Bee mortality, weakening and depopulation surveillance systems in Europe are characterised by the diversity of the approaches and operational means implemented within them. However, the majority do share common features, which are the weakness of the systems implemented and the lack of representativeness of the data they produce.

Therefore, the project recommends that the existing EU surveillance programmes for honey bee colony losses must be developed and enhanced. Priority should be given to the 20"improvement points" listed below. The development of future surveillance systems, truly adapted for the surveillance of colony losses, should build upon the existing surveillance systems on communicable and notifiable diseases already present in many countries.

Even if a country does not have an organised and well-operating surveillance network, very accurate data can still be gathered using well-designed surveys and a representative sample of beekeepers. If these surveys are undertaken under the umbrella of well-organised surveillance systems, they will be sustainable and can provide the possibility of detailed investigations and a real monitoring of colony losses.

For the sake of consistency, we have divided the identified improvement points using a single format, and have also produced ideas for organisation of surveillance systems at the European level.

1.2.9.1. Improvement points

Objectives and scope of surveillance

1. Objectives targeted specifically to colony losses surveillance should be formalised for each surveillance system;

Central institutional organisation

2. A specific steering committee for colony losses surveillance should be identified in each country, gathering all partners involved in the surveillance including beekeepers representatives;
3. A technical committee, comprised of scientists able to support the development of surveillance protocols and data interpretation, should be identified in each country;
4. A central coordination unit constituted by several persons at a central level, possibly representing the various surveillance systems existing in the country should be formalised in each country;

Field institutional organisation

5. A field network of surveillance agents should be identified in the countries where this system is absent. Considering the lack of veterinarians trained and interested in bee production, this field network should rely on specifically-trained beekeepers where it is not possible to have a public field agents network;
6. Intermediate levels of data gathering, validation and transmission should be identified with the public services and/or with the beekeepers associations;

Laboratory

7. Laboratories should be clearly integrated in the surveillance systems. Where diagnostic facilities are not available or insufficient, a link should be formalized with foreign laboratories in order to enable specific studies;
8. An inventory of specific diagnostic capabilities should be made at the European level, in order to facilitate technical transfer or support regarding new diagnostic techniques developed by different laboratories. This will promote more cost effective, more accurate, and more efficient diagnostics (multi-residues, multi-diseases, etc.);

Formalisation and surveillance procedures

9. Complete surveillance protocols should be formalised in each country, all of them following a common adopted format;
10. Clear and specific case definitions should be formalised by each surveillance system. These case definitions should be discussed at the European level, in order to ensure a common description of the colony losses situation across countries;
11. Active surveillance procedures should be enhanced and implemented in a way such that they will be able to gather representative data for each country. These procedures should

ensure use of a common set of indicators that will allow comparisons between national colony loss situations at the European level;

12. In order to investigate the possible risk or causative factors of colony losses, the idea of organising a case control study in a group of countries, applying a set methodology and consistent case definitions, should be considered;

Data management

13. The use of relational databases gathering population data with geo-referenced information should be promoted;
14. A common data model should be developed, so that set of standardized epidemiological data can be gathered at the European level;

Supervision

15. Supervision and coordination activities should be developed by all surveillance systems, to sustain the efficiency and motivation of field agents;

Training

16. The presence of staff trained in epidemiology should be ensured at the central level of the surveillance systems;
17. At a central, intermediate and field level, training in bee production and diseases should be enhanced;

Communication

18. Internal communication among all partners of the surveillance networks should be enhanced through newsletters, leaflets and websites;

Evaluation and performance indicators

19. Simple performance indicators based on a formalised surveillance protocol should be developed and calculated by the surveillance systems. A common set of performance indicators could be developed at the European level in order to compare and support all the countries.
20. External on site system evaluation should be performed for each surveillance system.

1.2.9.1 Perspectives

In order to enable the implementation of all the above listed recommendations, a scientific group could be designated to develop the following activities:

- Development of common guidelines for the organisation, implementation and follow-up of a national surveillance system for colony losses, detailing each one of the ten sections above. These guidelines should include several examples of active surveillance procedures that meet the objective of representativeness, and an example of a complete surveillance protocol;
- Development of a common set of:
    - Case definitions;

  - Epidemiological indicators;
  - Performance indicators;

  To be followed at the European level.
- Implementation of a scientific task force for the external evaluation and support of national surveillance systems.

2 WORK PACKAGE 2: COMPILATION AND ANALYSIS OF SURVEILLANCE DATA

All possible data from surveillance networks have been collected and standardised to facilitate their analysis at the European level. This will allow objective quantification and assessment of the colony losses phenomenon. Prior to this study, it was not possible to determine if any one country was more affected than another, and there was no overall data about colony loss trends.

2.1 Materials and Methods

2.1.1 Data collection

Data collection was achieved using four complementary strategies: Data surveillance request; individual contribution; study of COLOSS documentation; study of the literature study. These strategies are described below:

2.1.1.1 Data surveillance request

Several questions about data availability, quality and quantity were integrated in the Bee SNAT questionnaire. These related to:

- Possibility of data exchange;
- Data file form;
- Anonymisation of the data;
- Scale (number of events per administrative unit per time period);
- Age of the oldest data;
- Existence of a geographical information system.

Upon submission of its completed SNAT, each country was asked to share its surveillance data. They received an official letter and a personalised Excel file in which to place their data (see in Appendix 5). This strategy elicited data from 11 different surveillance systems: Belgium, Denmark, Croatia, Estonia, Finland, France, Greece, Norway, Poland, Sweden and the Netherlands. As several countries did not have any surveillance system, did not have available data fitting to the requested format, or did not respond to our request, it was also necessary to gather data by other means.

2.1.1.2 Individual contribution

Using e-mail communication between partners from different countries, it was possible to obtain several partial datasets, not coming from any particular surveillance system, but from specific studies. This strategy allowed the project to gather data coming from three countries: Belgium, Finland and Luxembourg.

2.1.1.3 COLOSS document study

The study of the documentation coming from the two last meetings of the COLOSS group (the 4th COLOSS Conference in Zagreb in 2009, and the COLOSS Workshop in 2009 about Bee monitoring) allowed the project to obtain further data, from several countries: Austria, Belgium, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Northern Ireland, Norway, Poland, Portugal, Republic of Ireland, Scotland, Slovenia, Spain, Sweden, Switzerland, The Netherlands, England and Wales.

2.1.1.4 Literature study

The study of the references gathered in the database yielded data for 11 countries: Austria, Belgium, Denmark, France, Germany, Luxembourg, Poland, Slovenia, Sweden, Switzerland and the United Kingdom.

Note: It was not possible to obtain any data for the Czech Republic, Hungary, Romania and Slovakia. Limited figures are available in the previous EFSA report for the Czech Republic and Romania.

2.1.2 Data entering

All data was entered into a project database, specifically designed to respect the variability of the indicators used. The information entered into this database for each group of data was as follows:

- The country;
- The source (surveillance data, COLOSS, individual contribution, publication, other) and details about the source;
- The precision (1 if no information, 2 if the size of the studied group is inferior to 10% of general colony population, 3 for 10-50%, 4 for more than 50%);
- The representativeness (1 if no information, 2 if data come from a passive system, 3 if they come from an active system, 4 if they come from an active random system).

Each datapoint within any group of data was registered with the following characteristics:

- Year;
- Period (spring-spring, autumn-autumn, spring-autumn, autumn-spring, summer-spring);
- The geographical area and the level of this area (country, province, region, department, county);
- Details about the data;
- Type of indicator (mean of mean losses per beekeeper, general loss, percentage of beekeepers with a loss superior to 60% of their colonies, superior to 50%, superior to

30%, superior to 20%, superior to 10%, % of beekeepers with no loss, median loss, approximate figure with no details).

It is important to note that data about collapse, weakening, and mortality due to notifiable diseases were not registered in the database. This is because inspection of completed SNATs revealed that few countries actually record this information. Four countries provided information about collapse, mortality or weakening due to OIE notifiable diseases: Estonia for collapse and weakening, Croatia for mortality and Italy and Belgium for weakening.

2.1.3 Data analysis and standardisation

For the small amount of data that were not totally aggregated, all possible indicators of the database were calculated. For example, in Finland, a scientist sent data about the loss of individual (anonymised) apiaries, from which all indicators used by the other surveillance systems were calculated. As few data were as detailed, this is effectively the only dataset on which it was possible to do this standardisation.

The surveillance data were analysed at a national and European level, and maps drawn to allow colony mortality rates in each country, depending on the year, to be visualised.

2.1.4 Data description

2.1.4.1 Quantitative description

All gathered data were already anonymised and most of them were aggregated. Defining a dataset as a group of data comprised of the following information: Year / Period / Zone (administrative unit) / Indicator (at least one), 674 different datasets were entered into the database. Ten different indicators were registered according to the indicators sent by the countries (as detailed in the above description of the database).

2.1.4.2 Qualitative description

All gathered data showed a significant variation in quality, restricting possibilities of interpretation at the European level.

2.1.4.2.1 Variability and validity of the indicators

As detailed above, the project found that different indicators are used from one country to another. Sometimes the same indicator is always used in the country, facilitating a longitudinal comparison. However, on other occasions more than one indicator is used within a single country (for the same period or for different periods). Therefore it was not possible for us to consider some of the indicators due to their scarcity of application at the European level. The following indicators could not be used: percentage of beekeepers with a loss greater than 60% of their colonies, greater than 50%, greater than 30%, greater than 20%, greater than 10%, % of beekeepers with no loss, median loss.

Some indicators were not considered to be valid for colony losses description: “Mean of mean colony losses”, for example, does not correctly represent the situation of colony losses in the country, because it does not integrate the size of each unit. Information such as this was excluded from the data interpretation.

2.1.4.2.2 Variability of the definitions

The definition of a same indicator varied between countries. For example, in the French professional surveillance system, the indicator is defined as:

"colony lost" = dead colony + diseased colony + weak colony + queenless colony

But in most of the other countries, a lost colony is simply a dead colony. As a consequence, the “colony loss rate”, summarised as “mortality rate”, will not have the same meaning and significance, depending on the reporting country.

2.1.4.2.3 Variability of the unit

For the indicator “percentage of beekeepers with a loss greater than 60% (or 50, 30, 20, 10, 0) of their colonies”, some countries consider that the unit is the beekeeper (Switzerland for example), and other countries consider that the unit is the operation (Austria or Poland for example). This is not a very important difference (the difference only arises when a beekeeper owns more than one apiary), but it underlines the fact that apparently it is the same indicator, the same definition, but a different unit.

2.1.4.2.4 Importance of the period used and calculation of the indicator

The definition of “the period” was sometimes vague. To define the period, the following terms have been used in different references: “the end of the season”; “late summer”; “autumn”. The period may thus correspond to September, October or November. Linked to the definition of the period, countries were found to differ in the way they calculate the same indicator. In Belgium for example, the number of colonies lost is not counted, but estimated by: “the number of colonies at the beginning of the season minus the number of colonies at the end of the season”. When colonies are divided by the beekeepers (to avoid swarming), or bought during the season, the number of colonies increases and the estimated mortality rate appears to be negative. In these cases, mortality rates are greatly underestimated. The way indicators are calculated by the countries must therefore be considered very carefully.

2.1.4.2.5 Discordance of the data

For a few countries, for the same period and the same geographical area, data coming from different sources are discordant (e.g. the Netherlands). For the purpose of this study, it has been decided to prioritise those datasets which came from the surveillance systems or were extracted from communications supplied by persons responsible for the surveillance systems.

2.1.4.2.6 Representativeness and precision

The first work package of the project has shown that significant diversity exists between the quality of surveillance systems producing data on colony losses. This means that each country’s dataset has

its own characteristics with respect to representativeness and precision. The most representative surveillance systems have been identified as Germany, Denmark, Sweden, Finland, England and Wales, and Italy.

Regarding precision, the surveillance systems based on the most statistically valid samples of beekeepers are implemented in England and Wales, Denmark, Sweden and Finland.

2.1.4.2.7 Indicator used and data presentation

In conclusion, the only indicator that appears to be commonly used is the "global (overall) colony loss rate" during a period (winter) and in a zone (country). Once again, significant variations exist regarding definition of period monitored and the administrative zone from which data were available:

- The period during which colony losses are most commonly counted is winter (observation period from autumn to spring). Other periods, such as the complete year or spring-summer mortality are used less often;
- Some countries sent detailed data for administrative national subdivisions (such as region, land, county, etc.) but, considering that country level information is the baseline data available, it has been decided, at this stage, to analyse data at this cruder level.

Taking into consideration the variability of representativeness and precision of the available data, interpretation must be carried out with care, and few of the datasets can be considered as properly comparable. Therefore, for the purposes of further temporal analysis, this project report presents only those six available datasets considered to be the most representative, apart from where important differences were noticed in the way the indicator has been calculated and/or the way data is collected in the country. Datasets from the other countries are presented singly, country by country. Geographical analysis (maps) present all countries together, year by year.

The consequence of the use of a single indicator (global colony loss rate during winter) is that all aspects of colony losses (such as summer losses) could not be addressed through this study.

2.2 Results

Two types of data treatments were performed:

- A temporal analysis, to provide an idea of any trends in the data;
- Geographical analysis, to reveal national distribution.

Only one indicator was suitable for data treatment at the European scale: percentage of colonies lost during the winter (see above). Results for any one year are the percentage of colonies lost during the previous winter. For example, 2008 results represent the numbers of colonies lost during the winter 2007-2008 (period of observation "autumn – spring").

2.2.1 Temporal trends

Figures 36 presents the temporal trends for the five surveillance systems that were considered to provide representative data. Results obtained from all other systems are presented from Figure 37 to Figure 49. When continuous data were not available, the dataset is represented with dots.

All these trends are difficult to interpret, especially when keeping in mind the great variety in quality between those surveillance systems that produced the data. However, the following trend should be noted:

- A baseline colony losses rate around 10% is observed at European level (during the period 2000 – 2009 the minimum winter colony loss rate range from 4.8% to 11%, regression line from 9.6% in 2000 to 6.3% in 2009). This baseline loss rate is the normal loss rate admitted for bee production systems;
- The project identifies a higher level of colony losses in some countries during the years 2003 and 2008. This apparent finding is, however, based on limited data that varies in representativeness, precision and the indicator calculation methods used. It must therefore be viewed with caution.

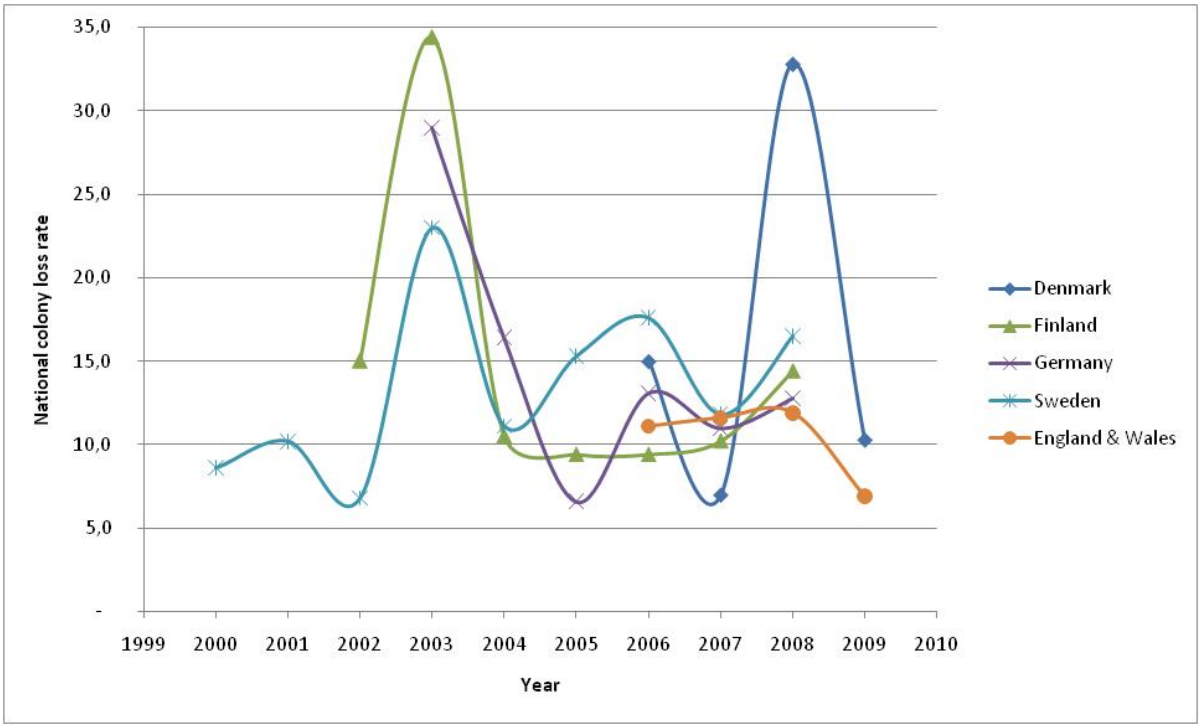


Figure 36. **National percentages of colonies lost during winter from 2000 to 2009 in Denmark, Finland, Germany, Sweden, England and Wales**

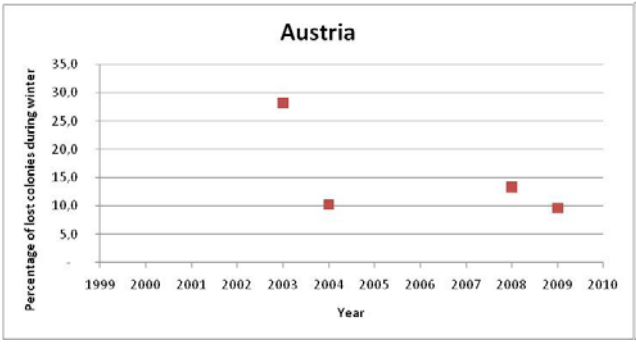


Figure 37. **Percentage of winter colony losses in Austria from 2000 to 2009**

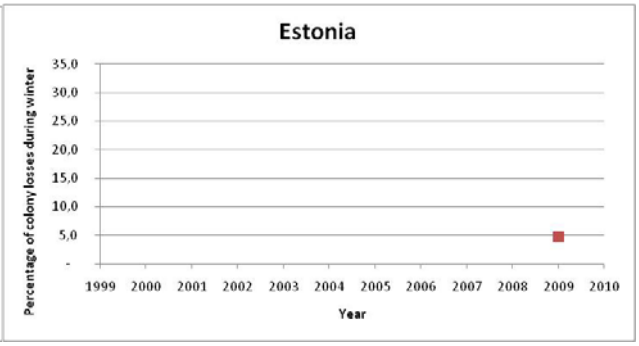


Figure 38. **Percentage of winter colony losses in Estonia from 2000 to 2009**

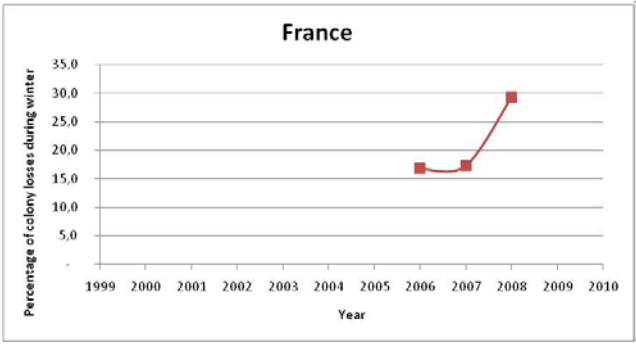


Figure 39. **Percentage of winter colony losses in France from 2000 to 2009**

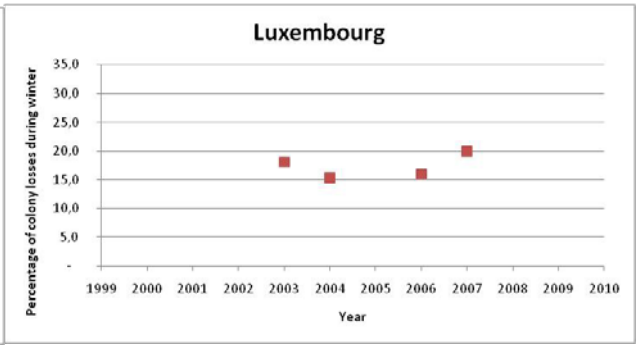


Figure 40. **Percentage of winter colony losses in Luxembourg from 2000 to 2009**

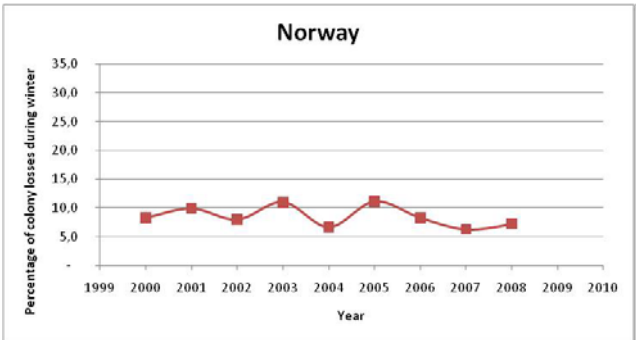


Figure 41. **Percentage of winter colony losses in Norway from 2000 to 2009**

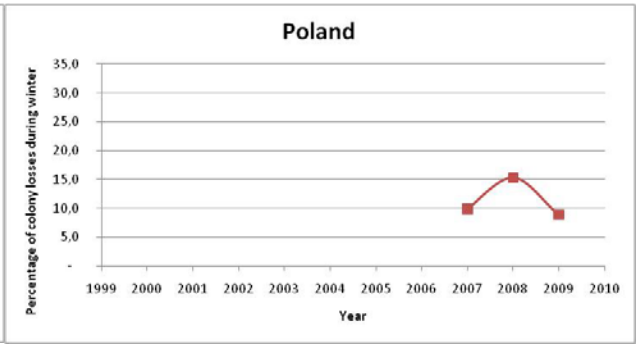


Figure 42. **Percentage of winter colony losses in Poland from 2000 to 2009**

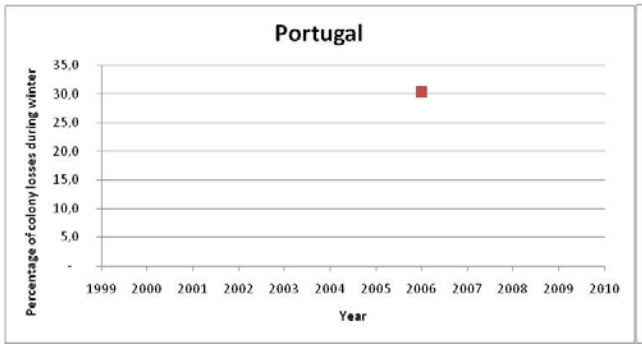


Figure 43. **Percentage of winter colony losses in Portugal from 2000 to 2009**

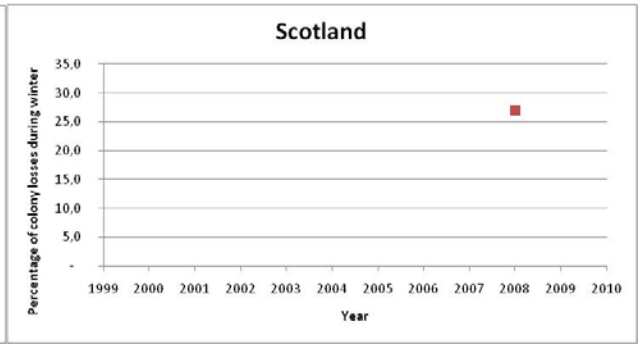


Figure 44. **Percentage of winter colony losses in Scotland from 2000 to 2009**

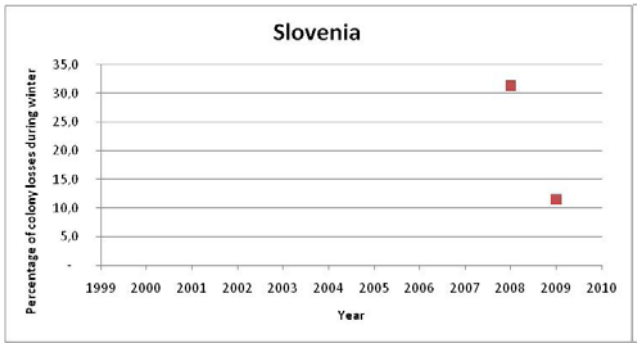


Figure 45. **Percentage of winter colony losses in Slovenia from 2000 to 2009**

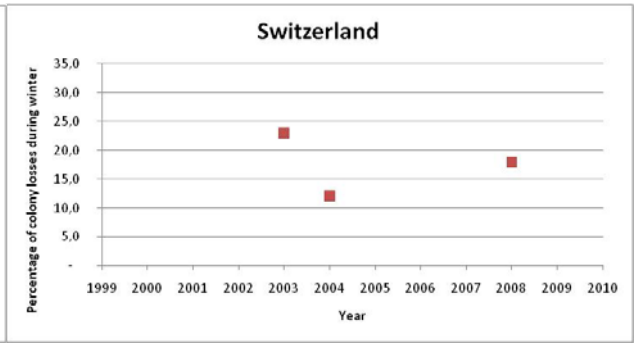


Figure 46. **Percentage of winter colony losses in Switzerland from 2000 to 2009**

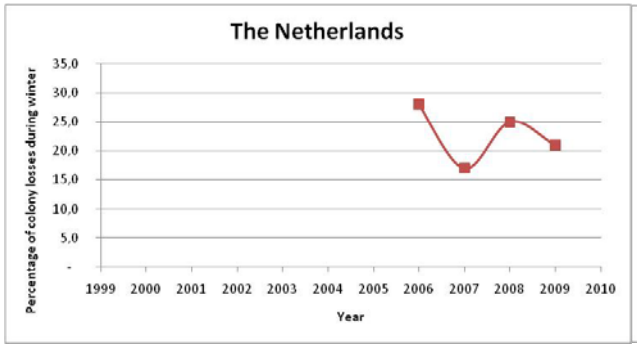


Figure 47. **Percentage of winter colony losses in the Netherlands from 2000 to 2009**

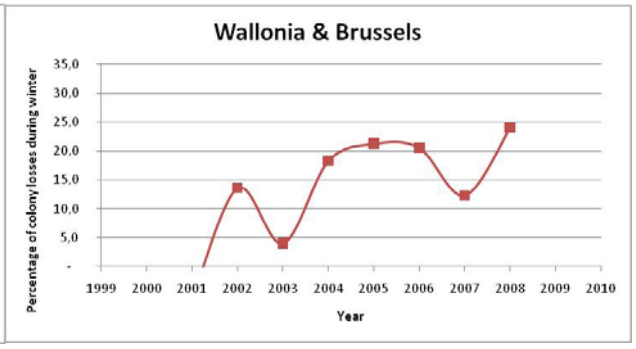


Figure 48. **Percentage of winter colony losses in Wallonia & Brussels from 2000 to 2009**

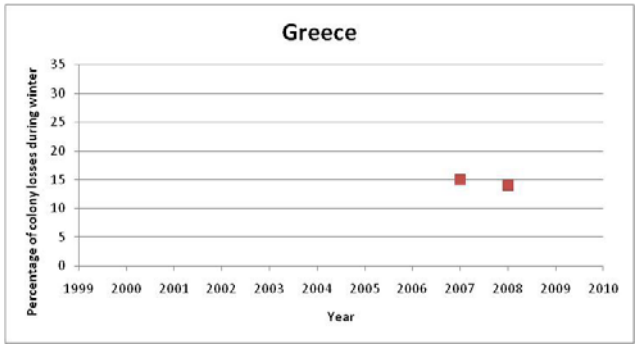


Figure 49. **Percentage of winter colony losses in Greece from 2000 to 2009**

2.2.2 Geographical distribution

A series of ten maps display all the results of colony losses in Europe over previous years (Figures 50 to 59). For the same reasons as previously stated, it has proved very difficult to compare geographical distributions of colony losses between countries. The same assumptions as those expressed for the temporal trends can be made for this indicator:

- A baseline incidence of colony losses of approximately 10%;
- Higher honey bee mortality rates in 2003 and 2008.

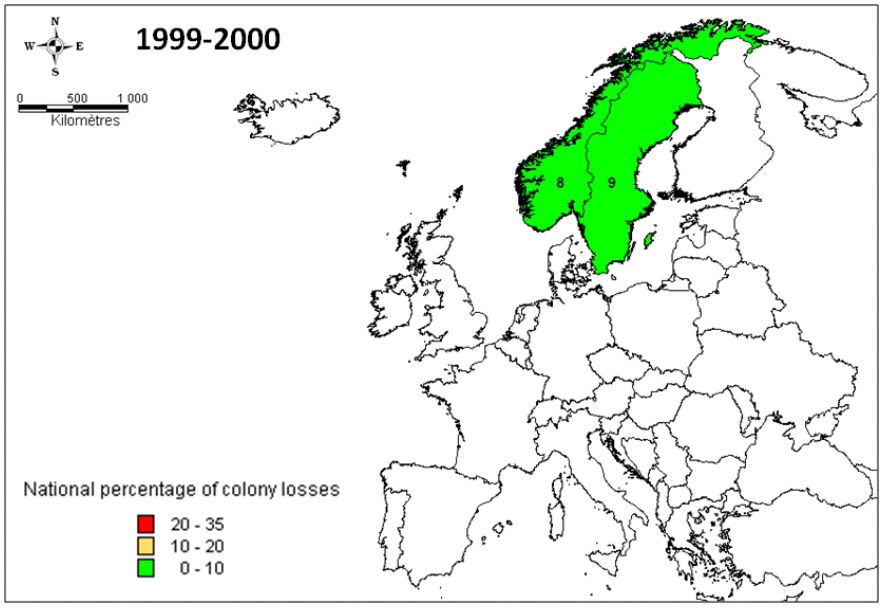


Figure 50. **Percentage of colony losses in some countries of Europe during winter 1999-2000**

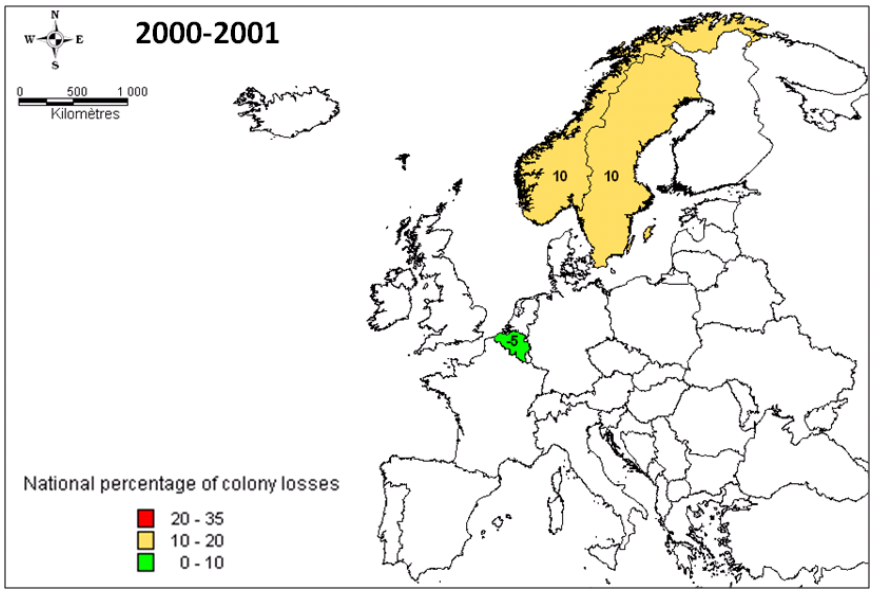


Figure 51. **Percentage of colony losses in some countries of Europe during winter 2000-2001**

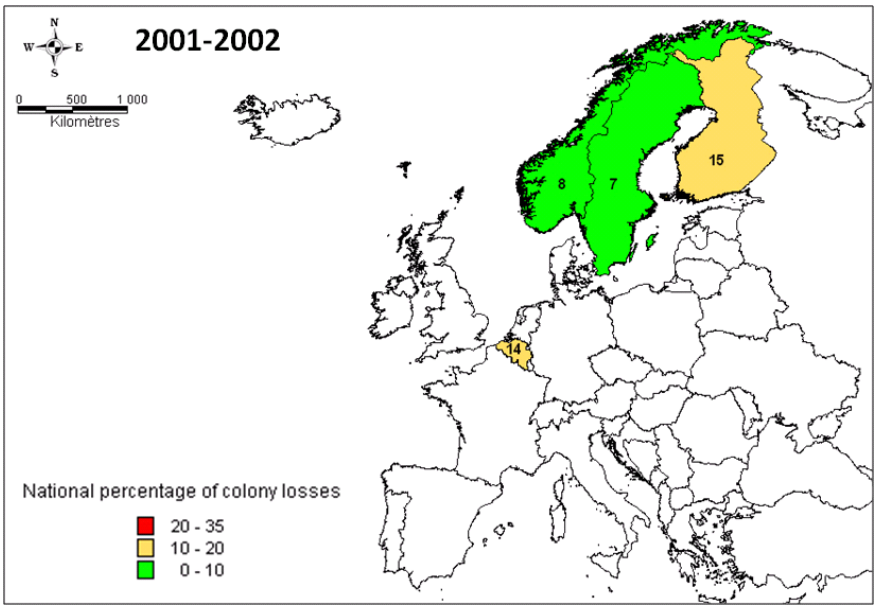


Figure 52. **Percentage of colony losses in some countries of Europe during winter 2001-2002**

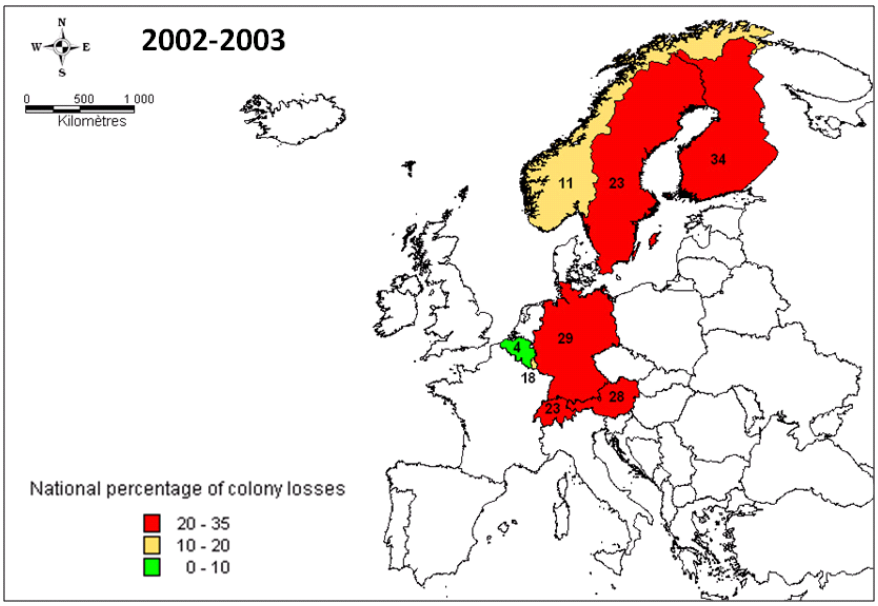


Figure 53. **Percentage of colony losses in some countries of Europe during winter 2002-2003**

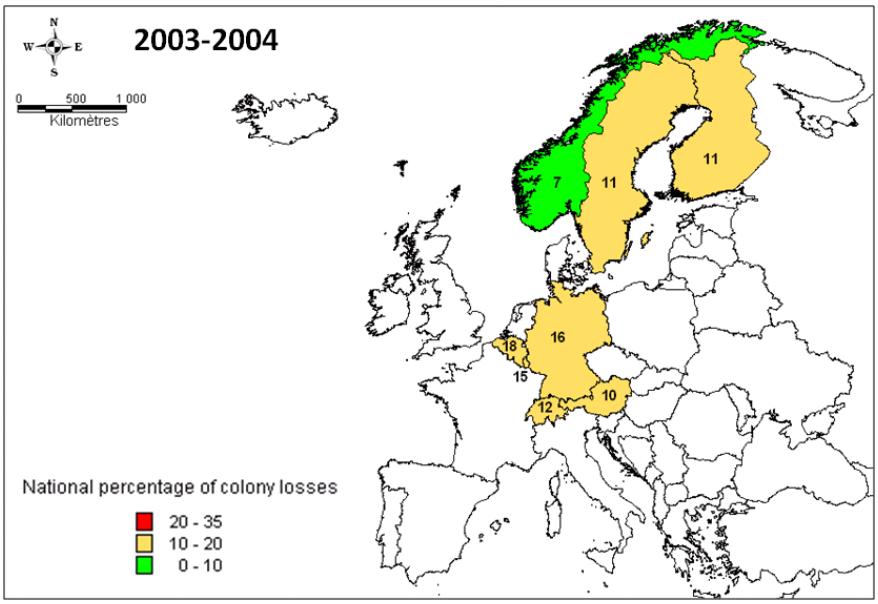


Figure 54. **Percentage of colony losses in some countries of Europe during winter 2003-2004**

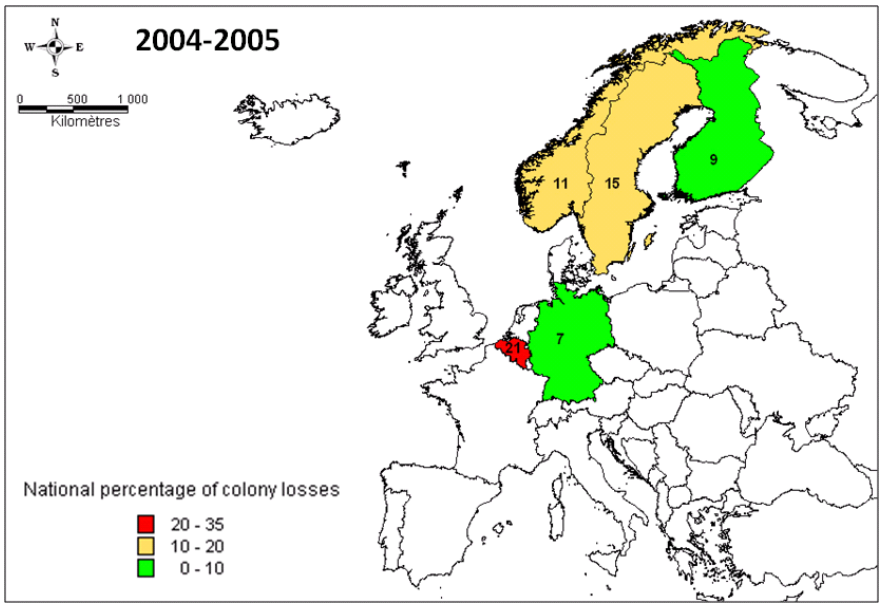


Figure 55. **Percentage of colony losses in some countries of Europe during winter 2004-2005**

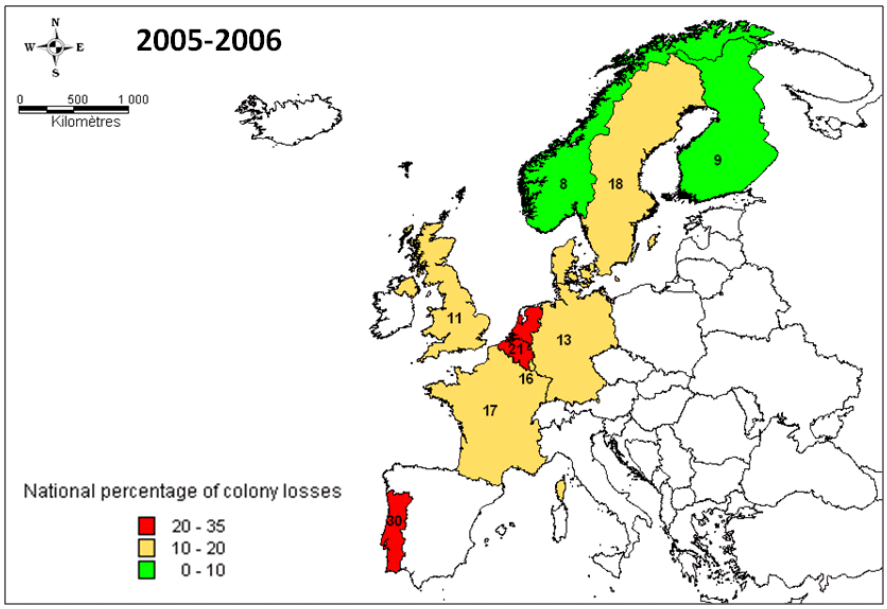


Figure 56. **Percentage of colony losses in some countries of Europe during winter 2005-2006**

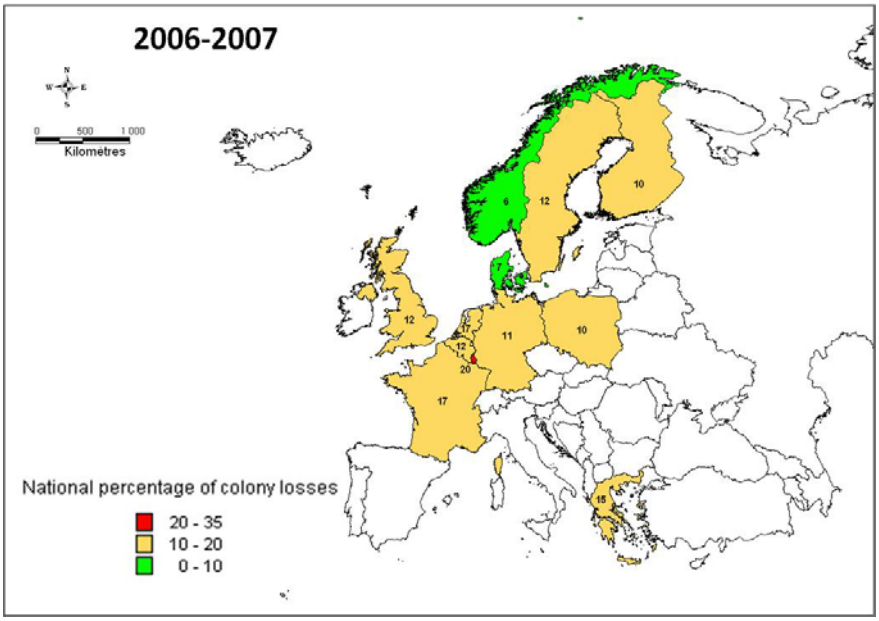


Figure 57. **Percentage of colony losses in some countries of Europe during winter 2006-2007**

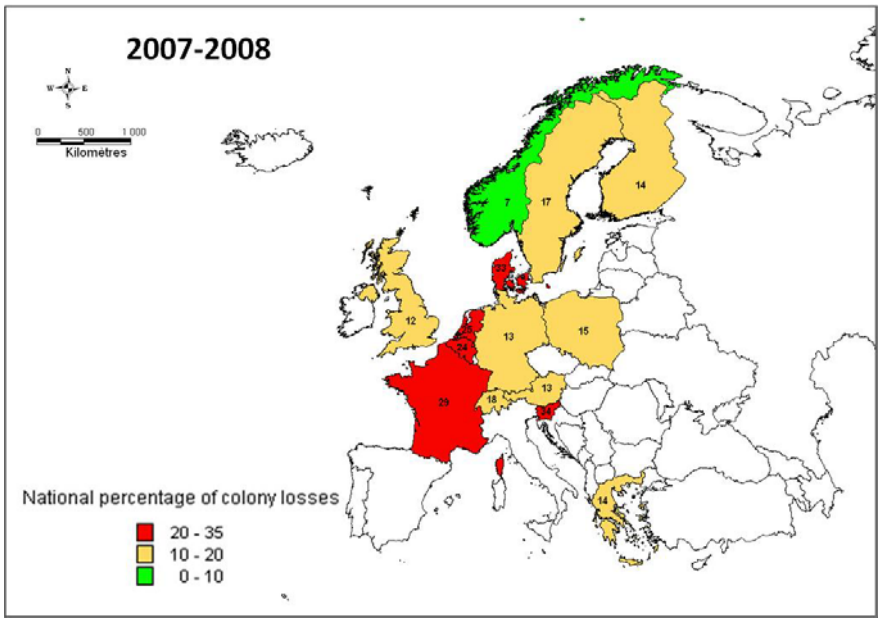


Figure 58. **Percentage of colony losses in some countries of Europe during winter 2007-2008**

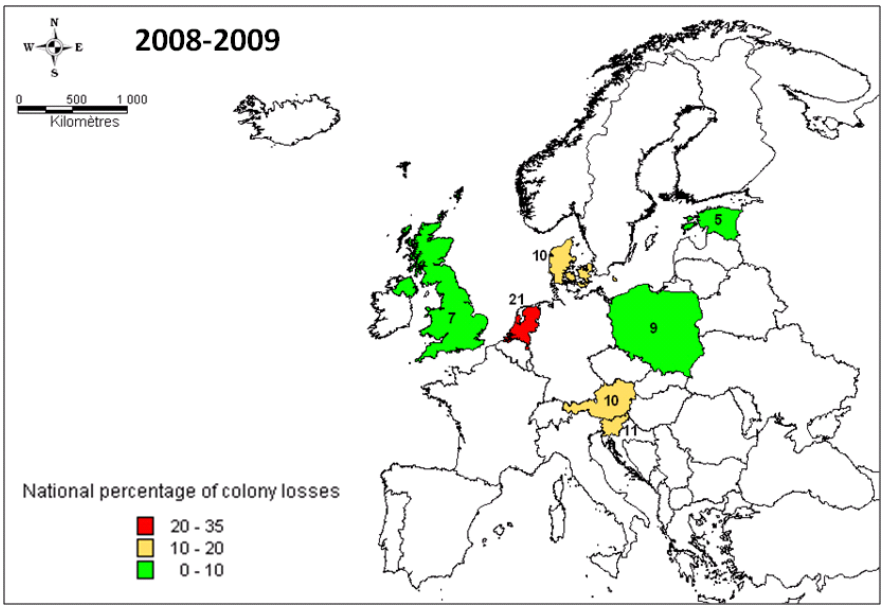


Figure 59. **Percentage of colony losses in some countries of Europe during winter 2008-2009**

2.2.3 Conclusions, recommendations and perspectives

Collection and analysis of data stemming from the colony losses surveillance systems in Europe clearly reveal that there is an absence of shared loss indicators, calculated following the same procedures, and applied to comparable populations. Therefore, the only indicator that could be used in this study was the winter colony loss rate. Even though analyses of temporal trends or geographical incidence seem to suggest some periods of higher winter colony loss rates, these findings should not be over interpreted; this highlights how some existing data collection systems are unsuitable for drawing any comparisons between situations in different European countries, and in the analysis of colony loss trends at the European level.

Therefore, according to the recommendations proposed following the assessment of the surveillance systems, harmonisation of surveillance procedures at the European level must include the establishment of a common set of epidemiological indicators, calculated following the same rules in all countries, and produced by comparable active surveillance procedures applied on comparable populations. This recommendation is essential to allow comparison between countries' situations within Europe, and the objective assessment of the trends in colony losses, not only addressing winter colony losses but also summer colony losses giving a more complete view of the phenomenon. An appropriate tool to monitor colony losses at the European level is important as this will provide national or European decision makers and the beekeeping industry with accurate figures about colony mortality, allowing them to focus their collective research and control activities.

The above mentioned scientific monitoring group which should be implemented at the European level for the harmonisation of surveillance systems, should be also responsible for the implementation and follow-up of the European data collection, management and interpretation

activities. Composed of scientists specialised in bee diseases and bee production and epidemiology, this group would represent the appropriate scientific and technical support to European institutions such as EFSA and European Commission for risk analysis and decision-making.

3 WORK PACKAGE 3: CRITICAL REVIEW AND SELECTION OF RELEVANT LITERATURE ON THE POSSIBLE CAUSES OF HONEY BEE COLONY COLLAPSE, WEAKENING AND MORTALITY

The aim of this work package was to critically review all relevant scientific literature (grey and white literature) pertaining to honey bee colony losses. The literature was searched using two strategies. Firstly consortium partners were asked to select and submit relevant references for review; secondly, a specific Internet literature search was carried out by AFSSA.

3.1 Material and Methods

3.1.1 Methodology of literature search

3.1.1.1 References gathered through the consortium

All partners were asked to send all bibliographical references they had about:

- Risk factors for mortality, collapse and weakening in beehives;
- Causative factors for colony losses;
- The operation (or surveillance data) of colony losses surveillance programs in Europe;
- Colony losses episodes.

In this way the project gathered 319 references.

The previous EFSA report ("Bee Mortality and Bee Surveillance in Europe") was also studied, including all of the completed questionnaires therein. This yielded 44 additional references.

During the study, 119 additional references were gathered from other miscellaneous sources (such as the bibliography of the AFSSA report "Mortality, collapse and weakening of honeybee colonies", internal communication, references sent by several persons who do not belong to the consortium, etc). These references were selected using three questions as detailed below. This first part of the literature search assembled a total of **482** relevant references.

3.1.1.2 Classical literature search on public database

The first part of the literature search concluded with a classical literature search on public databases through:

- PubMed (search on MEDLINE, OLDMEDLINE and PubMed database);
- Science Direct (one of the largest online collections of published scientific research, which contains over 8.5 million articles from over 2500 journals).

References were selected through the following search strings, used in title, abstract and keywords:

« mortality OR collapse OR weakening OR surveillance OR losses AND (bee OR bees OR honeybee OR honeybees OR "*Apis mellifera*") »

« mortalité OR effondrement OR affaiblissement OR surveillance OR pertes AND (abeille OR abeilles OR « *Apis mellifera* ») »

« mortalität OR einsturz OR schwächung OR aufsicht OR verlust AND (biene OR bienen OR "*Apis mellifera*") »

« mortalidad OR hundimiento OR debilitamiento OR vigilancia OR pérdida AND (abeja OR abejas OR "*Apis mellifera"*) »

« mortalità OR crollo OR indebolimento OR sorveglianza OR perdita AND (ape OR api OR "*Apis mellifera*") »

The search in English uncovered 275 references on PubMed, and 186 on Science Direct. In French, the selected references respectively numbered one and four. Searches in German, Spanish or Italian, did not yield anything. This can be explained by the fact that few non-English written journals are referenced in those public databases. This weak point has been compensated by the other research strategies. After removing duplicate references, 417 additional articles were found through this search. After the further removal of references already gathered in our database (references from partners or EFSA), we had a net gain of 360 additional references. Some references were subsequently found to be irrelevant to this study. For example:

Bencko, V., J. Rames, et al. (2009). "Ecological and human health risk aspects of burning arsenic-rich coal." Environ Geochem Health **31 Suppl 1**: 239-43.

This reference was originally selected because of the presence of those two sentences in the abstract: "The first indication of environmental pollution by arsenic-containing emissions was the mass extinction of **honeybee** colonies" and "significant hearing **losses** were detected in exposed children". This article doesn't deal at all with honeybee. Therefore, it was decided to answer to three questions before entering those selected references in our database:

- Does this reference deal with honeybees?
- Does this reference concern an EU country or USA (considering that it had been decided to integrate references from USA during the launching meeting in Parma in January 2009)?
- Does this reference deal with colony mortality, collapse or weakening?

If the answer to any of these questions was "No", the reference was excluded from the database. After this sorting, **21** references were entered in our database.

3.1.1.3 Specific screening on Google using the advanced search function

To complete the above research, the classical Google search engine was used with the advanced search function, using different search strings, depending on the researched document format. Keywords were not changed between the different search strings, but the date, the precision degree and the place where they are looked for were varied. All search strings were used in English, French, German, Italian and Spanish. Keywords used in English were: honeybee, *Apis mellifera*, mortality, collapse, weakening, surveillance and losses.

➢ *Search for Acrobat Reader documents*

The following search string allows to obtain 133 000 documents:

(bee OR honeybee) mortality OR collapse OR weakening OR surveillance OR losses filetype:pdf

To reduce this huge volume of documents, keywords were searched for their titles ("allintitle" function). They were used as both singular and plural forms, in order not to exclude any potentially relevant documents. Many English language references deal with wild bees, so we used "honeybee" instead of "bee". For other languages, we kept the general term, because the number of references was already limited by the "allintitle" function. As many references deal with anaphylaxis accidents or the use of venom in human therapy, we decided to exclude documents containing the words "sting, stings or venom". All search strings used are detailed below:

allintitle: ("Apis mellifera" OR honeybee OR honeybees OR "honey bee" OR "honey bees") mortality OR collapse OR weakening OR surveillance OR losses -sting –stings -venom filetype:pdf

allintitle: ("Apis mellifera" OR "abeille" OR "abeilles") mortalité OR effondrement OR affaiblissement OR surveillance OR pertes -piqûre -piqûres -venin filetype:pdf

allintitle: ("Apis mellifera" OR "biene" OR "bienen") mortalität OR einsturz OR schwächung OR aufsicht OR verlust -stich -stiche -gift filetype:pdf

allintitle: ("Apis mellifera" OR "ape" OR "api") mortalità OR collasso OR indebolimento OR sorveglianza OR perdita -puntura -punture -veleno filetype:pdf

allintitle: ("Apis mellifera" OR "abeja" OR "abejas") mortalidad OR hundimiento OR debilitamiento OR vigilancia OR pérdida -picadura -picaduras -veneno filetype:pdf

➢ *Search for Word, Power Point or Rich Text Format Document*

On the Internet, far fewer documents are available in those formats, compared to the number found in Acrobat Reader format. For this reason, keywords were searched for in the entire document, not just in the title. To obtain the most relevant documents, the kind of bee (honeybee) was specified in all languages. As keywords were searched for in entire documents, it was not necessary to use the singular and plural forms; only plural forms were used. For English language Word documents, as there were so many (512 results), the research was restricted to the "web pages discovered in the last 365 days", and to the 100 first results of the research with no date restriction. Search strings are detailed above. They were also used for "filetype:docx", "filetype:ppt", filetype:pptx", filetype:rtf".

("Apis mellifera" OR honeybees OR "honey bees") mortality OR collapse OR weakening OR surveillance OR losses –sting –stings -venom filetype:doc

("Apis mellifera" OR "abeilles domestiques" OR "abeilles mellifères") mortalité OR effondrement OR affaiblissement OR surveillance OR pertes -piqûre -piqûres -venin filetype:doc

("Apis mellifera" OR "hausbiene" OR "hausbienen") mortalität OR einsturz OR schwächung OR aufsicht OR verlust -stich -stiche -gift filetype:doc

("Apis mellifera" OR "api domestice") mortalità OR collasso OR indebolimento OR sorveglianza OR perdita -puntura -punture -veleno filetype:doc

("Apis mellifera" OR "abejas meliferas" OR "abejas domesticas") mortalidad OR hundimiento OR debilitamiento OR vigilancia OR pérdida -picadura -picaduras -veneno filetype:doc

➢ *Results*

The most relevant documents/web pages were selected by answering the following six questions:

- Does this document deal with honeybees?
- Does this document concern an EU country or USA?
- Does this document deal with colony mortality, collapse or weakening?
- Is it the first time this document enters in our selection process?
- If this document deals with a colony losses episode, is more than one apiary/bee-keeper concerned?
- Does this document give additional original information?

If the answer to any of the above questions was "No", the reference was excluded from our database. We also posed an additional question for all documents:

- Does this document include any interesting links (to literature of relevance to colony losses)?

If the answer to this question was "Yes", web pages provided by the article were entered into our selection process (using the above six questions). After this sorting, and after having studied all relevant links, **45** references were entered in the database. Table 10 summarises the number of documents/web pages found according to search string. Numbers in brackets show the number of references added to our database after the use of the six questions.

Table 10. **Number of documents found depending on the search string**

Language	English	French	German	Italian	Spanish
Format					
.pdf	**30 (8)**	**14 (5)**	**0**	**3 (2)**	**3 (0)**
.doc	**[(a)]163 + 100 (13)**	**120 (5)**	**6 (1)**	**14 (0)**	**98 (1)**
.docx	**10 (1)**	**0**	**0**	**0**	**2 (0)**
.ppt	**88 (4)**	**5 (0)**	**0**	**2 (0)**	**3 (0)**
.rtf	**63 (5)**	**19 (0)**	**1 (0)**	**8 (0)**	**5 (0)**
Total	454 (31)	158 (10)	7 (1)	27 (2)	111 (1)

[(a)]Pages discovered in last 365 days

3.1.1.4 Search on a personalized Google search engine

A "Beekeeping" search engine developed by Bruno Peiffer (French Ministry of Agriculture and Fisheries) interrogates 125 websites specialised in beekeeping. The list of the websites used is presented in Appendix 6. Using this engine one can find, for example, all pages produced by the World Organisation for Animal Health, by the Mid-Atlantic Apiculture Research and Extension Consortium (the major American bee working group), or from the main European bee research institutes. The project used this search engine was used to find new references, using the following search strings:

Daterange: 2451557-2455057 ("Apis mellifera" OR honeybee OR honeybees OR "honey bee" OR "honey bees") mortality OR collapse OR weakening OR surveillance OR losses -sting -stings –venom

Daterange: 2451557-2455057 ("Apis mellifera" OR "abeille" OR "abeilles") mortalité OR effondrement OR affaiblissement OR surveillance OR pertes -piqûre -piqûres -venin

Daterange: 2451557-2455057 ("Apis mellifera" OR "biene" OR "bienen") mortalität OR einsturz OR schwächung OR aufsicht OR verlust -stich -stiche -gift

Daterange: 2451557-2455057 ("Apis mellifera" OR "ape" OR "api") mortalità OR collasso OR indebolimento OR sorveglianza OR perdita -puntura -punture -veleno

Daterange: 2451557-2455057 ("Apis mellifera" OR "abeja" OR "abejas") mortalidad OR hundimiento OR debilitamiento OR vigilancia OR pérdida -picadura -picaduras -veneno

The "Daterange:" function allowed us to limit our searches to web pages discovered between two dates. The dates had to be written in "Julian day". In the present study we searched for documents originating between the 1st January 2000 and the 1st August 2009. Keywords were used in both their singular and plural forms, to avoid excluding any relevant documents. Following the use of this tool, 259 web pages were found in English, 542 in French, 54 in German, 78 in Italian and 93 in Spanish. Relevant ones were selected using the six questions detailed above. Finally, **27** new references were added to the database (19 in English, 6 in French, 2 in German, 1 in Spanish).

3.1.2 Entering of the references into a database

3.1.2.1 Operation of the database

All these references were entered in an EndNote® database named "Bee Surveillance". All full texts have been uploaded on the EFSA portal (access path: Bees AMU-EFSA-2008-01 / Bee Surveillance / WP3 – Literature review and analysis / References – Full text or abstracts), and relevant references were circulated by e-mail to all our partners.

In the EndNote® database, different fields were added:

- "Kind of source": the origin of the reference was specified using the following code. "1" for references coming from a partner of the consortium, "2" for PubMed/Science Direct, "3" for Google research, "4" for references coming from the previous EFSA report, "5" for miscellaneous sources.

- Reading priority: the way of choosing the reading priority is detailed below.
- Reading statute: if there is a "0", it means that the reference has not to be read in priority. For a "1", the reference has to be read in priority. For a "2", the reference has been read, and if there is no figure, the reference has not to be read in priority, but could be read in second intention.
- Reader: name of the person who has studied the reference.
- Reason of non-reading: this field is detailed below.

Nearly all titles were translated into English in the field "Translated title". All available full texts were attached to the reference, and all abstracts (or introduction, where no abstract for the reference was given) and keywords (when available) were entered in the "Abstract" and "Keywords" field, in order to ease the study of the references. A "screen shot" of this EndNote database is Available in Appendix 7.

3.1.2.2 Qualitative and quantitative description of the bibliography

At the end of the literature research, our database gathered 575 references. The sources of these references are presented in Figure 60. The majority of references came from the consortium. Few additional references were found through PubMed/Science Direct, because all major references had already been gathered through the consortium and the EFSA report. The searches on Google yielded several references that didn't come from peer-reviewed journals, such as PowerPoint presentations, interviews, reports, hearings, etc. Regarding the Internet searches, use of the six questions proved to be very important, because so many documents deal, at least in some way, with honey bee mortality/weakening/collapse, especially with the CCD in the United States of America. Such documents are, for the most part, popular articles. They are interesting in so far as they contribute to our understanding of the controversial aspects of the subject of colony losses, but most of them do not give new scientific information. This current project was able to filter them out by applying one or other of the following two questions "If this document deals with a colony losses episode, is more than one apiary/bee-keeper concerned?" and "Does this document give new information?".

Figure 61 shows the variability of the languages of our references (9 different languages). For most references gathered, we were able to obtain full texts. All these references are detailed in Appendix 8, ranked according to their reading priority (see below).

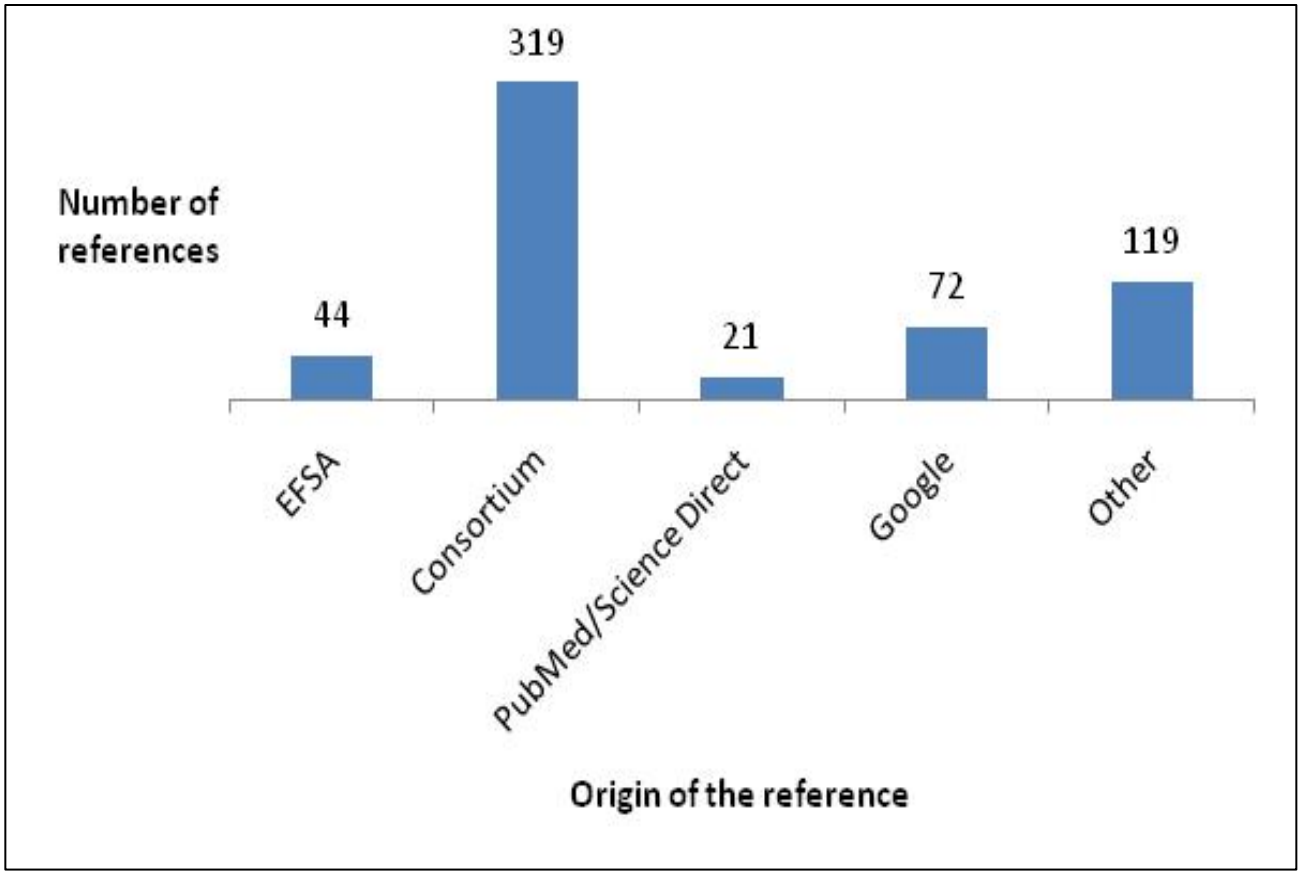


Figure 60. **Number of references of the EndNote® database, depending on the source**

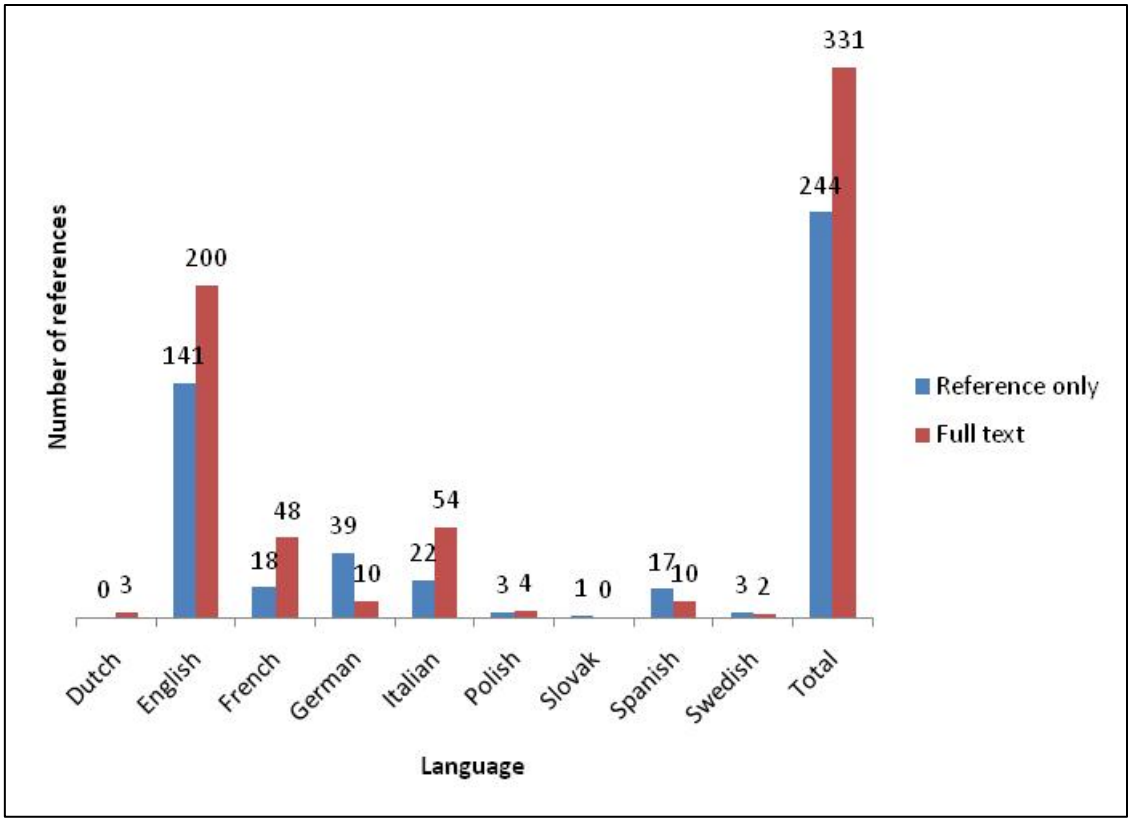


Figure 61. **Number of references, depending on the language**

3.1.3 Study of the references

3.1.3.1 Reference selection: decision tree

In order to establish objective reading priorities for the 575 references gathered, the project developed a reading decision tree. This method is based on the search for keywords in Title, Abstract, and Keywords ("TAK" method).

- When the keywords are found in Title, the reference should be read as a priority. The code is "1" in the field "Reading priority" of our database, and "1" in the field "Reading statute".
- When the keywords are found in a document's Abstract, the reference does not need to be read as such a high priority, but in "second intention". In this case, the code is "2" in the field "Reading priority". There is no code in the field "Reading statute".
- When the keywords are found in Keywords, the reference is of lower "third intention" priority. The code is "3" in the field "Reading priority". There is no code in the field "Reading statute".
- When the keywords are not found in Title, Abstract or Keywords, the reference should be considered to be of the lowest priority. The code is "0" in the field "Reading priority", and "0" in the field "reading statute".

During the reading process of the project, all references of "priority 1" had to be read and studied. When they are all read and studied, then one should move on to "priority 2" references. In each case, the Abstracts are first read, and by answering the 6 questions used during the Internet research, one can determine if the reference has to be read (the code is "1" in the field Reading statute"), or not (the code is "0"). If, having followed this process, the article can be rejected, the reason must be specified in the field "Reason of non reading". It is possible that a reference first selected on the Internet was not then chosen for further study beyond this stage, if the information given by the article has already been covered and read in a "priority 1" article.

When all those "priority 2" have been read, the same process has to be applied to the "priority 3" references.

The keywords used were:

Mortality OR mortalité OR mortalita OR mortalidad OR mortalitat OR collapse OR weakening OR surveillance AND « year is greater than 2000 ».

The word "losses" and the date of "2000" were chosen according to the EFSA point of view, after the first interim meeting. Figure 62 explains the method and gives the number of references of "priority 1", "priority 2", "priority 3" and "priority 0", respectively. As a lot of references were in "priority 1", the abstract relevance reading of "priority 2" references has not been completed.

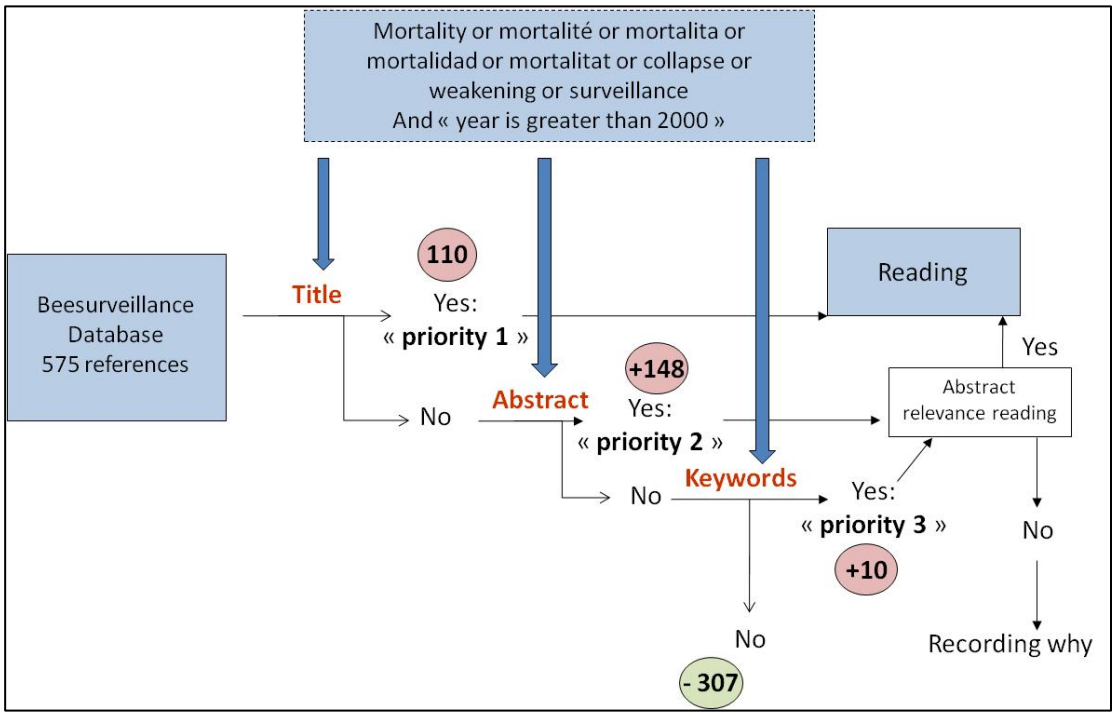


Figure 62. **Summary of the "TAK" method**

This method allows objective choices to be made about which references to study, and in what order of priority. One can see that 110 references are of "priority 1", but for 3 of those references, it

has not been possible to collect the abstract or the full text. In reality we have therefore 107 references of priority 1.

3.1.3.2 Data extraction: reading grid

The project developed a grid to implement literature data extraction. This grid was based on one that was developed for a project about *Campylobacter* in the United Kingdom: "A critical review of interventions and strategies (both biosecurity and non-biosecurity) to reduce *Campylobacter* on the poultry farm." This tool was adapted for the purposes of the Bee Surveillance project. The objectives of the grid are to extract with a standardised method information about:

- Risk or causative factors for colony losses, with degrees of probability;
- Indicators and definitions used to describe the studied phenomenon;
- Quantification (figures) about colony losses;
- Conclusions of the reference;
- Quality assessment of the reference.

The questionnaire is divided in several parts (see below). For each document, only the relevant parts need to be filled in (at least the first and the last one, and generally one or two intermediary ones), depending on the topic of the source:

- General questions;
- Questions specific to abstracts;
- Questions specific to epidemiological studies of colony loss risk factors;
- Questions specific to reviews;
- Questions specific to reports on colony losses episode(s);
- Questions specific to reports on a European surveillance network;
- Questions about the opinion of the reader.

The grid was modified after the first interim meeting, according to EFSA recommendations. Changes were as follows:

- Addition of a question about "environmental factors";
- Addition of a field to detail the answer when a reader considers that information contained in the reference is not "objective" or that something is not "valid";
- Addition of a table to enter figures given by the reference.

An example of a filled grid is presented in Appendix 9. The original grid and all filled grids can be found on the EFSA Assessment Methodology Workspace, following this access path: Bees AMU-EFSA-2008-01 / Bee Surveillance / WP 3 – Literature review and analysis. One hundred and seven references were analysed using this grid.

3.1.3.3 Data analysis: reading grid database

A database was developed to gather all data extracted through the grid. It allowed the project to develop statistics about:

- The event studied (weakening, mortality, collapse);
- The definition used;
- The occurrence of major risk/causative factors, and their degree(s) of probability (according to the authors);
- New possible risk/causative factors identified;
- Published or unpublished mortality data;
- The source of the articles dealing with this subject.

The schema of the database are available in Appendix 10.

3.1.4 Limitations of the methodology

The objectives of the reference selection methodology ("TAK" method), and the data extraction grid, were to screen the most relevant references on colony losses, and to have a standardised data extraction system from these various documents. The lists of references show that the screening method was powerful, yielding many new references to complement those provided by consortium partners. The grid proved easy to use. However, one should take into consideration some limitations of the proposed method:

- Where references are effectively selected on the basis of their relevance to the chosen target subject (colony losses), it is difficult to avoid redundancy/duplication when several references relate the same single event, or to the same set of research findings. Therefore, quantitative results (such as number of occurrences of a risk factor) should be viewed with caution, bearing in mind that such results could be artificially over represented;
- The decision taken to integrate non peer-reviewed publications and grey literature was important, because it allowed us to detect interesting new information. However, it also reinforced the above-mentioned risk of information redundancy/duplication, and widened the variability of quality of the collected information;
- The selection methodology applied above was very sensitive to the words used in the search strings. Every effort was made to choose the most relevant strings. However, it is still possible that some references have slipped through this screening process;

- Even if the extraction grid enables a standardised analysis of the references, it cannot avoid some differences in the interpretation made by different readers. The best way to avoid this risk would have been to have two readers per reference. However, this was not possible for practical reasons in the project.

3.2 Results

One hundred and seven references were read through the reading grid.

3.2.1 Description of the studied references

One third of the references were found to concern the United States of America; all the others related to Europe. For Europe, references concerned 15 countries, with majority being about Italy, France and Spain (Figure 63). Seventy-six percent of the references were published between 2007 and 2009. This reflects both the increase in the published literature on colony losses over the last three years, and also the concern of the project to stick to actual findings (Figure 64). Considering the topics addressed by the references, Figure 65 suggests that there is a balanced representation of diseases and poisoning issues, indicating that none of these potential causes/risk factors were under- or over-represented in the study. Environmental factors were considered by 41% of the references (Figure 66). The majority of the studied references are public, but not peer-reviewed, documents (68%). Only 31% have been published in peer-reviewed journals (Figure 67). One can see that very few documents studied come from grey literature. The only possible origin for grey literature in this study was the partners of the consortium or EFSA, and few documents were received. These documents were frequently written in a language other than English, and their titles were frequently indistinct (for example misspelled). For these reasons, comparatively few grey literature documents were in “priority 1”. Subjects covered by the references studied were found to be nearly equally distributed between risk factors studies, primary research, description of colony losses episodes and others (Figure 68). One should note that a lot of reviews are integrated in the “other” topic.

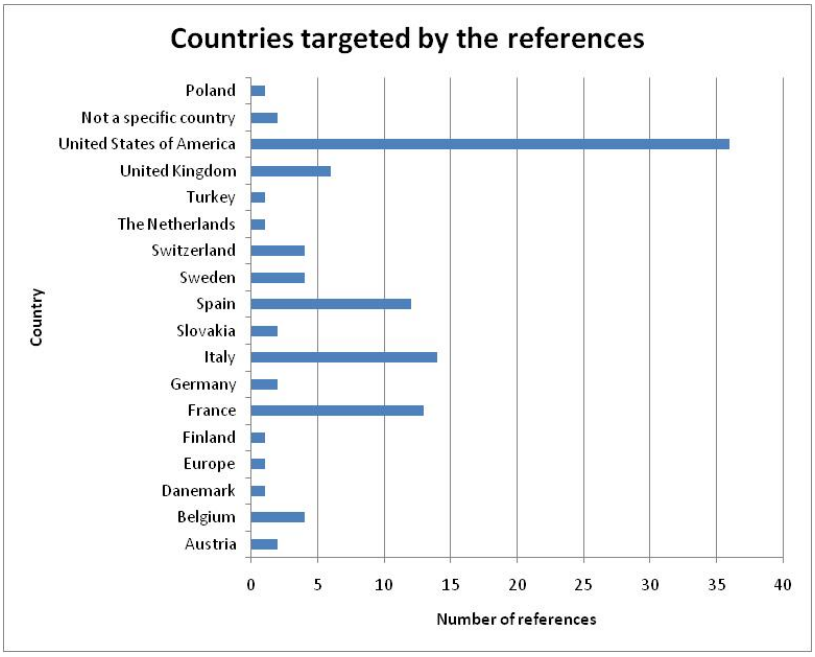


Figure 63. **Countries targeted by the studied references**

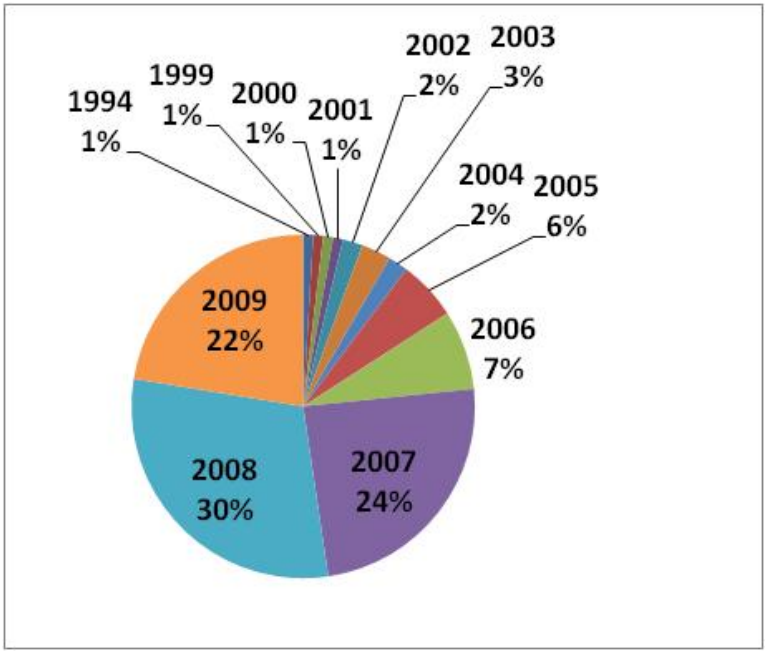


Figure 64. **Year of publication of the studied references**

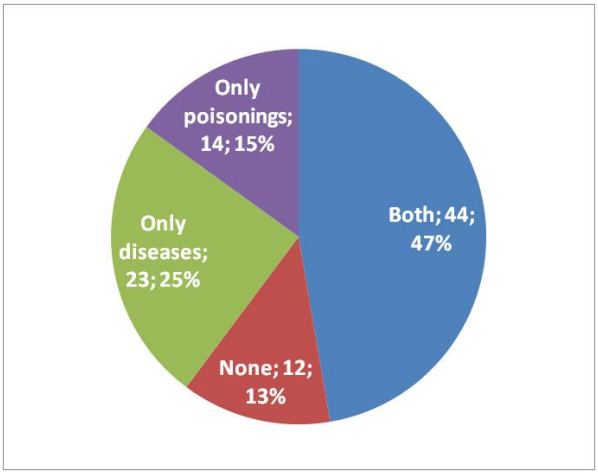


Figure 65. **Topics addressed by the studied references**

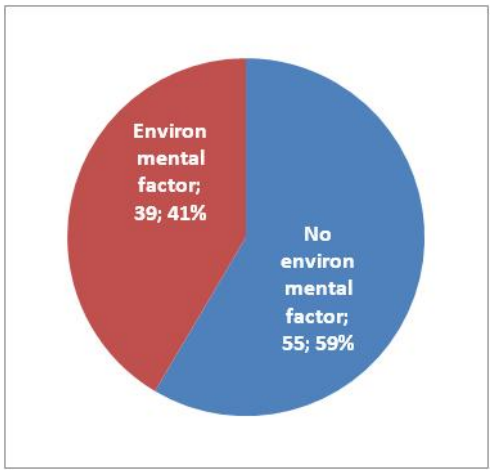


Figure 66. **Studied references dealing with environmental factors**

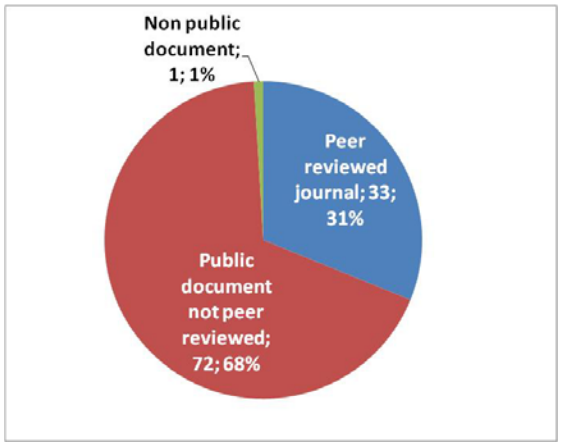


Figure 67. **Type of references studied**

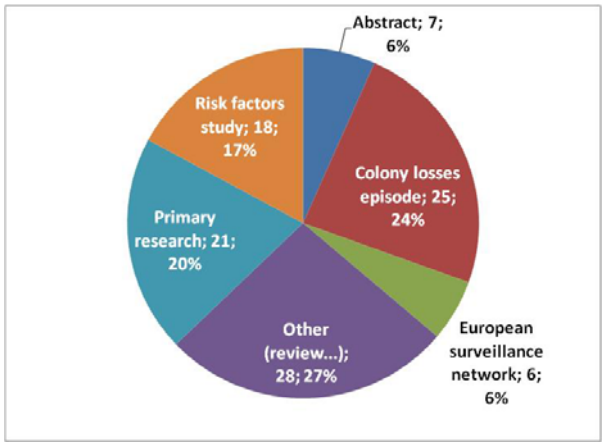


Figure 68. **Subjects of the studied references**

3.2.2 Variability of the events studied and the used definitions

Figure 69 shows an important variability of the studied events. Most of the "collapse" studies are dealing with "Colony Collapse Disorder" (CCD) in the United States of America. Even references dealing with mortality were sometimes found to be, in fact, talking about CCD, it was just that the authors were imprecise in their usage of terminology. CCD is a phenomenon quite well described and defined, but there is frequent confusion between CCD and the winter mortality. Studies about "mortality" are mainly dealing with "colony losses" syndrome in Europe. In several references, different events are studied together. Figure 69 only represents the comparison between all the different indicators.

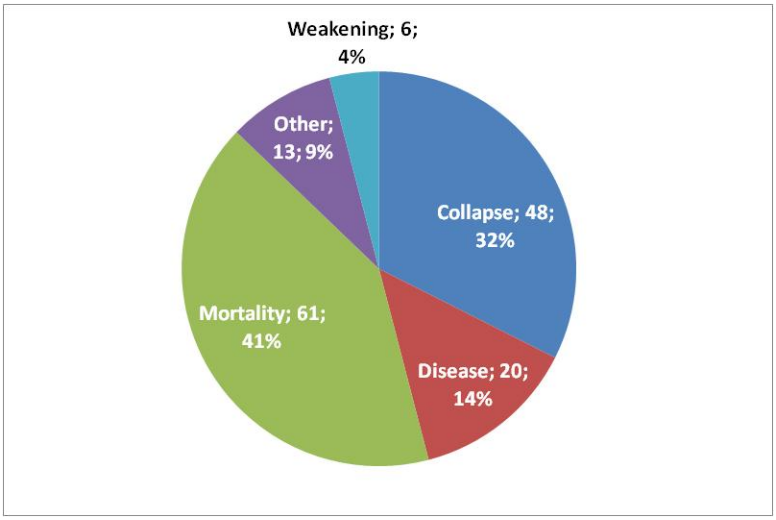


Figure 69. **Events studied in the studied references**

The same variability appears regarding the indicators used to describe the phenomenon investigated (Figure 70). However, it seems clear from the literature that the main indicator used to describe the phenomenon of colony losses is the "colony mortality rate". This was already the most used indicator within the surveillance systems. Bee mortality rates are used to describe acute poisonings, or to measure the influence of a causative factor at the laboratory level. Bee population dynamics indicators are also used to measure the impact of causative factors on the hive population.

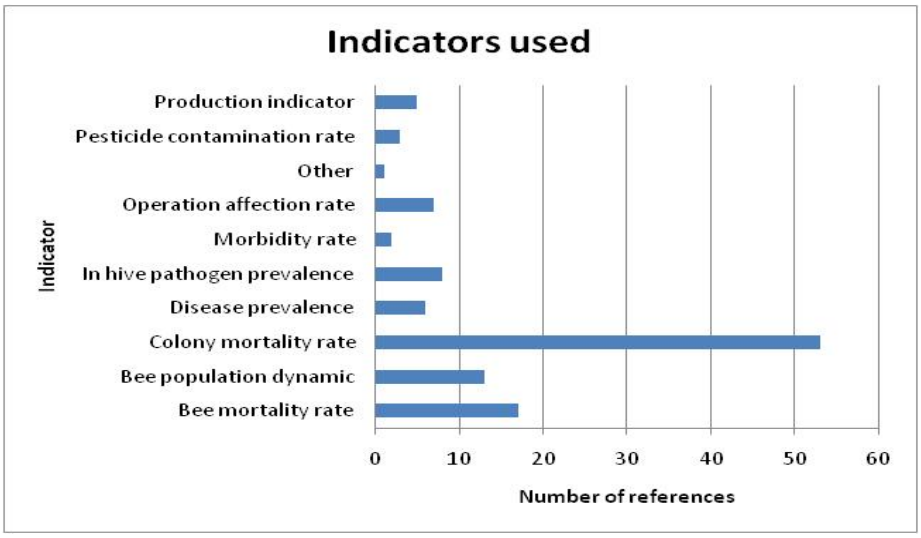


Figure 70. **Event studied in the read references**

Table 11 gathers some of the definitions given for CCD in the studied references. The first one is the definition given by the MAAREC (Mid Atlantic Apiculture Research and Extension

Consortium), which is comprised of scientists from all over the United States of America, and has organised a working group specifically dedicated to the research of CCD causes. This definition could be considered as a standard definition, and is used in many references. A few characteristics were found in nearly all of these definitions:

- A depopulation of the colony,
- The rapidity of the phenomenon,
- The absence of dead bees in the hive.

Other elements are not so universally shared. The most interesting thing, perhaps, within these various definitions, is the duration of the phenomenon. If one follows the first definition, this phenomenon occurs during beekeeping season. But in several definitions it is not clear, and in others (in red in the table) CCD can occur in winter. In many publications no definition is given for CCD, but winter mortality is included in the study. One can see here that there is frequent confusion between two different phenomena:

- CCD, that is a rapid loss of the bees of the colony, with no dead bees inside the beehive, occurring during the beekeeping season, and mainly studied in America;
- The increase of winter mortality, which is mainly studied in Europe.

Weakening is rarely covered in the literature, and is usually described as a symptom, or consequence of the CCD.

Table 11. **Some of the definitions used for the CCD in the studied references**

CCD definition
(i) sudden loss of the colony's adult bee population with very few bees found near the dead colonies; **(ii) several frames with healthy, capped brood with low levels of parasitic mites, indicating that colonies were relatively strong shortly before the loss of adult bees and that the losses cannot be attributed to a recent infestation of mites;** **(iii) food reserves that have not been robbed, despite active colonies in the same area, suggesting avoidance of the dead colony by other bees;** **(iv) minimal evidence of wax moth or small hive beetle damage; and** **(v) a laying queen often present with a small cluster of newly emerged attendants**
• The rapid and seemingly spontaneous loss, disappearance, and demise of honey bee colonies
• A disorder in which disturbing numbers of bees are disappearing from their colonies
• Suddenly empty hives, no dead bees inside or around the hive, no bees in the hive, evidence of recent brood (queen and young larvae are left behind), absence of pests (no wax moths or hive beetle, nothing trying to rob the honey). Colony leaves behind brood, honey, pollen & all resources.
• It is characterized by: a rapid loss of adult bees, excess brood in all stages (abandoned in the hive), low level of Varroa, a lack of dead bees in or near the hive
• A mysterious malady depopulating beehives around the globe
• Rapid loss from a colony of its adult bee population with no dead adult bees found inside or in the close proximity to the colony. Presence at the end of the stage of the queen with few newly emerged bees, capped brood and sufficient food reserves
• One of the symptoms is a complete absence of bees in dead colonies or apiaries
• An operation was considered to be suffering from CCD when one-half or more of the colonies lost in an operation

were lost with few or no bees present in the hive or in the colony's apiary

- Sudden weakening and death of a colony without any evident signs of a disorder
- CCD leaves a hive with a few newly hatched adults, a queen and plenty of food
- Sudden colony death with a lack of adult bees in/in front of the dead-outs. Foraging populations are greatly reduced/non-existent. Honey and bee bread are usually present and there is often evidence of recent brood rearing. Presence of capped brood. In some cases, the queen and a small number of survivor bees may be present in the brood nest. There is an insufficient workforce to maintain the brood that is present. The workforce seems to be made up of young adult bees. The queen is present, appears healthy and is usually still laying eggs. The cluster is reluctant to consume feed provided by the beekeeper, such as sugar syrup and protein supplement. Delayed robbing and slower than normal invasion by common pests such as wax moth and small hive beetles. Appears throughout the year. The loss is rapid: few weeks or even few days.
- Sudden depopulation of the colony with disappearance of forager bees. Queen with some bees stay in the colony and finally dies. Capped brood indicates that the colony was strong before collapse. No dead bees in front of the hive like during intoxication or some infections. Food reserves indicate that the colony has not starved.
- Forager bees disappear and only few bees around the queen
- A rapidly depopulated beehive. The queen and immature bees (brood) remain, and there are no dead bees in the hive. Often there is still honey.
- The official description of a syndrome in which many bee colonies died in the winter and spring of 2006-2007
- The main symptom is simply a low number of adult bees in the hive
- The consequences are an unexplained disappearance of adults bees, a lack of attention to the brood, reduced colony vigor, and heavy winter mortality without any apparent pathological infection
- No or few adult bees in or around the hive, sealed brood present, stores present and not robbed by bees, wax moth or small hive beetles
- Small population of younger bees unable to care amount of brood present, queen present, colony reluctant to take food provided by the beekeeper

3.2.3 Risk and causative factors highlighted in the studied references

All risk and causative factors mentioned in the studied references are detailed in this chapter. It has proved difficult to separate risk factors from causative factors. This distinction is rarely drawn in the literature; authors often mix these concepts and, in many cases, misuse them. This is certainly due to the lack of understanding of the origin of the colony losses syndrome and the difficulty scientists are facing, when identifying a link between a factor and the phenomenon, to clearly state if it's a causative or a risk factor. Therefore, this difference has not been highlighted in the following description.

The quantitative data given in this chapter should not be used as evidence to categorise the importance or to qualify the certainty of the involvement of a specific factor. Quantitative data should express more the relative "popularity" of the studied factors. Furthermore, a certain redundancy occurs in the read references, due to the integration of reviews and non peer-reviewed literature mentioning results from the peer-reviewed literature. Therefore, an "amplification effect" may over represent the occurrence of one factor in the literature, without representing any link with its real involvement in the phenomenon.

An attempt to address the link between any factor and the phenomenon has been done by qualifying the probability of this link according to authors' opinion, using a four scale scoring: Unlikely,

probable, very likely and proven. Once more, due to the lack of evidence of the origin of colony losses and the amount of ongoing research into this, proven effects are very scarce and unsubstantiated authors' opinions should be viewed with caution.

A four-class categorisation scale was used to capture the range of factors mentioned in the literature. Figure 71 shows that biological agents are the most represented factors. Each type is detailed and discussed in the following paragraphs.

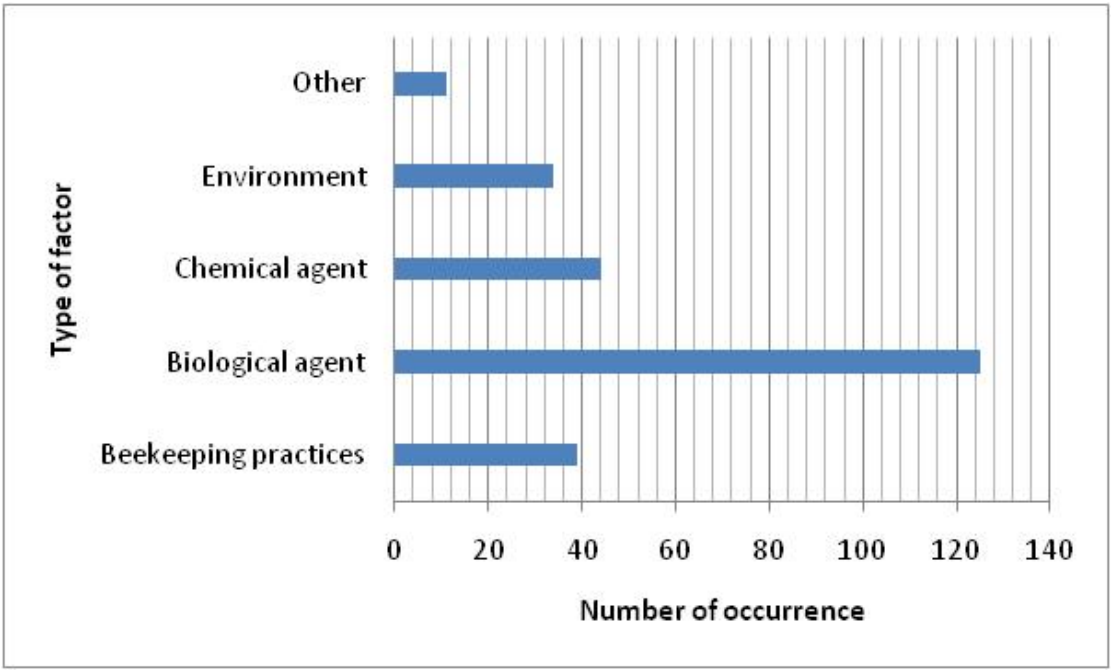


Figure 71. **Types of factors occurring in the studied literature**

3.2.3.1 Beekeeping practice

All beekeeping practices mentioned in the literature were in relation to the stress they can cause to the colony. Therefore, apiary management, nutrition deficiencies and migration conditions are considered more as risk factors for colony losses, rather than causative agents in the strict sense (Figure 72). None of these factors have been proven to be linked with all events studied, but most of them are considered to be able to play a role in colony losses (Table 12). No priority or importance scaling is proposed for the involvement of these factors. As risk factors, they are considered to "open the door" to biological agents, thus contributing to the appearance of colony losses.

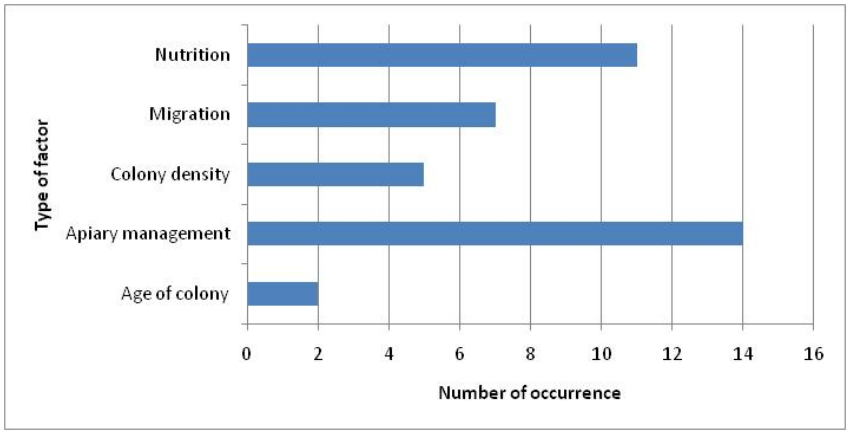


Figure 72. **Number of reports of each beekeeping practice factor in the studied references**

Table 12. **Authors' opinion on the beekeeping practice factors involvement in colony losses**

	Unlikely[1]	Probable[2]	Very likely[3]	Proven[4]	Total
Factor					
Age of colony					**0**
Apiary management	**2**	**8**			**10**
Colony density	**1**	**1**			**2**
Migration		**5**	**1**		**6**
Nutrition	**3**	**5**			**8**
Total	6	19	1	0	26

[1] The author reports that he is considering this factor is not involved in colony losses.
[2] The author reports that he is considering this factor is possibly involved in colony losses.
[3] The author reports that he is considering this factor is certainly involved in colony losses but he gives no proof for it.
[4] The author gives a proof of the involvement of this factor in colony losses.

3.2.3.2 Biological agents

A significant number of biological agents are reported to be involved in colony losses. Viruses are the biological agents most frequently mentioned (Figure 73). As more than 15 different viruses are known to infect bees, often without any clinical symptoms and since, co-infection with several viruses is not uncommon, they are the subject of much research. Due to their frequent presence, they are found in many colony losses cases where it is very difficult to determine whether they are at the origin of the losses, or just co-factors. Of the eight viruses mentioned in the literature, IABPV is the most frequently mentioned, and some scientists consider it as a "marker" of CCD in the United States (Figure 74). *Varroa*, *Nosema* spp and *Acarapis woodi* infections are the three other most commonly mentioned biological factors. Some scientists consider them to be causative factors in a certain amount of colony losses (for *Nosema* mainly in Spain). Others consider that they are co-factors, contributing to the stress of the colony or contributing to the "expression" of colony mortality as causative factor of death for a colony already weakened by other stress factors. This is why the factors "multiple infection" and "unidentified disease" appear in the assumptions made by the authors. All these hypotheses open the floor to a debate on possible treatments to prevent or

cure these infections. This links together these biological agents with chemical factors and beekeeping practices because beekeeping practices and chemical treatments are used to control infections. The debate on the involvement of the various biological agents is clearly expressed in the author's opinions summarised in Table 13 with a high rate of "possible involvement" and balanced reports between "unlikely" and "very likely".

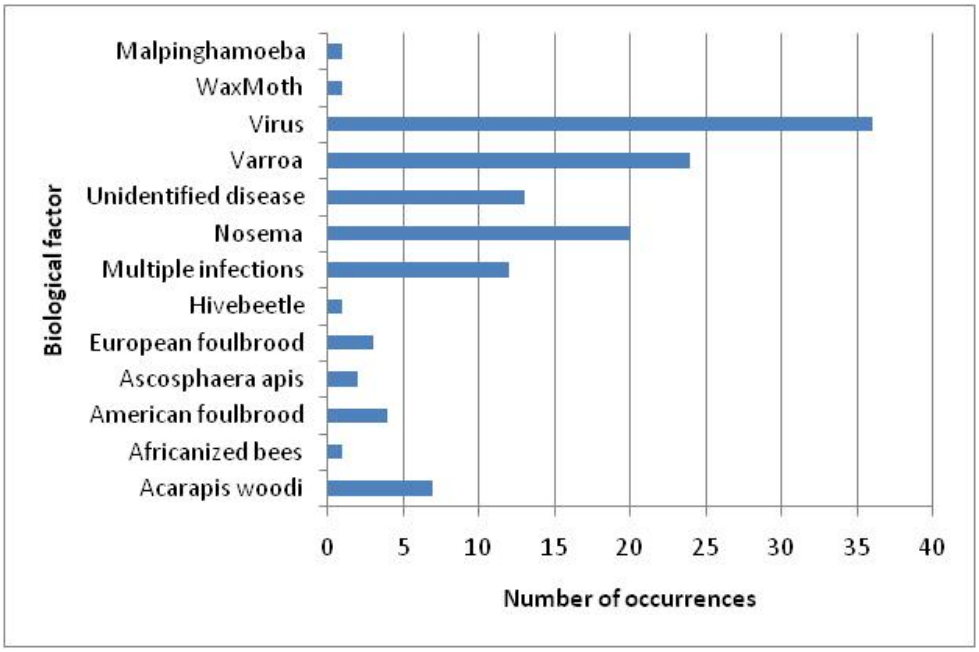


Figure73. **Number of reports of each biological agent factor in the studied references**

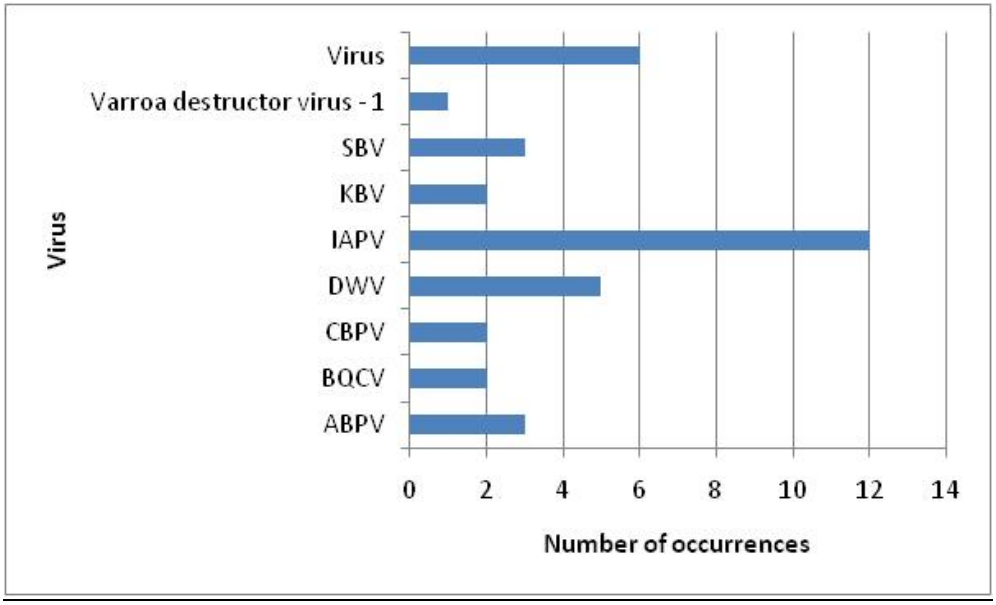


Figure 74. **Number of reports of each virus in the studied references**

Table 13. **Authors' opinion on the biological agent factors involvement in colony losses**

	Unlikely[1]	Probable[2]	Very likely[3]	Proven[4]	Total
Class of factor					
Acarapis woodi	**1**	**1**	**1**	**1**	**4**
Africanized bees					**0**
American foulbrood		**1**		**1**	**2**
Ascosphaera apis					**0**
European foulbrood		**1**			**1**
Hivebeetle					**0**
Malpighamoeba					**0**
Multiple infections	**1**	**5**	**5**		**11**
Nosema	**4**	**5**		**1**	**10**
Unidentified disease	**1**	**8**	**2**		**11**
Varroa	**2**	**10**	**6**	**1**	**19**
Virus	**7**	**12**	**1**		**20**
WaxMoth					**0**
Total	16	43	15	4	78

[1] The author reports that he is considering this factor is not involved in colony losses.
[2] The author reports that he is considering this factor is possibly involved in colony losses.
[3] The author reports that he is considering this factor is certainly involved in colony losses but he gives no proof for it.
[4] The author gives a proof of the involvement of this factor in colony losses.

3.2.3.3 Chemical agents

The debate on chemical agents is mainly concentrated on the agrochemicals used for crop treatments. Neonicotinoids are the focus of the greatest interest in the literature (imidacloprid, clothianidin and fipronil); other publications just mention "pesticides" in general, but certainly with an implicit consideration of neonicotinoids (Figure 75). Scientists are clearly divided on the role of these pesticides, as illustrated in Table 14. Although no involvement of pesticides has been proven for colony losses or CCD, a significant amount of pesticide residues are frequently found in the studies analysing bees, pollen and wax, usually at sublethal levels. A question arises, therefore, about the possibility for a conjunction of chemical residues present in the hive at sublethal concentrations, which may produce a lethal effect or clinical signs affecting the ability of colony to survive. Several authors mention these pesticides as factors contributing to stress or weakening of colonies which, once again, may "open the door" to other causative factors.

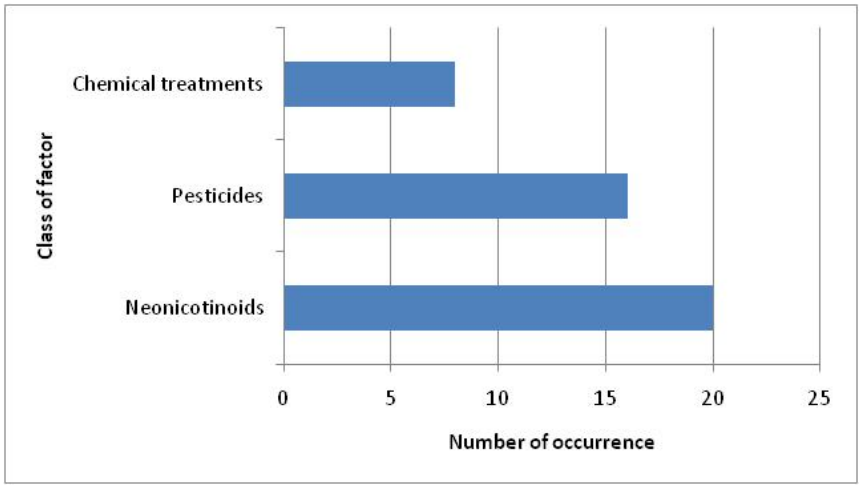


Figure 75. **Number of reports of each chemical agent factor in the studied references**

Table14. **Authors' opinion on the chemical agent factors involvement in colony losses**

	Not likely[1]	Probable[2]	Very likely[3]	Proven[4]	Total
Class					
Neonicotinoids	**6**	**4**	**5**		**15**
Pesticides	**3**	**10**	**1**		**14**
Chemical treatments	**4**	**4**	**0**		**8**
Total	13	18	6	0	37

[1] The author reports that he is considering this factor is not involved in colony losses.
[2] The author reports that he is considering this factor is possibly involved in colony losses.
[3] The author reports that he is considering this factor is certainly involved in colony losses but he gives no proof for it.
[4] The author gives a proof of the involvement of this factor in colony losses.

3.2.3.4 Environmental factors

The two main environmental factors mentioned by the literature are the incidence of a lack of biodiversity (on a qualitative and a quantitative way), and the role of climate (understood as weather (temperature, precipitation) and long term climate evolution) (Figure 76). Lack of biodiversity is recognized to be a factor inducing a nutritional stress on the bees due to the reduced quality or even the lack of availability of pollen. This stress is then supposed to have an effect on other factors inducing colony mortality. The role of climate is two fold: climate change might have an impact on the impoverishment of the environment and may directly stress the bees (cold, hot or rainy weather according to seasons). A consensus on these assumptions as authors' opinions is expressed in Table 15. Considering the role of GMOs and electromagnetic radiations, another consensus arises: the role of either of these two factors on colony losses is absent (Table 15).

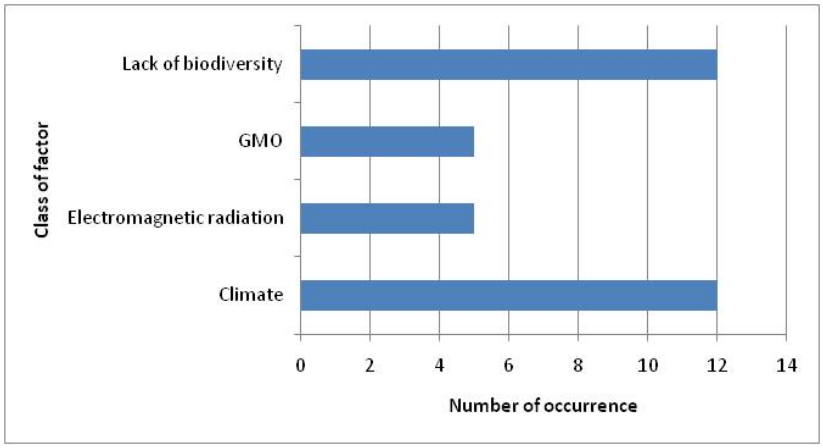


Figure76. **Number of reports of each environment factor in the studied references**

Table 15. **Authors' opinions on the environment factors involvement in colony losses**

	Not likely[1]	Probable[2]	Very likely[3]	Proven[4]	Total
Class factor					
Climate		**8**			**8**
Electromagnetic radiation	**4**	**1**			**5**
GMO	**4**				**4**
Lack of biodiversity	**1**	**7**	**1**		**9**
Total	9	16	1	0	26

[1] The author reports that he is considering this factor is not involved in colony losses.
[2] The author reports that he is considering this factor is possibly involved in colony losses.
[3] The author reports that he is considering this factor is certainly involved in colony losses but he gives no proof for it.
[4] The author gives a proof of the involvement of this factor in colony losses.

3.2.3.5 Other factors

A few other factors are mentioned in the literature, and most of these publications were found to express the main ideas presented when studying the other factors (Figure 77). As developed previously, various stressors and their immunosuppressant effects are likely to be involved. The end result is a multifactorial phenomenon with the involvement of one or more stressors/factors that ultimately lead to death of the colony. This consensus is illustrated in Table 16.

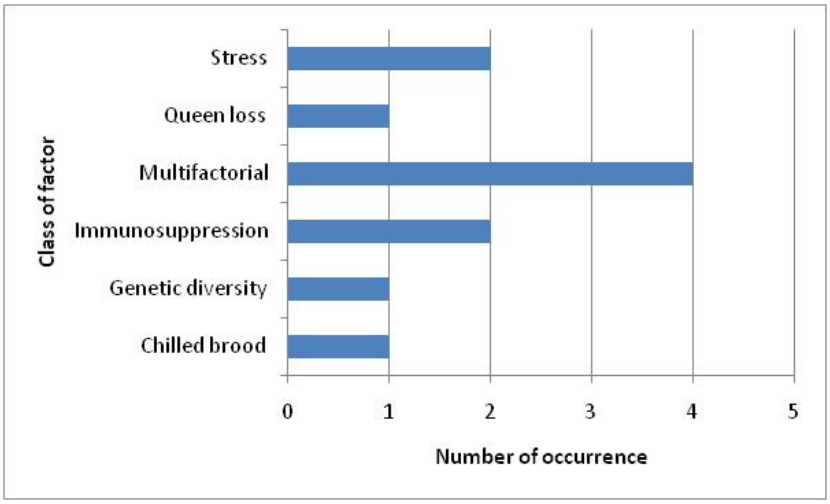


Figure77. **The number of reports of each factor in the studied references**

Table 16. **Authors' opinions on the other factors involvement in colony losses**

	Not likely[1]	Probable[2]	Very likely[3]	Proven[4]	Total
Class factor					
Chilled brood	**0**		**1**		**1**
Genetic diversity	**0**	**1**			**1**
Immunosuppression	**0**	**1**	**1**		**2**
Multifactorial	**0**	**3**	**1**		**4**
Queen loss	**0**	**1**			**1**
Stress	**0**		**2**		**2**
Total	0	6	5	0	11

[1] The author reports that he is considering this factor is not involved in colony losses.
[2] The author reports that he is considering this factor is possibly involved in colony losses.
[3] The author reports that he is considering this factor is certainly involved in colony losses but he gives no proof for it.
[4] The author gives a proof of the involvement of this factor in colony losses.

3.2.4 Conclusion and perspectives

The work package on literature review allowed the development of a specific methodology for literature search and analysis. The "priority 1" references selected and reviewed validate the objectivity of the literature search which is expressed through the variability and the balanced topics included. The results of this work regarding risk and causative factors involved in colony losses have to be taken as a "snap shot" of the scientific community's opinion as they are today; these are also "time sensitive", and evolving due to the amount of ongoing research which will likely lead to new findings and a better understanding of the factors involved in the coming months or years.

To summarise this picture, common consensus amongst the scientific community about the multifactorial origin of colony losses in Europe and in the United States (in the two aspects of this term: combination of factors at one place and different factors involved according to place and period considered) suggests the following factors are important, namely: beekeeping practices (feeding, migratory beekeeping, colony husbandry, treatments applied and so forth), environmental

factors (climate, available forage, biodiversity, etc.), chemical factors (pesticides) or biological agents (Varroa, *Nosema spp*, etc.) which together create stress, weaken bees' immune systems that then allow pests and pathogens to kill the colony (e.g. one or several parasites, viruses, etc.).

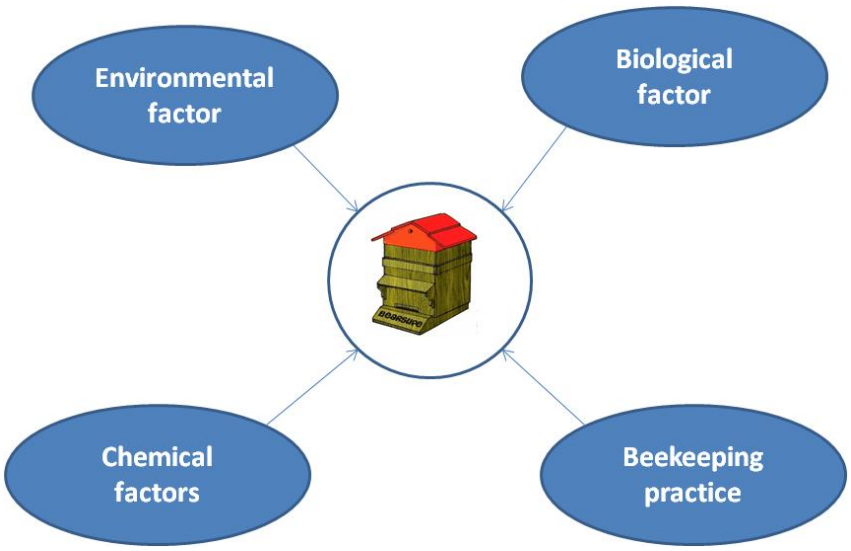


Figure78. **Factors involved in colony losses**

Questions remain about the sequence of events that lead to colony mortality, and future studies should be designed and conducted to address this:

- There are many inconsistencies in the ways in which "colony losses" are defined. Up to 17 different definitions for CCD in the literature. This means that involved persons may not always be referring to the same phenomenon, and this creates confusion when trying to explain the origin of what has been identified in the field. The described pathology is varied, with authors/using the same descriptions for different sets of circumstances. A specific study should be undertaken to clearly categorise and quantify the various expressions of colony losses in the field. This study will be closely linked to the strengthening of surveillance systems;
- High concentrations of pesticides have rarely been identified in relation to colony losses (CCD in USA and winter colony losses in Europe) although acute events of pesticide toxicity are well described during the production season (and clearly differentiated from CCD and winter colony losses). However, the questions of possible synergistic effects of various pesticides and the effect of chronic exposure to sublethal doses of pesticides remains, and requires further investigation;
- Biological agents such as parasites, viruses or bacteria, alone or in combination, have clearly been identified as important factors in colony losses. Nevertheless, there is still a lack of knowledge about the exact mechanisms and/or interactions involved, that must also be addressed;
- Even though the multifactorial origin of colony losses is well acknowledged, the respective role of each factor as a risk or causative agent is unknown, and no hierarchy of relative threat posed

by each one has been established. These matters require further investigation using appropriate epidemiological studies (case control and longitudinal studies).

Conclusion

This bee surveillance project sought information on both the prevalence of honey bee colony losses, and the surveillance systems respectively in 27 European countries. Through a standardised questionnaire, each of the surveillance systems collecting these data was evaluated. In addition, a thorough literature search of the existing databases, as well as relevant grey literature about causes of colony losses was completed, and the literature evaluated.

The main conclusions from project activities can be summarised as follows:

- General weakness and high variability of most of the surveillance systems in the 25 systems investigated;
- Lack of representative data at country level and comparable data at EU level for colony losses;
- Common consensus of the scientific community about the multifactorial origin of colony losses in Europe and in the United States and insufficient knowledge of causative and risk factors for colony losses.

From these finding the consortium makes the following recommendations:

1. Implementation of a sustainable European network for coordination and follow-up of surveillance, and research on colony losses to underpin monitoring programmes;

2. Strengthen standardization at European level by harmonization of surveillance systems, data collected and by developing common performance indicators;

3. Build on the examples of best practice found in existing surveillance systems on communicable and notifiable diseases already present in some countries;

4. Undertake specific studies that build on the existing work in progress to improve the knowledge and understanding of factors that affect bee health (for example stress caused by pathogens, pesticides, environmental and technological factors and their interactions) using appropriate epidemiological studies (case control and longitudinal studies);

5. The set up of the coordination team at European level. This is a crucial issue and the coordination team should be organized in such a way so as to ensure its sustainability and to enable effective surveillance programme activities at the European level.

Glossary of Acronyms used in the report

ABPV	Acute bee paralysis virus
AFB	American foulbrood
AFSSA	Agence française de sécurité sanitaire des aliments
AT	Austria
BE-Fl	Belgium - Flanders
BQCV	Black queen cell virus
CARIBVET	Caribbean animal health network
CBPV	Chronic bee paralysis virus
CCD	Colony collapse disorder
CD	Compact disc
CH	Switzerland
COLOSS	Colony losses European network
COPA-COGECA	European Farmers European Agri-Cooperatives
CZ	Czech Republic
DE	Germany
DK	Denmark
DWV	Deformed wing virus
EE	Estonia
EFB	European foulbrood
EFSA	European food safety agency
ES	Spain
EU	European Union
FERA	The food and environment research agency
FI	Finland
FR-Pbl	France public sector
FR-Pro	France professionnal sector
GB-E&W	Great Britain England and Wales
GB-Sco	Great Britain Scotland
GB-Nir	Great Britain Northern Ireland
GMO	Genetically modified organism
GR	Greece
HR	Hungary
IAPV	Israeli acute paralysis virus
INRA	Institut national de recherché agronomique
IT	Italy
IZSVe	Instituto zooprofilactico sperimentale della Venetia
KBV	Kashmir Bee Virus
LU	Luxembourg
MAAREC	Mid Atlantic Apiculture Research and Extension Consortium
NA	Not applicable
NL	The Netherland
NO	Norway
P&Ds	Pests and diseases
PL	Poland
SBV	Sacbrood virus
SE	Sweden
SI	Slovenia
SK	Slovakia
SLU	Swedish university of agricultural science
SNAT	Surveillance network assessment tool
TAK	Title-abstract-keyword
UK	United Kingdom

USA	United States of America
WP	Work package

Glossary of Terms

Weakening: lack of strength (or vigour) of a beehive. It is linked to a decrease in the hive population density over a period of time combined, mostly, with a decrease in the hive activity. Bee disorders can be observed, for example, growth or behavior disorders. Weakening is combined with a loss of honey production

Collapse: rapid loss of bees in the hive, leading to its destruction

Mortality: death of bee colonies

Passive surveillance: Surveillance system based on the spontaneous notification of cases or suspicions to a central processing unit (The nature, the number, location and date of data collected are not known before they are collected).

Active surveillance: Surveillance system based on an organized and planed collection of data on diseases under surveillance (The nature, the number, location and date of data collected are known before they are collected).

Risk factor: A risk factor is a variable associated with an increased risk of disease or infection. Risk factors are correlational and not necessarily causal, because correlation does not imply causation.

Causative factor: Factor where responsibility for the onset or the development of a disease or infection has been experimentally demonstrated.

APPENDIX 1. DETAILED PARTNERS DESCRIPTION.

	Country of origin	Neighbouring contacts
Coordinator: **P. Hendrikx,** **M-P. Chauzat,** **M. Debin** *French food safety agency*	France	Belgium
		Czech Republic
		Estonia
		Luxembourg
		Romania
		The Netherlands
Partner 1: **M. Brown** *Central science laboratory*	United Kingdom	Scotland
		Northern Ireland
		Republic of Ireland
Partner 2: **Y. Le Conte** *National institute for agronomical research*	France	French apicultural organisations
Subcontractor 1: **F. Mutinelli** *Istituto Zooprofilattico Sperimentale delle Venezie*	Italy	Spain
		Portugal
Subcontractor 2: **A. Gregorc** *Agricultural Institute of Slovenia*	Slovenia	Austria
		Croatia
		Slovakia
Subcontractor 3: **W. Ritter** *CVUA Freiburg*	Germany	Poland
		Hungary
Subcontractor 4: **P. Neumann** *Swiss Bee Research Centre*	Switzerland	Denmark
		Greece
Subcontractor 5: **I. Fries** *Swedish University of Agricultural Sciences*	Sweden	Finland
		Norway

1 **APPENDIX 2.** AGENDA OF THE PROJECT.

		Months								
		1&2	3	4	5	6&7	8	9	10	11
Coordination	Organisation	02								
	Workshop 1		05-06/03							
	Workshop 2							29-30/09		
	Distant meetings (phone and/or internet)									
Tasks	1. Assessment of surveillance programmes									
	2. Compilation and analysis of surveillance data									
	3. Review and analysis on published surveillance data									
Meetings	Kick off meeting with EFSA staff	26/01								
	Interim meeting with EFSA staff				14/05					
	Second interim meeting with EFSA staff							23/09		
	Final meeting wih EFSA staff									18/11
Deliverables	First written interim report			30/04						
	Second written interim report						31/ 08			
	Written final report								16/ 10	

Bee Surveillance

SNAT

SURVEILLANCE NETWORK ANALYSIS TOOL

Country: Specify the name of the country where the questionnaire is implemented

Surveillance system: Specify the name of the surveillance system the questionnaire is relating. If several surveillance systems, please complete one questionnaire for each system

Introduction date: Specify the month and year the surveillance system began to work. If another surveillance system has existed but is no longer functioning, precise its name and functioning dates

Implementation date: Specify the month of finalization of the questionnaire (for example May 2009)

Internal contributors: Specify the name of the person(s) who have contributed to the filling of the questionnaire in the institution coordinating the surveillance system in the country

External contributors: Specify the name of the person(s) external to the country who have contributed to the filling of the questionnaire

Version of April 2009

Guidelines

1. Objectives

This questionnaire was developed to realize an inventory of the situation of an epidemiological surveillance system.
The majority of epidemiological surveillance systems have common organizational methods, and it seemed relevant to develop a questionnaire which could be used in all countries.

1. Organization of the questionnaire

This questionnaire is built according to two logics. The first is to draw up a detailed inventory of the structures and procedures of an epidemiological surveillance system. The second is to present a synthesis of the progress of the surveillance system for its principal fields of activity, through a summary table.

In order to ease the understanding of a surveillance system situation, the document goes from the most synthetic to the most detailed description of the system.
The first part presents a one page table of the global results of the SNAT displaying the level of compliance for each one of the 10 sections of the questionnaire.
The second part presents, for each one of the 10 sections, the summary of findings and the proposed ways to improve the situation of the system, including estimates of costs and origin of funds.
The third part is the detailed questionnaire itself including all necessary questions to be addressed in order to have a precise description of the surveillance system.

The summary part of the questionnaire is always presented in the form of four criteria which are satisfied or not by the system under study. If the criterion is satisfied, which is established after having filled the appropriate section of the detailed questionnaire in the third part, the box corresponding to the criterion is ticked.
Once the four criteria have been addressed, the summary of the chapter is done by counting the number of satisfied criteria (number of boxes ticked) then by surrounding the pie chart corresponding to the result (for example, a pie chart half filled would correspond to two criteria satisfied out of four).

2. When to fill in this questionnaire?

This questionnaire is intended to be used in a participative way with the persons in charge of the system under study.

Filling the questionnaire starts with the detailed part. Each section is then summarized in the appropriate part of the questionnaire.

Preliminary table

Put a cross in the appropriate box for each question, and when a link exists in the box or in the questionnaire (highlighted in yellow), follow it.

Question	Yes	No
1. Does a surveillance system exist in your country for colony mortality and/or weakening and/or collapse?	Section 1	It is not necessary to fill in the questionnaire!
2. Does a surveillance coordination unit (central unit) exist for the surveillance system?	Section 2.3	Go to question 3
3. Does a steering committee or equivalent (giving the main orientations of the surveillance at the national level and taking decisions) exist?	Section 2.4	Go to question 4
4. Does a technical committee (developing technical documents and protocols of the network in order to support the coordination) exist?	Section 2.5	Go to question 5
5. Does an intermediate level between beekeepers and the central unit exist (like provincial unit, local bee association playing a role in the surveillance system…)	Section 3.1	Section 3.2
6. Are laboratory analysis performed for the surveillance?	Section 4	Go to question 7
7. Is the surveillance system integrated in the legislation?	Section 5.1	Go to question 8
8. Does a formalized protocol exist?	Section 5.2	Section 5.2.2
9. Are meetings realized for field surveillance actors?	Section 7.1	Go to question 9
10. Are field surveillance actors visited (by the central unit, provincial level visit…) for supervision?	Section 7.2	Section 8.1
11. Are training courses realized for the staff of the surveillance system?	Section 8.2	Section 9.1
12. Are surveillance results communicated?	Section 9.2	Go to question 13
13. Is the surveillance system evaluated through performance indicators or external evaluation?	Section 10	The questionnaire is completed!

Pie charts to be completed once the whole questionnaire has been filled with results for each section

Global results of the SNAT

Number	Section	Result
1	*Objectives and scope of surveillance*	
2	*Central institutional organization*	
3	*Field institutional organization*	
4	*Diagnostic laboratory*	
5	*Formalization of surveillance*	
6	*Data management*	
7	*Coordination and supervision of the surveillance system*	
8	*Training*	
9	*Restitution and dissemination of information*	
10	*Evaluation and performance indicators*	

Section 1: Objectives and scope of surveillance

	Yes	No	Comment / Answer
1. OBJECTIVES OF THE SURVEILLANCE SYSTEM			
Description of the global objectives of the surveillance system			**Specify the global objectives of the surveillance system according to the documents available on the development, organization and operation of the system**
Description of the specific objectives of the surveillance system			**Specify the specific objectives of the surveillance system according to the documents available on the development, organization and operation of the system**
2. PUBLIC AND PARTNERS WAITING OF THE SURVEILLANCE SYSTEM			
Public			**Specify the public expectations related to the surveillance system. These expectations may be extracted from the press and the feelings expressed by the administration responsible for the management of the system. It can be rated "very high" with concern related to public health on pesticide or "null" if no specific concern of the public related to this subject.**
Institution implementing the surveillance			**Specify expectations from the institution implementing the surveillance**
Partner 1……			**For each important partner of the surveillance system (official technical and scientific support body, universities, professionals) specify what are their interest in being part of the surveillance systems or in receiving the results of this surveillance**
Partner 2……			
3. STRATEGY			

3.1. Bee diseases, syndromes and contamination

Disease, syndrome or contamination	Situation (with OIE codes if relevant)	Disease, syndrome or contamination covered by the surveillance system
List all diseases, syndromes, poisonings or contaminants of interest in the country (including all compulsory notification diseases at national level). Be as specific you consider it relevant (contaminants might be specified only by class or with more precision if needed)	**Mention the situation of this disease, syndrome, poisoning or contaminant within the country using the OIE codes when relevant (**Disease never occurred, Disease last reported [precise the year], Disease not currently present, Demonstrated infection but no clinical disease, Disease restricted to certain zone(s)/region(s) of the country, Clinical disease**). When it is not, precise "reported" or "not reported". Precise if it is a compulsory notification disease at national level.**	**Yes / No**
Weakening		
Mortality		
Collapse		
American foulbrood		
European foulbrood		
Varroosis		
Acarapisosis		
Small hive beetle infestation		
Tropilaelaps infestation		
Poisonings		
GMO		

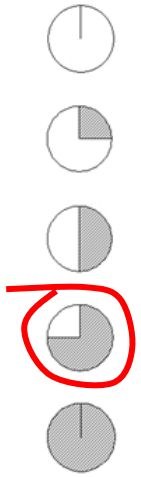
3.2. Strategy for surveillance and control

Disease, syndrome or contamination	Surveillance[1]	Compulsory Screening[1]	Compulsory culling[1]	Compulsory treatment[1]	Other	Funding		
						State	Professionals	External funding agency
Use the same list than above	**Put a cross if surveillance implemented**	**Put a cross if compulsory screening under national active programme implemented**	**Put a cross if culling is imposed by regulation**	**Put a cross if treatment is imposed by regulation**	**Specify any other action implemented under a national programme if any**	**Put a cross if State funding for these actions**	**Put a cross if professional funding for these actions**	**Put a cross if external funding for these actions**
Weakening								
Mortality								
Collapse								
AFB								
EFB								
Varroosis								
Acarapisosis								
Small hive beetle infestation								
Tropilaelaps infestation								
Poisonings								
GMO								

Tick the boxes expressing the situation you have detailed in the previous questions

And the circle the appropriate pie chart according to the number of boxes checked

Section 1: Objectives and scope of surveillance - Summary

X ☐ Relevant and detailed surveillance objectives X ☐ Awaiting of partners and institution clearly defined and relevant with surveillance objectives X ☐ Diseases, syndromes and contamination covered by the surveillance system relevant with the situation in the country ☐ Relevant control strategy implemented for the main bee diseases in the country	Circle the result 
Comments: **Put any comment you feel necessary to understand the situation. Ticking the boxes is a subjective activity these comments will help to give more precision to your decision.** **These comments might also be important to draw recommendation for the future of this surveillance system.**	

Section 2: Central institutional organization

	Yes	No	Comment / Answer
1. Administration in charge of surveillance			
1.1 General information			
Name (institution)			**Give the name of the institution responsible for and coordinating the surveillance at the national level**
Supervising Ministry(ies)			**Give the name of the ministry on which this institution is depending on**
Address			**Full address of the institution**
Name of the contact person			**Give the name of the contact person responsible for the surveillance system. Most probably the person filling the questionnaire…**
Telephone			**Telephone number of this contact person**
Fax			**Fax number of this contact person**
E-mail			**E-mail of this contact person**
1.2 Human resources involved in the surveillance system (including field actors)			
Number of people that have at least 5 years of training (engineers, scientists, veterinarians…)			**Give the number of people involved in the surveillance, including the field actors. Precise if possible if they are engineers, scientists, veterinarians… A broad idea is needed, if no precise data available intend to give general figures.**
Number of technicians (technician with 2 or 3 years of training)			**Same question with technician level**
Numbers of other employees (secretary, etc)			**Same question with other employees**
Financial resources of the surveillance system			
Annual operation budget of the surveillance system (except wages)			**If available, give the global operational budget for bee surveillance activities. If not available, please mention it**
Wages paid for the surveillance system (In EFT – Equivalent full time)			**Give the number of equivalent full time wages paid for the surveillance system.**
2. Surveillance system central organisation			
Is the surveillance system coordinated by a central unit comprising one or more persons devoted to this coordination			**Mention Yes or No and add, if necessary, some precision about what could be considered as a coordination unit. The following chapters will allow you to give more details about this coordination unit.**
Are the main orientations of surveillance decided by a steering committee or any structure compatible with the definition of a steering committee			**Same question**
Are the technical documents (protocols, etc) developed by a technical committee or any structure compatible with the definition of a technical committee			**Same question**

Come back to the preliminary table

3. Surveillance coordination unit = Central unit			
Existing			**Mention if a coordination unit exist**
Formalized in a document			**Specify if the existence of this unit is formalized in a document**
Operational			**Mention if this unit is operational**
Composition			
Formalized			**Mention if the composition of the central unit is formalized in a written document specifying who is part of the unit**
If yes, which kind of formalization			**Mention the nature of document formalizing the composition of this unit (law, agreement, charter)**
Executive manager:			**The executive manager is the person responsible for the coordination unit. It might be a person with higher position than the coordinator. But there might be no executive manager and only a coordinator or any other denomination…**
Name			**If any, give the name of the executive manager**
Organization			**Give the name of the organization he is depending on**
Time devoted (% compared to full time)			**Specify the time he is devoting to the management of the surveillance system in percentage of his time.**
Coordinator:			**if this position has another denomination specify it here**
Name			**Give the name of the surveillance system coordinator,**
Organization			**Give the name of the organization he is depending on**
Time devoted (% compared to full time)			**Specify the time he is devoting to the coordination of the system in percentage of his time.**
Roles and attributions			
Defined			**Mention if the roles and attributions of the coordination unit are clearly defined**
Formalized			**Specify if the roles and attributions are formalized in a document**
Specific material means for the operation of the coordination unit			**Mention if the coordination unit has specific material means for its operation**
Specific financial means for the operation of the coordination unit			**Same question about the financial means.**
If yes			
proper to central unit			**If specific financial means are given to the coordination unit specify if these means are proper to the unit …**
Integrated to general budget			**… or if they are integrated in the general budget**

Come back to the preliminary table

4. Steering committee or equivalent (giving the main orientations of the surveillance at the national level and taking decisions – usually gathering the main decision makers of involved organizations)			
Existing			**Mention if a steering committee exist (or any structure playing the role of a steering committee)**
Formalized in a document			**Specify if the existence of this committee is formalized in a document**
Operational			**Mention if the committee is operational (at least meeting!)**
If there is no steering committee, who or which structure is taking the main decisions for the orientation of the surveillance system?			**In case no specific structure could be identified as steering committee, give some details about the decision making process for the main orientations of the system (is it one person, who ? a group of person ? a structure ?)**
4.1 Composition			
Formalized			**Mention if the composition of the steering committee is formalized in a written document specifying who is part of it**
Composition:			
Beekeepers representatives			Specify **Are beekeepers representatives members of the steering committee. If yes, who is member, from which beekeepers association?**
Veterinary Services			Specify **Is someone from the veterinary services part of the steering committee. If yes, who is specifically member of the committee**
Other professionals (e.g. tradesmen)			Specify **Are other professionals members of the steering committee. If yes, who is member, from which association?**
Ministries			Specify **Are other ministries (other than the ministry from which depend the veterinary services) part of the steering committee. If yes, which ministry?**
Universities			Specify **Are Universities member of the steering committee. If yes, who is member from which University?**
Technical or Scientific Agencies			Specify **Are technical or scientific agencies member of the steering committee. If yes, who is member from which agency?**
Research laboratories or bee research institutes			Specify **Are research laboratories or bee research institutes member of the steering committee. If yes, who is member from which agency?**
Veterinarians (veterinary order or trade unions)			Specify **Are representatives of veterinary professional organizations member of the steering committee? If yes, from which organization do they come from?**
Others			Specify **Specify any other member of the steering committee**
The steering committee already met			**Did the steering committee already met?**
Dates of the 3 last meetings			**If yes, mention the 3 last meeting dates**

Are minutes of these meetings available			**Mention if reports, minutes, written documents are available to have an idea of the decisions taken during these steering committees**
4.2. Roles and attributions of the steering committee			
Defined			**Are roles and attributions of the steering committee clearly defined?**
Formalized in a document			**Are these roles and attributions formalized in a written document?**
Specific financial means for the activities of the steering committee (expenses coverage)			**Are specific financial means targeted for the activities of the steering committee? (mainly to cover meeting expenses)**
Come back to the preliminary table			
5. Technical committee = technical support to the coordination (developing technical documents and protocols of the surveillance system in order to support the coordination - usually gathering scientists and technicians of the main involved organizations)			
Existing			**Mention if a technical committee exist (or any structure playing the role of a technical committee)**
Formalized in a document			**Specify if the existence of this committee is formalized in a document**
Operational			**Mention if the committee is operational (at least meeting!)**
5.1 Composition			
Formalized			**Mention if the composition of the technical committee is formalized in a written document specifying who is part of it**
Composition:			
Beekeepers			Specify **Are beekeepers representatives members of the technical committee. If yes, who is member, from which beekeepers association?**
Veterinary Services			Specify **Is someone from the veterinary services part of the technical committee. If yes, who is specifically member of the committee**
Laboratories			Specify **Are laboratory representatives members of the technical committee. If yes, who is member, from which laboratory?**
Other professionals			Specify **Are other professionals members of the technical committee. If yes, who is member, from which association?**
Ministries			Specify **Are other ministries (other than the ministry from which depend the veterinary services) part of the technical committee. If yes, which ministry?**
Universities			Specify **Are Universities member of the technical committee. If yes, who is member from which University?**
Technical or Scientific Agencies			Specify **Are technical or scientific agencies member of the technical committee. If yes, who is member from which agency?**
Research laboratories or bee research institutes			Specify **Are Research laboratories or bee research institutes member of the technical committee. If yes, who is member from which**

			agency?
Private veterinarians			Specify **Are representatives of veterinary professional organizations member of the technical committee? If yes, from which organization do they come from?**
Others			Specify **Specify any other member of the technical committee**
Did the technical committee already met?			**Did the technical committee already met?**
Dates of the 3 last meetings			**If yes, mention the 3 last meeting dates**
Are minutes of these meetings available?			**Mention if reports, minutes, written documents are available to have an idea of the work achieved by the technical committee**
5.2 Roles and attributions			
Defined			**Are roles and attributions of the technical committee clearly defined?**
Formalized			**Are these roles and attributions formalized in a written document?**
Specific financial means for the activities of the technical committee (expenses coverage)			**Are specific financial means targeted for the activities of the technical committee? (mainly to cover meeting expenses)**

Section 2: Central institutional organization - Summary

☐ Appropriate and sufficient budget devoted to MDW surveillance system ☐ Operating central unit composed of several person and equipped with sufficient operational means ☐ An established and appropriate steering committee who defines the main orientations of surveillance and meets regularly ☐ An organized and appropriate technical committee supporting the development of all technical documents of the surveillance system meets regularly	Circle the result 
Comments:	

Come back to the preliminary table

Section 3: Field institutional organization

	Yes	No	Comment / Answer
1. Provincial units (intermediate level between central unit and field units or field actors collecting data) these units can be "provinces", "regions", "lands" according to the administrative organization of the country			
Existing			**Mention if a provincial unit exist (or any structure playing the role of a provincial unit)**
Formalized in a document			**Specify if the existence of this unit is formalized in a document**
Operational			**Mention if this unit is operational (at least identified and working!)**
Give the local name of the provincial unit (e.g. Province, department, region, land …)			**Mention the local name given to the provincial / intermediate unit**
Number of administrative provinces (annex a map)			**Give the number of administrative structures on which these provincial/intermediate units are based on. If necessary or easier, annex a map**
Number of provincial surveillance units			**Give the number of provincial / intermediate unit based on these administrative provinces**
Average number of field agents/provincial unit			**Give the number of bee surveillance field agents per provincial / intermediate unit in the whole country**
1.1 Composition of the provincial unit			
Formalized			**Mention if the composition of the provincial unit is formalized in a written document specifying who is part of the unit**
Composition:			
Beekeepers provincial association			Specify **Is someone from the provincial beekeepers association part of the provincial unit? If yes, who is specifically member of the unit?**
Provincial Veterinary Services			Specify **Is someone from the provincial veterinary services part of the provincial unit? If yes, who is specifically member of the unit?**
Provincial Laboratory			Specify **Is someone from the provincial laboratory part of the provincial unit? If yes, who is specifically member of the unit?**
Other professionals			Specify **Are other professionals part of the provincial unit. If yes, who is specifically member of the unit?**
Other			Specify **Are other structures part of the provincial unit. If yes, who is specifically member of the unit?**
1.2 Roles and attributions			
Defined			**Are roles and attributions of the provincial unit clearly defined?**
Formalized			**Are these roles and attributions formalized in a written document?**

Which roles:			
Supervision of field agents			Specify who performs supervision and how **Does the provincial unit perform supervision of field agents? If yes, specify who performs this supervision and how.**
Data centralization			Specify who performs centralization and how **Does the provincial unit perform data centralization? If yes, specify who performs this centralization and how.**
Data validation			Specify who performs validation and how **Does the provincial unit perform data validation? That is, does someone verify that data are valid and can be processed? If yes, specify who performs this validation and how.**
Organization of meetings			Specify who organizes meetings, with whom & frequency **Does the provincial unit organize meeting with field staff? If yes, specify who organize these meetings, who is invited and what is the frequency of these meetings.**
Others			Specify **Does the provincial unit perform any other kind of activity? If yes, specify which activity and who performs it.**
2. Field actors implementing the surveillance (identification of suspicions, cases and data collection)			
Existing			**Mention if field people are assigned to data collection on bee diseases in the field**
Formalized in a document			**Specify if the existence of these field actors is formalized in a document**
Operational			**Mention if these field actors are operational (at least sending data to provincial and central units!)**
2.1 Composition			
Government agents			Specify origin: **Are government agents assigned to data collection? If yes specify which kind of government agents (origin etc.)** Average number per provincial unit : **Mention the average number of governmental field agents assigned to data collection per provincial / intermediate unit** Total number: **Mention the total number of governmental field agents assigned to data collection in the surveillance system. Precise if some of them are full time working for the surveillance system.**

Field technicians			Specify origin: **Are field technicians assigned to data collection? If yes specify what is their origin (associations, etc.)** Average number per provincial unit: **Mention the average number of field technicians assigned to data collection per provincial / intermediate unit.** Total number: **Mention the total number of field technicians assigned to data collection in the surveillance system. Precise if some of them are full time working for the surveillance system.**
Trained beekeepers			Specify: **Are specifically trained beekeepers assigned to data collection? If yes specify their denomination and the process to be assigned to data collection** Average number per provincial unit : **Mention the average number of trained beekeepers assigned to data collection per provincial / intermediate unit** Total number: **Mention the total number of trained beekeepers assigned to data collection in the surveillance system**
Field veterinarians			Specify: **Are field veterinarians (from private practices) assigned to data collection? If yes specify which kind of veterinarian (specialists...)** Average number per provincial unit : **Mention the average number of field veterinarians assigned to data collection per provincial / intermediate unit** Total number: **Mention the total number of field veterinarians assigned to data collection in the surveillance system**
National coverage (%)			
Of the provincial administrative units (percentage of provinces covered by the surveillance system)			Total number of provinces covered by the surveillance system: **Mention the number of administrative intermediate units covered by the system.** Percentage covered by the surveillance system: **Considering the total number of provinces of the country, give the percentage of administrative units covered by the system** Name of the provinces covered by the surveillance system: **Mention all covered provinces.**
Of the bee colonies (Percentage of bee colonies covered by the surveillance system)			**Relating to the number of bee colonies located in the covered administrative units, give the percentage of the bee colonies covered by the surveillance system.**
Number of bee colonies per field agent			**Considering the number of bee colonies covered by the surveillance system and the number of field staff assigned to data collection, give the ratio of bee colonies per field agent for the surveillance system.**
Of the beekeepers (Percentage of beekeepers covered by the surveillance system)			**Relating to the number of beekeepers located in the covered administrative units, give the percentage of the beekeepers covered by the surveillance system.** **If the system targets only a certain part of the beekeepers population (only professionals for example) give the proportion of beekeepers covered by the surveillance system.**

Number of beekeepers per field agent			**Considering the number of beekeepers covered by the surveillance system and the number of field staff assigned to data collection, give the ratio of beekeepers per field agent for the system.**
2.2 Roles and attributions			
Defined			**Are roles and attributions of field staff assigned to data collection clearly defined?**
Formalized in a document			**Are these roles and attributions formalized in a written document?**
2.3 Means availability of the field agent to implement the surveillance			
Is the field agent given an allowance to collect data?			**Mention if a specific allowance is given to the field agent collecting data for collected data** Amount: **If yes, give the amount given** Conditions: **Give also the condition to receive this allowance (per data sent, per investigation, etc.)** Frequency: **Or give the frequency of attribution of a determined allowance.**
Sampling material			**Mention if sampling material is given to the field staff**
Shipment expenses			**Mention if samples shipment expenses are covered by the surveillance system and given to the field staff**
Form for suspicion and case notification			**Mention if suspicion forms are given to field staff to collect epidemiological data of their investigation**
3. Population under surveillance			
Is beekeeping a compulsory notification activity?			**Is it compulsory for someone to declare that he has bee colonies? If yes, precise if it is always compulsory, or only from a certain colony number (precise this number).**
3.1 Beekeepers			
Definition and number of professional beekeepers			**Give the total number of professional beekeepers registered/evaluated in the country (precise the date if it is not a real time evaluation). Precise how professional beekeeper is defined: by notification? According to the colony number (which number?)?**
Number of amateur beekeepers			**Give the total number of amateur beekeepers registered/evaluated in the country (precise the date if it is not a real time evaluation)**
Total number of beekeepers			**Give the total number of beekeepers registered/evaluated in the country**
3.2 Colonies			
Total number of colonies			**Give the total number of colonies registered in the country**
3.3 Data availability			
Existence of a database gathering population data			**Does a national database gather all population data on beekeepers and colonies in the country?**
Availability of georeferenced data			**Is this database georeferenced and to which extend (administrative location? geographical coordinates?)**

Section 3: Field institutional organization - Summary

☐ Provincial units formalized (one person having official skills for the surveillance system at the intermediate level between central level and field actors) on the whole territory. ☐ Active role of the provincial units in the system (active supervision of agents, data validation) ☐ Official and formalized concept of surveillance field agents with exhaustive field coverage ☐ Sufficient material and financial means of provincial units and field agents for a correct operation of the surveillance system	Circle the result 
Comments:	

Come back to the preliminary table

Section 4: Diagnostic laboratory

	Yes	No	Comment / Answer
1. Central laboratories			
Existing central laboratory			**Is there a central laboratory in the country for the analysis of samples collected for the diagnostic of bee diseases?**
If Yes, Name (institution)			**If yes, give the name of the laboratory**
Address			**Address of the laboratory**
Telephone			
Fax			
E-mail			
Number of people assigned to diagnostic of bee diseases in the central laboratory			**Specify the number of persons assigned to the diagnostic of bee diseases inside the laboratory**
Type of analysis performed in the central laboratory for the surveillance system			(fill the "bee diseases laboratory analysis" table) **This question is answered in the table at the end of this section**
If no central laboratory, where are the samples sent?			**Give the name of the laboratory where the samples are sent if there is no central laboratory**
Other central laboratories			Specify name, address and type of analysis performed (and fill the "bee diseases laboratory analysis" table): **Give all details about other central laboratories existing in the country if several laboratories are to be considered.**
Analysis expenses covered by the surveillance system			**Mention if analysis expenses are covered by the surveillance system and given to central laboratories**
Shipment of some samples to foreign laboratory(ies)			**Are some sample sent to foreign laboratories (for example if the diagnostic technique is not available in the country)**
Which laboratory (ies)?			**If yes, in which laboratory are the samples sent?**
For which analysis?			**If yes, for which analysis are foreign laboratories mobilized?**
For primary diagnostic			**Is a foreign laboratory used for primary diagnostic?**
For confirmation			**Is a foreign laboratory used for confirmatory diagnostic?**
Shipment and analysis expenses covered by the surveillance system			**Mention if samples shipment and analysis expenses are covered by the surveillance system and given to central laboratories**
1.1 Management of sample data at the central laboratory level			
Computerized (database)			**Is a computerized database used at the central laboratory to manage diagnostic data?**
Registers			**Or are these data only managed with paper registers?**

Classified forms			**Or are these data only managed with classified paper forms?**
Other			**Does any other data management system exist at the central laboratory level?**
1.2 Time frame for sample analysis results at the central laboratory			
Fixed			*for which disease* **Specify if the time frame for the analysis at the central laboratory are determined in a written document. If yes, specify for which diseases or analysis this time frame is determined**
Recorded			*for which disease* **Mention if this time frame is recorded i.e. if there is any possibility to check the compliance with this time frame. If yes, specify for which disease.**
Checked			*for which disease* **Mention if this time frame is checked by anybody and for which diseases if so.**
1.3 Quality assurance			
Procedure of quality assurance implemented			**Are any quality assurance procedures implemented for bee diseases analysis? If yes, you can mention for which analysis in the diagnostic table at the end of this section.**
Is the central laboratory under ISO 17025?			**Has the central laboratory been accredited for this international standard (delivered by an accreditation body that depends on the country: Beltest, ELOT, COFRAC…)**
Organization of inter laboratory assays by the central laboratory			**Does the central laboratory organize inter-laboratory assays for bee diseases analysis**
If yes, for which diseases or analysis			**Specify for which diseases**
Participation to inter laboratory assays organized by other laboratories			Which laboratories **Does the central laboratory participate to inter laboratory assays organized by other laboratories on bee diseases analysis?**
If yes, for which diseases			**Specify for which diseases**
Cost of the analyses quantified			**Is the cost of bee diseases analysis quantified and available?**
1.4 Recipient of results **Once the analysis performed, who is receiving the results?**			
Coordinator of the surveillance system			**Mention only the persons to whom the laboratory is giving the results directly. If the result is given afterwards to the field agents or beekeepers it will be mentioned in another section.**
Central veterinary services animal health officer & chief veterinary officer (CVO)			
Provincial unit			
Field agent			
Beekeeper			
2. Provincial laboratories			
Existing provincial laboratories involved in the surveillance system			**Are there provincial laboratories (at an intermediate level) in the country for the analysis of samples collected for the diagnostic of bee diseases?**
Number			**Mention the number of these laboratories involved in the surveillance**

Locations			**List the location of these laboratories. If easier, you can annex a map with the location of these laboratories.**
Type of analysis performed in these laboratories for the surveillance system			(fill the "bee diseases laboratory analysis" table) **This question is answered in the table at the end of this section**
All the provincial laboratories of the surveillance system use the same or validated analysis techniques			**Mention if all provincial laboratories, for one type of analysis, are using the same technique (to assess standardization of the process). You answer yes if this technique is validated.**
Formalized involvement of the laboratory in the surveillance system (with agreement, convention, charter)			Specify **Mention if the involvement of the provincial laboratories is formalized through a specific written procedure like an agreement or a charter and specify which kind of document is formalizing this involvement.**
Number of people assigned to diagnostic of bee diseases in each provincial laboratory			**Give the average number of persons assigned to diagnostic of bee diseases in each provincial laboratory.**
Analysis expenses covered by the surveillance system			**Mention if analysis expenses are covered by the surveillance system and given to provincial laboratories**
Shipment of some samples to the central laboratory(ies)			**Does the provincial laboratory send some samples to the central laboratory?**
Which laboratory?			**If yes, specify to which laboratory they send these samples (it can be according to the type of sample and then specify it)**
For which analysis?			**Give the type of analysis for which they send samples to central laboratories**
For primary diagnostic			**Is the central laboratory used for primary diagnostic?**
For confirmation			**Is the central laboratory used for confirmation diagnostic?**
Shipment and analysis expenses covered by the surveillance system			**Mention if samples shipment and analysis expenses are covered by the surveillance system and given to provincial laboratories**
2.1 Management of sample data at the provincial laboratory level			
Computerized (database)			**Is a computerized database used at the provincial laboratory to manage diagnostic data?**
Registers			**Or are these data only managed with paper registers?**
Classified cards (forms)			**Or are these data only managed with classified paper forms?**
Other			**Does any other data management system exist at the provincial laboratory level?**
2.2 Time frame for sample analysis results			
Fixed			*for which disease* **Specify if the time frame for the analysis at the provincial laboratory are determined in a written document. If yes, specify for which diseases or analysis this time frame is determined**

Recorded			*for which disease* **Mention if this time frame is recorded i.e. if there is any possibility to check the compliance with this time frame. If yes, specify for which disease.**
Checked			*for which disease* **Mention if this time frame is checked by anybody and for which diseases if so.**
2.3 Quality assurance			
Procedure of quality assurance implemented			**Are any quality assurance procedures implemented for bee diseases analysis at the provincial laboratory? If yes, you can mention for which analysis in the diagnostic table at the end of this section.**
Participation to inter laboratory assays			Organized by which laboratory **Does the provincial laboratories participate to inter laboratory assays organized by other laboratories on bee diseases analysis? If yes, specify by which laboratory these assays are organized.**
If yes, for which diseases			**Specify for which diseases**
Cost of the analyses quantified			**Is the cost of bee diseases analysis at the provincial laboratory quantified and available?**
2.4 Recipient of results **Once the analysis performed, who is receiving the results?**			
Central laboratory			**Mention only the persons to whom the laboratory is giving the results directly. If the result is given afterward to the field agents or beekeepers it will be mentioned in another section.**
Coordinator of the surveillance system			
Animal health officer & CVO			
Provincial unit			
Field agent			
Beekeeper			

Laboratory analysis performed in the country for the surveillance system

Pathogen or contaminant	Analysis	Level of analysis [1]		Standardized technique[2]	Inter-laboratory assay[2]	Quality assurance[2]	Comments
		Central[3]	Provincial				
Mention the name of the pathogen or contaminant to be analyzed	Mention the type of analysis to be performed (precise if it is an OIE recognized method or another standard one)	Put a cross if this analysis is performed in the central laboratory	Put a cross if this analysis is performed in the provincial laboratory	Mention if this analysis technique is using a standardized technique within the surveillance system	Are inter-laboratory assays organized for this technique	Put a cross if this analysis technique is under quality assurance	Give any relevant comment

[1] Check the box
[2] Yes / No
[3] If several, assign a code to each central laboratory

Section 4: Diagnostic laboratory - Summary

☐ Formalization and efficient integration of the diagnostic laboratory in the bee surveillance system ☐ Skilled human resources in sufficient number for the diagnostic needs of the surveillance system ☐ Diagnostic equipment sufficient for the needs of the surveillance system or formalized procedure to resort to a reference laboratory ☐ Standardized and recognized diagnostic techniques	Circle the result 
Comments:	

Come back to the preliminary table

Section 5: Formalization of surveillance

	Yes	No	Comment / Answer
1. REGULATION			
Surveillance system integrated in the legislation			**Is the operation and organization of the surveillance system formalized in the legislation**
Nature of the legislation			**Specify if possible the nature of the legislation (law, etc.)**
Control measures formalized in the regulation			**If the surveillance activities lead to a regulated problem (contagious disease, contamination), are the control measures formalized in the regulation?**
Nature of the regulation			**Specify the nature of the legislation (law, etc.)**
Charter, agreement, convention for surveillance operation signed among partner institutions			**Are all the partners of the surveillance system linked through a formal document such as a charter, an agreement?**
Come back to the preliminary table			
2. SURVEILLANCE PROTOCOL			
Existence of a formalized protocol			**Are all the surveillance procedures formalized following a written surveillance protocol?**
2.1 Items of the surveillance protocol (Answer yes only if the item is described in the protocol with significantly enough details, if you answer no, detail what is missing)			
Surveillance objectives			**Are the surveillance objectives clearly mentioned in the surveillance protocol?**
Institutional organization			**Is the institutional organization of the surveillance system clearly described in the surveillance protocol?**
Case definition			**Are the case definitions used within the surveillance system clearly described in the surveillance protocol? (precisions about case definitions are given in the next pages)**
Population under surveillance			**Is the population under surveillance clearly described in the surveillance protocol?**
Surveillance modalities (description of surveillance procedures, active and passive)			**Are the surveillance modalities (active and passive) of the surveillance system clearly described in the surveillance protocol? (precisions about these procedures are given in the next pages)**
Data collected			**Are all data to be collected (including samples) when implementing the surveillance clearly detailed in the protocol?**
Laboratory testing			**Are all analysis to be performed on the collected samples including technique and location detailed in the protocol?**
Data management, treatment and interpretation			**Are data management, treatment and interpretation procedures detailed in the protocol? (precisions about these procedures are given in another section)**
Information feedback and distribution			**Are information feedback and distribution procedures detailed in the protocol? (precisions about these procedures are given in another**

			section)
Supervision of the surveillance system			**Are supervision procedures detailed in the protocol? (precisions about these procedures are given in another section)**
Training			**Are training procedures detailed in the protocol? (precisions about these procedures are given in another section)**
Performance indicators and evaluation			**Are development of performance indicators and evaluation procedures detailed in the protocol? (precisions about these procedures are given in another section)**
2.2 Case definition			
Existence of (a) formalized case definition(s)			**Is there a formalized case definition developed for the surveillance?**
Give all details about the case definitions used in the surveillance system (attach any relevant document)			
Detail the case definition used. If several case definition (according to several diseases or situation) give each one. Precise for each definition if it refers to "suspicious case" or "confirmed case" (for the same disease one can have both definitions, used for example at two different levels of the surveillance system). **You can annex any document you feel relevant to understand better the use of the case definition (data collection form for example).**			

2.3 Passive surveillance procedures			
Are passive surveillance procedures implemented?			**Remember that passive surveillance is when suspicions are detected "spontaneously" when they occur. When you can not know before when, where and how many data you are going to collect it means that you have a passive surveillance system.**
Detection on beekeeper call			**Are suspicions detected when the beekeeper is calling the surveillance system field staff to come to implement an investigation?**
Detection on programmed visit			**Are suspicions detected when the surveillance system field staff implements a regular visit (this is a limit situation between passive and active surveillance)?**
Detection on visit for another reason			**Are suspicions detected when the surveillance system field staff implements a visit for another reason than data collection for the system?**
Other			**Mention any other mean for suspicion notification (other than active)**
Definition of the procedure to be followed in case of suspicion			**If a suspicion is detected, is there a formalized procedure describing all what has to be implemented?**
Standardized suspicion form filled			Annex the form **Is there a suspicion form to be filled in case a suspicion is detected? If yes, annex this form**
Sample commemorative form filled			Annex the form **Is there a sample commemorative form to be filled in case a suspicion is detected and samples taken? If yes, annex this form**
Suspicion recorded (register, spreadsheet or database)			**Are the suspicions recorded in any system? If yes, specify which one**
Maximum sample transmission time to the laboratory			**What is the maximum transmission delay to send the samples and forms to the intermediate or central level specified in the protocol?**
Motivation keeping for passive surveillance			
Meetings to sensitize beekeepers			**Are meetings organized with the beekeepers to sensitize them for suspicion notification?**
Compensation			**Are beekeepers incited to declare suspicions to the surveillance system? How? Get the beekeepers an indemnification in case there is a case and measures have to be taken?**
Press, media			**Are press or media releases used for beekeepers sensitization?**
Individual sensitizing (telephone, visit)			**Are any individual sensitization methods used?**
Other			Specify **Are any other sensitization methods used?**
Give any relevant detail regarding passive surveillance organization (Annex any relevant document)			

2.4 Active surveillance procedure

Are active surveillance procedures implemented			**Remember that active surveillance is when suspicions or cases are detected following an active search technique. When you know exactly when, where and how many data you are going to collect it means that you are implementing an active surveillance technique.**

Describe sampling procedures implemented in the surveillance system
For each procedure include :

- ***epidemiological unit (1)***
- ***size of the sample (2)***
- ***selection methodology (3)***
- ***frequency of sampling or investigation (4)***
- ***data collected (5)***
- ***analysis performed (6)***
- ***information collected in order to obtain risk factors (geographical location, veterinary treatments, climatic conditions, genetics…) (7)***

(Annex any relevant document)

You may have several active surveillance techniques implemented on several epidemiological units. Describe all of them (fill in the table and write additional information) and annex any relevant document to complement this information (data collection form for example).

Procedure	1	2	3	4	5	6	7
N°1							
N°2							
N°3							
N°4							
N°5							
N°6							
N°7							
N°8							
N°9							
N°10							

Section 5: Formalization of surveillance - Summary

☐ Surveillance system organization and operation registered in the regulation or in a charter ☐ Surveillance objectives clearly formalized and relevant ☐ Formalized surveillance protocol ☐ Complete surveillance protocols (all items covered) and standardization of data collected	Circle the result 
Comments:	

Section 6: Data management

	Yes	No	Comment / Answer
1. General information			
Existence of a procedure for data management			**Is there a formalized document describing the data management procedures implemented in the surveillance system?**
Existence of a centralized database			**Is there a centralized database used to manage all data gathered within the surveillance system?**
If Yes, since when is the database used?			**Precise since when the database is used**
What is the date of the oldest data in the database?			**Mention the date of oldest data in the database**
Means:			
Relational database			**Are data managed with a computerized relational database (such as ACCESS®, MySQL, Oracle®, EPI-INFO® or any other software)**
Specific software			**Has a specific software been developed for bee surveillance and, if yes, mention the name of this software.**
Spreadsheet			**Are data managed with a spreadsheet (such as EXCEL® or any other spreadsheet)?**
Paper classification			**Are data managed only on paper?**
Adequate computer equipment			**Is there an adequate computer equipment to manage data of the surveillance system?**
2. Data entry			
Data entered regularly			**Are data entered regularly in the database**
Frequency			**Specify the frequency of data entry**
Data entry centralized			Specify **Is data entry centralized (are all data entered at central level only)?**
Data entry decentralized			Specify at which level **Is data entry decentralized (are some or all data entered at an intermediate level or even at the field level)? Specify the level of data entry decentralization.**
Number of persons in charge of data entry			**Give the number of persons assigned to data entry**
Verification of data entry			By whom: **Is the quality of data entry verified and, if yes, who verifies data entry?** Which procedure: **What is the procedure of data verification?**
Data validation			By whom: **Are data validated and, if yes, by whom?**
3. Data analysis and interpretation			
Data analyzed regularly			**Are data analyzed on a regular basis?**
Frequency			**What is the frequency of this data analysis?**
Level of analysis:			
Tables with summary of cases			**Give the kind of data analysis done on a regular basis. You can choose several options. If other kinds of data analysis are performed, detail it.**
Mapping of cases			
Situation analysis with detailed comments			

Other			
Person(s) in charge of analysis:			
Coordinator			**Is the surveillance system coordinator in charge of data analysis?**
Multi-disciplinary team			**Is a multidisciplinary team in charge of data analysis? If yes, detail the composition of this team**
Technical committee			**Is the technical committee in charge of data analysis?**
Other			**Specify any other person or team implementing data analysis**
Person(s) trained for analysis techniques			How many: **Are persons specifically trained for data analysis and if yes, how many are they?**
Statistical and scientific validation of the analysis			By whom: **Is there any process for statistical and scientific validation of data analysis? If yes, specify who or which team is performing this validation.**
Availability of a GIS			Which one: **Is there a geographical information system available for data analysis? If yes mention the name of the software used (such as Arc-View®, Map-Info® or any other software)**
GIS actually used			**Is the GIS actually used for data analysis of the results of the surveillance system?**
Number of persons trained for GIS			**How many persons are trained for GIS use?**
Number of persons using GIS			**How many persons are really using GIS?**
Availability of GPS			How many: **Are global positioning systems available within the surveillance system? If yes, how many?** Who is using them: **Specify who is using these GPS units.**

Section 6: Data management- Summary

☐ Existence of a centralized database, on adequate computer equipment, to manage data of the surveillance system ☐ Routine use of a geographic information system for data analysis (regular production of maps for disease cases and suspicions) ☐ Specific personnel available and trained for data entry, management and analysis ☐ Multi-disciplinary analysis of data (interpretation of data)	Circle the result 
Comments:	

Come back to the preliminary table

Section 7: Coordination and supervision of the surveillance system

	Yes	No	Comment / Answer
1. Coordination of the surveillance system			
Coordination / information meetings (of the field surveillance actors)			**Are coordination or information meetings organized for the field staff of the surveillance system?**
If yes, pre-determined frequency of meetings with all staff of the surveillance system			
at the central level			..... times/year **If these meetings are planned at the central level (for the field actors) in the procedures of the surveillance system, what is the frequency pre-determined?**
Respected frequency			**Is this frequency really implemented?**
at the provincial level			..... times/year **If these meetings are planned at the provincial / intermediate level (for the field actors) in the procedures of the surveillance system, what is the frequency pre-determined?**
Respected frequency			**Is this frequency really implemented?**
Another form of coordination			Which one: **Is another type of coordination implemented within the surveillance system and, if yes, specify.**
Who is doing the coordination			**Who is organizing and implementing the coordination meetings and other types of coordination activities?**
Existing reports of coordination meetings			**Are any reports available on the organization of coordination meetings?**
Come back to the preliminary table			
2. Supervision of staff			
Supervision of field staff (visits of the field surveillance actors)			**Is an individual supervision activity implemented towards the surveillance field staff?**
by the central level			**Is this individual supervision activity implemented by the central level?**
Number of visits/year or proportion of visited field surveillance actors			**If yes, what is the number of individual supervision field visits organized by the central level or what is the proportion of field staff visited per year (for example 20%, 50% or any other percentage).**
by the provincial level			**Is this individual supervision activity implemented by the provincial level?**
Number of visits/year or proportion of visited stations			**If yes, what is the number of individual supervision field visits organized by the provincial level or what is the proportion of field staff visited per year (for example 20%, 50% or any other percentage).**
Who is performing the supervision			**Who is implementing these individual field supervision visits?**
Existing reports of supervision activities			**Are reports of these individual supervision activities available?**

Section 7: Coordination and supervision of the surveillance system - Summary

	Circle the result
☐ Existence of coordination meetings of the surveillance system at the central level and / or the provincial level, involving at least all agents once per year	
☐ Coordination meetings take place according to the predetermined frequency and a report is produced at the end of each meeting	
☐ Central unit active for field agents supervision (annual visit or meeting of all provincial units and at least 10% of the surveillance actors)	
☐ Provincial unit active for field agents supervision (annual visit or meeting of all surveillance actors)	
	
Comments:	

Section 8: Training

	Yes	No	Comment / Answer
1. Managers/coordinators and intermediate level actors			
Staff trained in epidemiology			how many **Are managers, coordinators and intermediate level actors trained in epidemiology? If yes, how many?**
Staff trained on bee production and pathology			how many **Are managers, coordinators and intermediate level actors trained in bee production and pathology? If yes, how many?**

Level	Basic concepts	1 to 4 week course	Master	PhD
Number for epidemiology	**Number of trained persons**	**Number of trained persons**	**Number of trained persons**	**Number of trained persons**
Number for bee production and pathology	**Number of trained persons**	**Number of trained persons**	**Number of trained persons**	**Number of trained persons**

Come back to the preliminary table

2. Initial training of field staff (field surveillance actors and provincial units staff)			
Collective			**Are collective training sessions organized for the field staff of the surveillance system?**
Individual			**Is an individual training activity organized for the field staff of the surveillance system?**
e-learning			**Is an e-learning activity organized for the field staff of the surveillance system?**
Information meeting only			**Are general information meeting on the organization and process of the surveillance system organized for the field staff?**
Duration			**What is the length of the training activity (number of days)?**
Content of initial training course:			
Policy for Bee diseases and regulation			**Mention for each one of these topics if they are integrated into the training programme. You can give any relevant detail or annex any relevant document.**
Arguments for setting up the surveillance system			
Training on general procedures of the surveillance system			
Knowledge of the diseases, syndromes and contamination under surveillance			
Clinical sign identification (suspicion)			
Knowledge of documents to be filled			
Knowledge and practical on sample collection			
Knowledge of sample packaging & preservation			
Knowledge of submission of sample and form			
Knowledge of deadlines			
Knowledge of first control measures			
Communication to beekeepers			**Please precise**
Other subject			
Satisfactory use of good related field practices			**Is the training session only theoretical or also with a good part about field practices?**

Programming and supervision by a specialist in training methodology			**Is a specialist on training methodology involved in the preparation and organization of the training sessions?**
Involvement of all staff of the surveillance system			Specify **Are all staff of the surveillance system following the training sessions, if not, specify the percentage of field staff following a training session.**
Evaluation and independent assessment of knowledge (MCQ)			**Is an assessment of the trainees organized at the end of the training session?**
Availability of sufficient funds for training organization			**Are sufficient funds available for the organization of the training activities?**
3. Refresher / updating course for surveillance posts and provincial units			
Considered			*Frequency* **Are refresher courses organized for the field staff? If yes, specify the frequency of these refresher courses**
Content of refresher/updating course			
New diseases, syndromes, contamination diseases			**Mention for each one of these topics if they are integrated into the refresher course programme**
Update of procedures			
Synthesis of information already gathered			
Collection of field feedback			

Section 8: Training- Summary

☐ Satisfactory epidemiology training level of members of the central unit ☐ Initial training implemented for all field staff at their entry in the surveillance system ☐ Objectives and content of the training in adequacy with the operational needs of the surveillance system ☐ Regular refresher course (if possible annual, collective or individual) of all field staff	Circle the result 
Comments:	

Section 9: Restitution and dissemination of information

	Yes	No	Comment / Answer
1. Methods of communication among members of the surveillance system			
Mail (paper)			**Mention the communication means for the communication among members of the surveillance system and specify if necessary.**
Individual Meetings (supervision)			
E-mail			
Meetings			
Telephone discussions (conf)			
Forum on the Internet			
Access to Internet and email			
Provincial units			**Mention if the provincial / intermediate units have all access to internet**
Surveillance actors			☐None ☐<25% ☐<50% ☐<75% ☐> 75% **Mention which proportion of surveillance field staff has access to the Internet and e-mail.**
Come back to the preliminary table			
2. Communication of surveillance results			
2.1 Target **Mention in this chapter who receives communication of surveillance results**			
General public			**For each target, mention if results of surveillance are received and specify what type of results are received**
Neighboring countries			
Members of the surveillance system			
International organizations			
Public or private national partners			
COLOSS surveillance system			
OIE reports: Notification respected for bee diseases			**Are Bee diseases regularly notified to OIE following the OIE procedure**
Number of biannual/annual reports during the last year regarding bee diseases			**Specify by giving the number of twice yearly and annual reports submitted to OIE for bee diseases**
In order to analyze data at European level, would you accept to convey us your data?			**Specify on which form: primary data, partial data, database file, final report…**
If Yes, what kind of data are you ready to convey?			**Precise the kind of data (case number, localization, anamnesis…)**
Total anonymized (without any mention of individual names) database?			**Are data nominative or anonymized?**
Number of events per administrative unit per time period			**If yes, specify the smallest administrative unit until you can provide data :** **If Yes, specify the smallest time period until you can provide data (week, month, quarter, semester, year) :**
2.2 Means			
Laboratory results			Specify who is receiving the laboratory results **Are laboratory results feed backed to surveillance staff (indirectly), if yes, specify who receives these results**
Meetings			Frequency: **Are surveillance results feed backed during meetings. If yes, what is the frequency of these meetings?**

Review reports			Frequency: **Are review reports produced on surveillance results. If yes, what is the frequency of these reports?**
Information leaflet (2 pages max)			Frequency: **Are information leaflets produced on surveillance results. If yes, what is the frequency of these leaflets?**
News bulletins			Frequency: **Is an epidemiological news bulletin produced on surveillance results. If yes, what is the frequency of this bulletin?**
Web site			Which one: **Is a website displaying the results of surveillance? If yes, what is the address of the website and what is the updating frequency of the website?**
Other means of communication			Precise which one, and its frequency
If news bulletin			
Pre-determined frequency			**What is the pre-determined frequency of the bulletin?**
Respected frequency			**Is this frequency respected?**
Writers			
Executive manager of the surveillance system			Specify: **Mention who is responsible for writing the bulletin and specify, for each category, who is specifically in charge of it.**
Person in charge of communication			
Others			
Number of copies			**What is the number of copies printed for the news bulletin?**
Mailing list			**Is there a mailing list to distribute the bulletin?**
Recipients **Mention who receives the bulletin**			
Staff of the surveillance system			**Is each of these categories receiving the bulletin and if yes, specify how they receive it.**
Members of association/federation of beekeepers			
Other beekeepers			
Public health			
Other ministries			
Funding agencies			
Neighboring countries			
International organizations			
Other			
Evaluation of the quality of the bulletin			**Is there an evaluation process implemented to assess the quality of the bulletin?**

Section 9: Restitution and dissemination of information- Summary

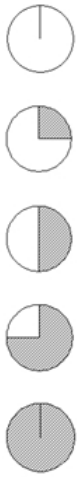
☐ Easy access for all actors of the bee surveillance system to communication means (Internet for central and provincial level, telephone surveillance actors) ☐ OIE notifications and reports realized at 100% for bee diseases ☐ Solid policy of external communication (bulletins, reports, Web) to animal bee production partners (including bee keepers), neighbouring countries and/or international organizations ☐ Broad diffusion, in particular to the field level, of an epidemiological bulletin published regularly and restitution of laboratory analysis results to field actors	Circle the result 
Comments:	

Come back to the preliminary table

Section 10: Evaluation and performance indicators

	Yes	No	Comment / Answer
1. Performance indicators			
Already defined			**Have performance indicators been developed to monitor or assess the operation of the surveillance system?**
Complete			**Is this set of indicators complete and addressing all parts of the surveillance system?**
Actually used			**Are these performance indicators really used by the management of the surveillance system?**
Calculated at the predetermined frequency			**Are these performance indicators calculated following the pre-determined frequency?**
Performance indicators calculation registered			**Are the results of the performance indicators calculation registered in order to access the evolution of the results?**
Use			
Implementation of correcting measures			**Are correcting measures implemented following the results of the performance indicators?**
Information for field staff			**Is the field staff informed about the results of the performance indicators?**
Publication of results			**Are the results of the performance indicators officially published by the surveillance system**
2. External evaluation			
External evaluation already carried out			**Has an external evaluation of the surveillance system already been carried out?**
Dates			**When did these evaluations take place?**
Organization and expert			**Who performed these evaluations (organization and name of the experts implementing it)?**
Report available			**Are the reports of evaluation available?**
Correcting measures implemented			**Have correcting measures been implemented following these evaluations?**
Examples of performance indicators			
Number of suspicion / agent / year / disease			
% of forms correctly filled			
% of samples correctly realized and analyzed			

Section 10: Evaluation and performance indicators- Summary

☐ Performance indicators developed and validated by the persons in charge of the surveillance system ☐ Performance indicators regularly calculated, interpreted and subsequent information disseminated ☐ At least one external evaluation of the surveillance system has been carried out ☐ Correcting measures implemented following the use of performance indicators or the external evaluation	Circle the result 
Comments:	

Acronyms used in the questionnaire

AFB	American foulbrood
CVO	Chief veterinary officer
e.g.	*exempli gratia* = for example
EFT	Equivalent full time
EFB	European foulbrood
GIS	Geographical information system
GPS	Global positioning system
i.e.	*id est* = that is
MCQ	Multiple choice question
MDW	Mortality, collapse and weakening
OIE	Office International des Epizooties = World Organization for Animal Health (WOAH)
SNAT	Surveillance Network Analysis Tool

Coloss Basic Questionnaire

Coloss Basic Questionnaire version 1.02

Monitor Honey Bee Colony Losses 2009

Introduction

Your willingness to fill in the Coloss questionnaire on honeybee colony losses is much appreciated. Coloss is an international scientist network that has set up projects to identify and investigate the underlying factors of colony losses. Your participation is an essential contribution to finding solutions for this problem. The answers that you provide will help the development and dissemination of emergency measures and sustainable management strategies to prevent large scale losses.

The questionnaire

In this questionnaire you will be asked some short questions about how your colonies made it through the last winter. Some beekeepers winter very small nucleus colonies to provide the production colonies with new queens in the following spring. Please don't count these nuces in your answers. This questionnaire is aimed on production colonies. With the term production colonies we mean colonies which could be used for honey production or pollination service in 2009.

Many beekeepers winter the colonies on more than one apiary. In this first edition of the coloss questionnaire we ask you to collect the combined total figures of the production colonies in all your apiaries.

This questionnaire will be translated and used in countries with different languages, beekeeping cultures and climates. This way we collect comparable information about colony losses in many countries. However there are also cons to this approach. We have to compromise for example in a precise wording of when winter is beginning or over. Please consider your colonies wintered when the colonies are prepared for winter. For many beekeepers that would be the moment that feeding the colonies is finished.

You can help us to determine how well the survey questions are working by answering some questions after you have completed the questionnaire.

Privacy

We need your personal information to find out if there are any specific conditions, like climate differences, in the area where you manage your colonies that might be related to colony losses. A second reason is that we want to collect data per beekeeper to observe if there are any patterns over the years. These data are only intended and available for scientific research. Your personal information will be anonymized and never shared with third parties.

Please fill in the questionnaire as precise as you can.

Beekeeper Information

Surname ……

Family Name ……..

Address ……

City ……..

State ……..

Country ……..

Zip/Postal Code ……..

Email Address ……..

Monitor Colony Losses 2009

1. Colonies that could be used for honey production or pollination service are defined in this questionnaire as production colonies.

How many production colonies did you have in 2008?

2. How many production colonies were lost in the late summer of 2008 or shortly after wintering?

3. In the following question you are asked, among other things, to give the total

number of colonies lost during last winter. Please include the number of colonies that were lost shortly after wintering.
What is the total number of production colonies on all your apiaries that were:
- (a) wintered last year?
- (b) lost during last winter?
- (c) too weak in spring this year to develop to a production colony?

4. How many of the colonies that were lost during winter, disappeared with none or only a few living bees remaining, while enough food supply was present?
5. In how many hives of the disappeared colonies, did you observe patches of capped brood?

Evaluation of the questionnaire *)

1. In the introduction of the questionnaire the term production colony was specified this way: "Some beekeepers winter very small nucleus colonies to provide the production colonies with new queens in the following spring. Please don't count these nukes in your answers. This questionnaire is aimed on production colonies. With the term production colony we mean colonies which could be used for honey production or pollination service in 2009."
(a) The term 'production' colony was for me clear / unclear
(b) The term 'production' colony was for my situation workable/ unworkable
2. In the questionnaire we did not define the moments that (1) colonies were wintered and (2) spring has arrived because it is depending on local conditions. Wintered was explained as the moment that the colonies were prepared for winter. For most beekeepers that would be after feeding the colonies for winter was completed.
(a) The term "wintering" was for me clear/ unclear
(b) The term "spring" was for me clear/ unclear
3. In the questionnaire you were asked to give the total number of some distinguishing features of your production colonies. We understand that beekeepers that manage many colonies might not have these figures at hand.
The numbers of colonies that I gave in my answers were generally a very raw estimate/ more or less accurate/ accurate

*) please circle the answer that describes your situation best.

QUESTIONNAIRE FROM THE NETHERLAND – APRIL 2006

Vragenlijst wintersterfte April 2006

1. Algemene informatie

1. Naam……...

2. Adres……...

3. Locatie bijenstand……...

4. Bijenras……...

2. Overwintering

1. Hoeveel volken heeft u ingewinterd in 2005? …….

   a. Hoe sterk (ramen bijen) waren de volken gemiddeld bij aanvang inwintering: ……

2. Hoeveel volken heeft u uitgewinterd in 2006? ……

   a. Hoe sterk (ramen bijen) waren de volken gemiddeld bij de eerste inspectie (svp datum vermelden):……..

3. Varroabestrijding

• Hoe heeft u in **2005** de varroamijt bestreden?

1. Darrenraat verwijderen

   a. Wanneer? …….

2. Thymolhoudende producten

   a. Welke producten? ……

   b. Wanneer toegepast? …….

3. Mierenzuur

   a. Wanneer? …….

   b. Hoe? …….

4. Oxaalzuur

   a. Wanneer? ……

   b. Hoe? …….

5. Anders

a. Hoe en wanneer? ……..

• Alle combinaties zijn mogelijk.

4. Zijn er in 2005 problemen geweest met?

1. Nosema (Nosema apis)

a. Wanneer geconstateerd? ……..

b. Welke maatregelen genomen? …….

2. Europees Vuilbroed (Melisococcus pluton)

a. Wanneer geconstateerd? ……..

b. Welke maatregelen genomen? …….

3. Kalkbroed (Ascosphaera apis)

a. Wanneer geconstateerd? ……..

b. Welke maatregelen genomen? …….

4. Zakbroed (Sacbrood virus, SV)

a. Wanneer geconstateerd? ……..

b. Welke maatregelen genomen? …….

5. Acarapis mijtziekte (Acarapis woodi)

a. Wanneer geconstateerd? ……..

b. Welke maatregelen genomen? …….

6. Deformed Wing Virus (bijen met onderontwikkelde vleugels)

a. Wanneer geconstateerd? ……..

b. Welke maatregelen genomen? …….

7. Vergiftiging door bestrijdingsmiddelen / agrochemicaliën

a. Wanneer geconstateerd? ……..

b. Welke bestrijdingsmiddelen? ……...

c. Welke maatregelen genomen? …….

8. Anders……

GREECE : QUESTIONNAIRE 2008

1.	Where do you live (area)				
2.	How many colonies you had in Autumn 2007?				
3.	How many you lost during winter?				
4.	Describe the ways your colonies were lost -Tick on or several ✓	All population was lost and the brood was abundoned			
		All foragers were lost			
		A gradual depopulation			
		Dead bees outside of the colonies			
		Other			
5.	From the lost colonies, did the food stores were robed?				
6.	Bee race (if it is known)	Local	Macedonica	Ligustica	Other
7.	Have you bought any queens last year and from which race?	Local	Macedonica	Ligustica	Other
8.	In how many colonies you have detected AFB (by laboratory analysis)?				
9.	Have you detected Nosema (by laboratory analysis)?	YES	NO		
10.	Which from the following you have used for Varroa control since October 2007 till now?	Perizin	Tac tic	Bayvarol	
		Apistan	Fluvalinate	Apiguard	
		Check mite	Formic acid	Oxalic acid	
		Other-……..			
11.	Mark the following in an order from 3 to 1 as the most effective to the less effective	Perizin	Tac tic	Bayvarol	
		Apistan	Fluvalinate	Apiguard	
		Check mite	Formic acid	Oxalic acid	
		Other-……..			
12.	How many times you treted your colonied for Varroa since October 2007?				
13.	Did you have any losses during spring summer from poisoning?				
14.	Honey production per colony for 2008 in Kg.				

Thank you

Signature of the beekeeper

Questionnaire from France

ACUTE COLONY LOSS SUSPICION FORM

DDSV de : Déclaration reçue le :
Déclarant :
Transmis BNEVP le :
Non transmis BNEVP :

Déclaration d'une suspicion de :

mortalité aigüe sans pouvoir exclure une intoxication par produit phytophamaceutique ' □
BNEVP'
autre cas (mortalité chronique, de fin d'hiver, ou affaiblissement, '
dépopulation, effondrement des colonies, suspicion de maladies, autre mortalité aigüe rattachée de façon
certaine à une autre cause qu'un produit phytopharmaceutique)
Questionnaire rapide concernant le rucher concerné :

1 — Renseignements concernant le propriétaire/détenteur du rucher

Nom/prénom : …….. Adresse :
…….....
…….....
.....
Tél. : ……..….
Fax : …….

2 — Renseignements concernant le rucher

Nombre de ruches : ……
Emplacement du rucher :
Département : ….……..…….. Commune :
……..
Lieu-dit : ……..……..…….
Date d'installation du rucher sur le site : ……..
Description de l'environnement du rucher cultures voisines :

3 -Constatation du trouble

Date: …… heure : ....., de la 1ère constatation de la mortalité
Date possible de début des anomalies :
Nombre de ruches atteintes : ……..… sur (*nombre total de ruches du rucher*) : …..….

4 - Symptômes :

Sur abeilles adultes

Abeilles mortes devant la ruche ∋' Abeilles tremblantes' ∋ δ⌈ποπυλατιον ∋'

Sur couvain

Aspect du couvain :…….
A-t-on constaté des phénomènes identiques dans des ruchers voisins ?
Oui ∍ A quelle distance ? …… Non ∋

5 - Traitements suspectés

(à remplir dans la mesure où l'apiculteur déclare des informations)

Culture : ……... Surface : ……....…
Distance rucher/culture : …….
But du traitement (insecticide, fongicide, herbicide, éclaircissage, substance de croissance…) :
……
…….
…….....
.....
Date : …… Heure : …… du traitement

QUESTIONNAIRE FROM FRANCE

EPIDEMIOLOGICAL INVESTIGATION FOR
ACUTE COLONY LOSS SUSPICION FORM

Fiche à remplir lors de la visite DDSV ou conjointe DRAAF-SRAL/DDSV
CONSTAT DE TROUBLES SUR UN RUCHER

1 — Renseignements concernant le propriétaire du rucher

Apiculteur …….. Adresse ……..……...
…….
Tél. ……..….
Fax …….

2 — Renseignements concernant le rucher

Nombre de ruches : …… à ……..…… cadres modèle
……..……
ruchettes : …… à ……..… cadres modèle ……..……...
Emplacement du rucher :
Département : ……..…….. Commune : ……..... … … … … … … …
...……..
Depuis le : …….. Lieu-dit : ……...
...……..……..
Description de l'environnement du rucher (cultures voisines, culture dominante, distance par rapport à ces cultures) sur l'aire de butinage (rayon de 5 km) :
Forêt _
Bois _
Champ cultivé _
Prairie _
Lande _
Verger _
Jardins _
Ville _
Usine _
Cours d'eau _
Schéma (joindre un schéma succinct si possible) :

3– Renseignements concernant les colonies d'abeilles avant les troubles

Race : ……Âge des reines : ……..……..…
Renseignements concernant les miellées précédentes (emplacement, nature, résultat et observation- indiquer les transhumances si il y a lieu …)
…….. .
…….. .
…….. .
…….. .
…….. ..
…….. .
Trappes à pollen en activité :……..…….. …
……..……
Date de la dernière visite avant constatation des problèmes : ……...
...……..…
État des colonies (% par rapport à la totalité des ruches)
Faible ……(%) Moyen …… (%) Fort …… (%)
Nombre de cadres d'abeilles
Nombre de cadres de couvain
Ex pour le couvain 4 (20 %) 6 (20 %) 8 (60 %)
Traitements sanitaires réalisés dans les 12 derniers mois :
- date : …….. - produit utilisé : ...…… - méthode :
….……

agent pathogène visé :...……
- date : ……..- produit utilisé : ..…… - méthode :
…..……
agent pathogène visé :...……
- date : ……..- produit utilisé : ..…… - méthode :
…..……
agent pathogène visé :...……
- date : ……..- produit utilisé : ..…… - méthode :
…..……
agent pathogène visé :...……
- date : ……..- produit utilisé : ..…… - méthode :
…..……
agent pathogène visé :...……
Renseignements concernant le nourrissement : ….
Energétique : oui/non
Nature du produit :
date de nourrissement :
……
……
Protéique : oui/non
Nature du produit
date de nourrissement
……
……
Traitements contre la varroase : dates : ……...
produits : …… …… méthode d'application……
……
4– Symptômes
Nombre de ruches atteintes : …… sur ……..…
Date de la 1 ère constatation : ……..
Type de problème constaté :
Symptômes devant les colonies
mortalité importante_
abeilles tremblantes_
abeilles traînantes_
abeilles noires et/ou dépilées_
abeilles rejetées par les gardiennes_
abeilles aux ailes déformées_
abeilles accrochées aux brins d'herbe_
abeilles disposées en soleil_
Agressivité _
Activité au trou de vol réduite _
traces de diarrhées devant la ruche_
autre (préciser)_.....
Symptômes à l'intérieur des colonies :
Sur abeilles :
Dépopulation constatée_
manque d'abeilles sur le couvain_
varroa phorétiques_
abeilles aux ailes déformées_
Sur couvain :
Affaiblissement des colonies _
atteinte du couvain ouvert_
atteinte du couvain operculé_
couvain en mosaïque_

opercules de couleurs différentes_
larve gluante, filante_
larves jaunes ou noires_
Couvain refroidi _
couvain plâtré/mycose_
Larves affaissées _
Nymphes désoperculées _
Autre : _……
Symptôme « sur cultures »
Absence d'abeilles sur fleurs _
Pas de récolte malgré fréquentation des abeilles _
Abeilles mortes dans la culture _
Autres : ……..
A-t-on constaté des phénomènes identiques dans des ruchers voisins ?
Oui _ A quelle distance ? …… Non _ Ne sait pas _
Des prélèvements ont-ils été faits :
Oui (Préciser le nombre)/Non
Effectué par (vous-même, gendarmerie, huissier…)
Abeilles _
Couvain _
Pollen _
Miel _
Fleurs, végétation _

Examens complémentaires

Analyses toxicologiques
Recherche demandée :……
Résultats
Produit : ……
Quantité détectée : …… Indiquer le seuil de détection :……
Autre :
……
……
Laboratoire qui a effectué les analyses :
……
Informations complémentaires : ……
……..
……
Analyses pathologiques
Résultats
Maladies réputées contagieuses (résultats et seuil de détection si nécessaire)……
……
……
……
Viroses……
……
Laboratoire ayant réalisé l'analyse :……
……

5– Traitements phytopharmaceutiques suspectés

(à remplir dans la mesure des informations dont dispose l'apiculteur)
Culture : …… Surface : …… Distance rucher/culture : . ……
Stade de floraison : …… Présence d'adventices en fleurs : oui/non
But du traitement (insecticide, fongicide, herbicide, éclaircissage, substance de croissance…) :……..…….
Produits utilisés (nom commercial) :

……
Mode d'épandage : terrestre au sol / terrestre en pulvérisation / aérien
Date : …… Heure : ……
Conditions météorologiques (température, vent, hygrométrie…)
- le jour du traitement :
……
- les jours suivants :
……
…..

Nom et signature des agents assermentés……

APPENDIX 5. DATA COLLECTION GRID.

Format of surveillance data requested

YEAR 2008

Table 1

Year and season of the observation: Observation period (winter, summer, all year...): Kind of unit (colony, apiary, beekeeper): Kind of calculation (mean of individual percentage, general percentage) Remark	

Administrative subunit (region, land, province...)	Size of the population of the subunit: beekeepers	Size of the population of the subunit: colonies	Size of the population under surveillance: beekeeper number (at the moment of the data collection)	Size of the population under surveillance: colony number (at the moment of the data collection)	Size of the population under surveillance: apiaries (at the moment of the data collection)	Number of affected colony / apiary / beekeeper (mortality)	% of affected colony / apiary / beekeeper (mortality)	Number of affected colony / apiary/ beekeeper due to notifiable diseases * (mortality)	Number of affected colony / apiary / beekeeper (collapse)	% of affected colony / apiary / beekeeper (collapse)	Number of affected colony / apiary/ beekeeper due to notifiable diseases * (collapse)	Number of affected colony / apiary / beekeeper (weakening)	% of affected colony / apiary / beekeeper (weakening)	Number of affected colony / apiary/ beekeeper due to notifiable diseases * (weakening)
Subunit 1														
Subunit 2														
Subunit 3														
Subunit 4														
Subunit 5														
Subunit 6														
Subunit 7														
...														
All country														

* According to OIE listed disease

APPENDIX 6. WEBSITES INTERROGATED BY THE SPECIALIZED GOOGLE SEARCH ENGINE

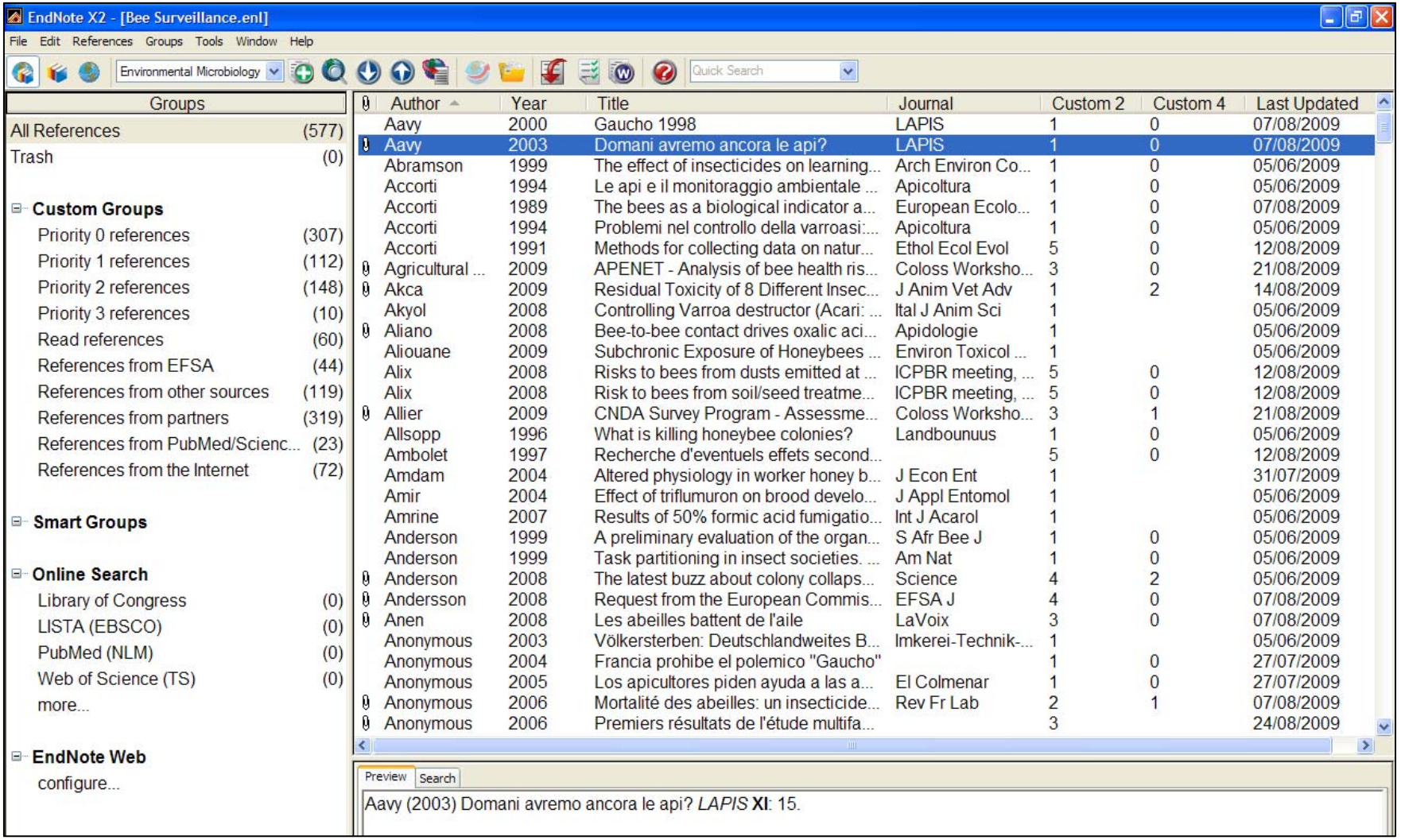
(version of August the 1st, 2009)

*.ac.be
*.ac.uk
*.admin.ch
*.afssa.fr
*.agrireseau.qc.ca
*.assemblee-nationale.fr
*.cnrs.fr
*.easternapiculture.org
*.edu/*ccd*
*.edu/*CollapseDisorder*
*.esa.confex.com
.europa.eu.int/
.europa.eu/
.europarl.eu.int/
*.fl.us/*ccd*
*.gouv.fr
*.gov/*honey*
*.il.us/*CCD*
*.inra.fr
*.nature.com
*.oie.int
*.psu.edu
*.qc.ca/*apiculture*
*.qc.ca/*beille*
*.scientificcommons.org
*.senat.fr
*.usda.gov/*ccd*
*.wikipedia.org
http://*.edu/*African*HB*
http://ag.arizona.edu/pubs/insects/ahb/
http://apihb.123.fr/
http://apisite.online.fr
http://asso.objectif-sciences.com/Le-CCD-ou-Colony-Collapse-Disorder.html
http://beealert.blackfoot.net
http://beebase.csl.gov.uk
http://bees.tennessee.edu/
http://blogabeilles.affaire-gaucho-regent.com
http://cognition.ups-tlse.fr
http://coloss.org/
http://entomology.ifas.ufl.edu/sanford/apis/
http://entomology.ucdavis.edu/faculty/Mussen/beebriefs*
http://gdsa27.free.fr/
http://honeybee.tamu.edu/
http://indianabeekeepingschool.com
http://inpn.mnhn.fr
http://maarec.cas.psu.edu/
http://maarec.psu.edu
http://nebraskabeekeepers.org/
http://questions.assemblee-nationale.fr/*
http://unapla.free.fr/
http://web.uniud.it/*arroa*
http://web.uniud.it/eurbee/Proceedings/ExtendedAbstracts.html
http://www.abeille-perigordine.fr
http://www.abeilles.ch/
http://www.academie-veterinaire-defrance.org
http://www.alimentosargentinos.gov.ar/apicola/Seminario_Internacional_30del09/P_Raezke.pdf
http://www.api-connaissance-sanitaire.fr

http://www.apicultura.com.ar/
http://www.apicultura.entupc.com/
http://www.apiculturaonline.com/
http://www.apiculture.co.za
http://www.apidologie.org/
http://www.apimondia.org/
http://www.apimondia2009.com
http://www.apimondiafoundation.org/
http://www.apis.lu
http://www.apiservices.com
http://www.apivet.eu
http://www.apiwiki.eu
http://www.ars.usda.gov
http://www.assemblee-nationale.fr/*abeilles*
http://www.badbeekeeping.com
http://www.barnstablebeekeepers.org
http://www.beealert.info/
http://www.beebase.org/
http://www.beeculture.com/
http://www.beekeeping.com/
http://www.beenova.net
http://www.beesfordevelopment.org/
http://www.beespace.uiuc.edu/
http://www.biodiversite-poitou-charentes.org
http://www.biomedexperts.com/Concept.bme/2276/Bees
http://www.capabees.com
http://www.cari.be
http://www.cnda.asso.fr/
http://www.defra.gov.uk/hort/*ees*
http://www.dipucordoba.es/medioambiente/pdf/XJornadasApiPonencia01.pdf
http://www.echomagazine.ch/Default.asp?340332233DD6746230D361E6266332D37047263339933DE6
http://www.ento.psu.edu/MAAREC/
http://www.fortnet.org/NCBA/Nosema_ceranae_EmergentPathogen_Apis_mellifera_2007_.pdf
http://www.forumphyto.fr/*beilles*
http://www.frelon-asiatique.com/
http://www.galerie-insecte.org/
http://www.gds38.asso.fr/web/gds.nsf/8cb279f7ace047aac1256c0f004cf0d5/47cd459ac2fa25ccc125726800515d65%21OpenDocument
http://www.honey.com
http://www.honeybeelab.com/
http://www.honeycouncil.ca
http://www.ibra.org.uk/
http://www.in.gov/dnr/entomolo/files*
http://www.inia.es/gcontrec/pub/322-325-SC._First_report_1188555815453.pdf
http://www.insectscience.org
http://www.invasivespeciesinfo.gov/*bee.shtml
http://www.jacheres-apicoles.fr/
http://www.legs.cnrs-gif.fr/perso.php?id=19&lang=fr
http://www.lerucherduperigord.fr/
http://www.lesruchersdargonne.com/*osemos*
http://www.life.illinois.edu/robinson/
http://www.liste-hygiene.org
http://www.llh-hessen.de/cms/bienen/2548.php?z=1
http://www.lwg.bayern.de/bienen/
http://www.masterbeekeeper.org
http://www.meckbees.org/
http://www.monde-solidaire.org/*collapse_disorder*
http://www.nao.org.uk//idoc.ashx?docId=ac47b21d-2085-47ef-bf51-39904b555f72&version=-1
http://www.njbeekeepers.org

http://www.oardc.ohio-state.edu/agnic/bee/
http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2075036
http://www.scientific.micropolis.biz/
http://www.sos-abeilles.com
http://www.spmf.fr/
http://www.syndapi74.fr/nouvellepage4.htm
http://www.tela-insecta.net
http://www.unaf-apiculture.info/
http://www.varapiloisir.com
http://www.wncbees.org
http://www7.nationalacademies.org/ocga/*Collapse_Disorder*
https://www.uni-hohenheim.de/67724.html*

APPENDIX 7. SCREEN SHOT OF THE ENDNOTE DATABASE "BEE SURVEILLANCE".



APPENDIX 8. REFERENCES GATHERED FOR WP3.

Priority 1 references (110)

(2007). Review colony collapse disorder in honey bee colonies across the United States. Subcommittee on horticulture and organic agriculture. Washington, U.S. Government printing office: 188.

Allier, F. (2009). CNDA Survey Program - Assessment of colony losses during winter 2007/2008. Coloss Workshop 2009 - Bee Monitoring, Amsterdam (The Netherlands).

Anderson, D. and I. J. East (2008). "The latest buzz about colony collapse disorder." Science 319(5864): 724-5; author reply 724-5.

Anonymous (2006). "Mortalité des abeilles: un insecticide hors de cause?" Rev Fr Lab 2006(386): 8-8.

Anonymous (2007). "Bee researchers close in on colony collapse disorder." Am Bee J 147(11): 930-931.

Anonymous (2008). "Bee researchers unveil tool to chase Colony Collapse Disorder." Am Bee J 148(10): 867-867.

Anonymous (2008). Colony losses 2008 - No surprise for certain insider.

Anonymous (2009). Monitoring of honeybee colony losses in Poland during the winter of 2008/2009. Coloss Workshop 2009 - Bee Monitoring, Amsterdam (The Netherlands).

Aubert, M., J. P. Faucon, et al. (2006). "Recherches sur les mortalités d'abeilles et prévention des risques liés aux insecticides." B E H(20): 1-4.

Baggio, A., C. Nardon, et al. (2005). Monitoring programme for honeybee colonies losses in selected areas of northern Italy, Dublin, Ireland apimondia, apimondia2005.com.

Ball, R. (2007). "Colony losses: putting it all in perspective." Bee Craft(June): 8-9.

Beattie-Moss, M. (2008) "Colonies in collapse: What's causing massive honeybee die-offs?" PHYSorg.com 12 November 2008, 7.

Bee Research Institutes (2008). "Colony losses" monitoring project - Trial years 2005-2008, Bee Research Institutes in Celle, Freiburg, Halle, Hohenheim, Hohen-Neuendorf, Kirchhain, Mayen, Münster and Veitshöchheim: 37.

Bienkowska, M. and Z. Konopacka (2001). "Assessment of honeybee colonies infestation by the mite Varroa destructor based on its natural mortality during the summer season." J Apic Sci 45: 127-138.

Blacquière, T. and R. Van der Zee (2009). Colony losses in the Netherlands. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 30-31.

Brodschneider, R. and K. Crailsheim (2009). Overwinter colony mortality in Austria. Coloss Workshop 2009 - Bee Monitoring, Amsterdam (The Netherlands).

Brodsgaard, C. J., W. Ritter, et al. (2000). "Interactions among Varroa jacobsoni mites, acute paralysis virus, and Paenibacillus larvae larvae and their influence on mortality of larval honeybees in vitro." Apidologie 31(4): 543-554.

Buchler, R., S. Berg, et al. (2009). Honeybee colony losses and referring investigations in Germany. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 19-20.

Budge, G., B. Jones, et al. (2007). Investigating colony losses in England and Wales. York, Central Science Laboratory: 1.

Burgett, D. M., R. Rucker, et al. (2009). "Honey bee colony mortality in the Pacific Northwest (USA) winter 2007/2008." Am Bee J 149(6): 573-575.

CCD Steering Committee (2007). Colony Collapse Disorder action plan, CCD steering committee: 28.

CCD Steering Committee (2009). Colony Collapse Disorder - Progress Report, CCD steering committee: 45.

Celle, O., F. Schur, et al. (2008). Mortalités de colonies: recensement exhaustif et causes explicatives des cas de début d'année.

Charrière, J. D., A. Imdorf, et al. (2004). "Ampleur et cause des mortalités d'abeilles durant l'hiver 2002-2003." Rev Suisse Apic 125(8): 12-17.

Charrière, J. D. and P. Neumann (2009). Colony losses in Switzerland. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 41.

Chauzat, M. P., M. Ribière, et al. (2009). Colony losses in France. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 17-18.

Coffey, M. F. and J. Breen (2009). Colony losses in Ireland, a preliminary assessment during 2009/2010. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 23.

Cooper, E. L. (2007). "Colony collapse disorder may affect complementary and alternative medicine." Evid Based Complement Alternat Med 4(3): 275-277.

Cox-Foster, D., S. Conlan, et al. (2008). "The latest buzz about colony collapse disorder, response." Science 319: 724-725.

Cox-Foster, D. L., S. Conlan, et al. (2007). "A metagenomic survey of microbes in honey bee colony collapse disorder." Science 318(5848): 283-7.

Crailsheim, K., R. Moosbeckhofer, et al. (2009). Colony losses in Austria. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 7.

Dahle, B. (2009). Colony losses in Norway. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 32.

Darrouzet, E. (2006). Insecticides et mortalités des abeilles domestiques. Insectes: 15-18.

Del Bene, G., D. Tesoriero, et al. (2008). "Approccio alla idividuazione delle cause della sindrome dello spopolamento degli alveari (CCD Colony Collapse Disorder) con riferimento alle onde elettromagnetiche." APOidea 5(2): 70-77.

Duclos, P. (2009). "Enquête mortalité 2007-2008 en Saône-et-Loire." L'abeille de France et l'apiculteur 957.

Ellis, J. D., J. Evans, et al. (2009). Colony losses in the United States of America. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 45.

Ellis, M. and Y. Le Conte (2009). "Mortalités et dépopulations des colonies d'abeilles aux Etats-Unis." Santé de l'Abeille(223): 37-45.

Faucon, J. P. (2005). Affaiblissement et mortalités des colonies d'abeille, Académie d'agriculture de France: 2.

Faucon, J. P. (2006). Mortalités hivernales 2005-2006. Abeille française. 212: 485-488.

Faucon, J. P. (2007). Affaiblissements mortalités de colonies d'abeilles 1987-2007, Agence Française de Sécurité Sanitaire des Aliments: 11.

Faucon, J. P. and M. P. Chauzat (2008). "Varroase et autres maladies des abeilles, les causes majeures de mortalités de colonies en France." Bull Acad Vet Fr 3(161): 257-264.

Faucon, J. P., M. C. Clément, et al. (2008). Mortalités de colonies d'abeilles (Apis mellifera) au cours de l'hiver 2005-2006 en France : enquête sur le plateau de Valensole et enquête sur 18 ruchers de différents départements, Agence Française de Sécurité Sanitaire des Aliments: 26.

Faucon, J. P., L. Mathieu, et al. (2002). "Honey bee winter mortality in France in 1999 and 2000." Bee World 83(1).

Frazier, M. (2008). Update on colony collapse disorder in honey bee colonies in the United States. Prepared Testimony before the US House of Representatives Committe on Agriculture and Organic Agriculture, Pennsylvania State University: 5.

Frazier, M., D. van Engelsdorp, et al. (2007). FAQ's Colony collapse disorder. C. w. group: 5.

Gilles, M. (2007). "Colony collapse disorder. Plan d'action." La Santé de l'Abeille(222): 341-346.

Greatti, M. (2008). "Spopolamento degli alveari e mortalità di api in coincidenza della semina del mais in provincia di Udine." APOidea 5(2): 78-82.

Gregorc, A. and J. Kralj (2009). Colony losses in Slovenia. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 38.

Harrison, M. (2009) "The buzz about colony collapse disorder." MSU News.

Hatjina, F., M. Bouga, et al. (2009). Colony losses ni Greece: reviews of the situation from 2003 to 2009. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 21.

Haubruge, E., B. K. Nguyen, et al. (2005). "La surmortalité des abeilles: faits et causes..." Académie française d'agriculture(December).

Hayes, J. (2007). "Colony collapse disorder. Research update." Am Bee J 147(12): 1023-1025.

Henderson, C., L. Tarver, et al. (2007). "US national bee colony loss survey - www.beesurvey.com - Preliminary findings with respect to Colony Collapse Disorder (CCD)." Am Bee J 147(5): 381-384.

Higes, M., C. Botías, et al. (2008). Fumagillin can avoid colony collapse if Nosema ceranae is present. Third European Conference of Apidology EurBee, Belfast.

Higes, M., R. Martin-Hernandez, et al. (2008). "How natural infection by Nosema ceranae causes honeybee colony collapse." Environ Microbiol.

Higes, M., R. Martin-Hernandez, et al. (2009). "Honeybee colony collapse due to Nosema ceranae in professional apiaries." Environ Microbiol Rep: 1-4.

Higes, M., A. Meana, et al. (2009). Colony losses in Spain. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 39.

Hucorne, P. (2002). "Mortalités d'abeilles en 2000 et 2001." Abeilles et Cie 87: 12-14.

Janke, M., W. von der Ohe, et al. (2008). Veröffentlichung [publication]: Colony losses - Interactions of plant protection products and other factors. 10th International Symposium International Commission for plant-bee relationships bee protection group, hazards of pesticides to bees. Bukarest (Romania).

Kaplan, K. (2009). Survey reports latest honey bee losses, Agriculture Research Service: 1.

Kezic, N., M. Drazic, et al. (2009). Colony losses in Croatia during winter 2008/09. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 12.

Kievits, J. (2007). "Bee gone: colony collapse disorder." Pesticides News 76(6): 3-5.

Korpela, S., L. Kauko, et al. (2009). Colony losses in Finland. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 16.

Kristiansen, P. and I. Fries (2009). Colony losses in Sweden. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 40.

Laszlo, B. (2008). "About the uncommon bee losses. Literature review." Magy Allatorv Lapja 130(9): 551-557.

Le Conte, Y. and M. Ellis (2008). "Mortalités et dépopulations des colonies d'abeilles domestiques: le cas américain." Biofutur 284: 49-53.

Liebert-Courtois, F. (2008). "Surveillance sanitaire en apiculture: missions des directions départementales des services vétérinaires." Bull Acad Vet Fr 161(3): 265-271.

Lodesani, M., C. Costa, et al. (2008). "Rilevamenti e ipotesi sulla mortalità degli alveari: dati di un monitoraggio in alcune province dell'Emilia-Romagna." APOidea 5(3): 117-124.

Martin, S. J. (2001). "The role of Varroa and viral pathogens in the collapse of honeybee colonies: a modelling approach." J Appl Ecol 38(5): 1082-1093.

Mayack, C. (2009). Energetic stress as a potential cause of colony collapse disorder.

McMullan, J. B. and M. J. F. Brown (2009). "A qualitative model of mortality in honey bee (Apis mellifera) colonies infested with tracheal mites (Acarapis woodi)." Exp Appl Acarol 47(3): 225-234.

Medrzycki, P. (2008). Epidemiological assessment of excess mortlity of bees. First Mediterranean apiculture and research encounters. Montpellier: 55 slides.

Mid-Atlantic Apiculture Research and Extension Consortium (2007). "Questions and answers about colony collapse disorder and Israeli acute paralysis virus." Am Bee J 147(11): 932-932.

Mineau, P., K. M. Harding, et al. (2008). "Using reports of bee mortality in the field to calibrate laboratory-derived pesticide risk indices." Environ Entomol 37(2): 546-54.

Miserey, Y. (2004). Mortalité des abeilles: Gaucho et Régent hors de cause. Le Figaro.

Mogliotti, P. (2008). "Mortalità di api in Regione Piemonte." L'Apicoltore Italiano 1(7): 9-13.

Murilhas, A. (2009). Honey bee diseases and colony losses in Portugal. Results from the last nationwide survey. IV Prevention of Honey Bee Colony Losses Conferences. F. o. A. U. o. Zagreb. Zagreb (Croatia): 28.

Mussen, E. (2007) "Colony collapse disorder." Am Bee J 147, 593-594.

Mutinelli, F. (2008). Honey Bee Losses: causes, monitoring and prevention in Italy. The first international beekeeping and pine honey congress. Mugla (Turkey): 43-53.

Mutinelli, F., C. Costa, et al. (2009). Honeybee colony losses recorded in Italy. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia).

Mutinelli, F. and A. Granato (2007). "La sindrome del collasso della colonia (Colony Collapse Disorder) negli USA. Un aggiornamento sulla situazione attuale." APOidea 4: 175-185.

Naug, D. (2009). "Nutritional stress due to habitat loss may explain recent honeybee colony collapses." Biol Conserv In Press, Corrected Proof.

Nguyen, B. K., C. Saegerman, et al. (2009). "Does Imidacloprid Seed-Treated Maize Have an Impact on Honey Bee Mortality?" J Econ Ent 102(2): 616-623.

Norton, C. (2007). "Colony collapse disorder investigated by U.S. bee researchers." Am Bee J 143(3): 199-202.

Otis, G. W. (2007). "Comments about colony collapse disorder." Am Bee J 147(12): 1033-1035.

Pajuelo, A. G. and J. O. Bermejo (2007). Estudio de campo en España no demuestra relacion entre el Sindrome de Desaparicion de Colmenas (SDC = CCD, Colony Collapse Disorder) y la presencia de Nosema ceranae: 4.

Pajuelo, A. G., C. Torres, et al. (2008). "Colony losses: a double blind trial on the influence of supplementary protein nutrition and preventative treatment with fumagillin against Nosema ceranae." J Apic Res 47(1): 84-86.

Pettis, J., D. Vanengelsdorp, et al. (2007). "Colony collapse disorder working group pathogen sub-group progress report." Am Bee J 147(7): 595-598.

Porrini, C., A. G. Sabatini, et al. (2008). "Le segnalazioni degli spopolamenti e delle mortalità degli alveari in Italia: resoconto 2008." L'Osservatorio XI(6): 13-15.

Porrini, C., F. Sgolastra, et al. (2008). "Rete per il monitoraggio di fenomeni di spopolamento e mortalità degli alveari in Italia (APENET)." APOidea 5(2): 83-87.

Quarles, W. (2008). "Pesticides and honey bee colony collapse disorder." IPM practitioner 30(9-10): 1-10.

Rosenkranz, P. (2006). Monitoring of honey bee losses in Switzerland. 3e colloque technique apicole.

Rosenkranz, P. and K. Wallner (2008). The chronology for honey bee losses in Rhine Valley during spring 2008: an example of worst case scenario. J. Teeal, J. L. Osborne and R. J. Paxton. Belfast: 94-95.

Sabatini, A. G., M. Astuti, et al. (2008). "Mortalità di api e spopolamento degli alveari nella primavera del 2008: indagini in Lombardia e nel Triveneto." APOidea 5(2): 88-90.

Sgolastra, F. (2009). Bee mortality and colony loss survey in Italy. Coloss Workshop 2009 - Bee Monitoring, Amsterdam (The Netherlands).

Sgolastra, F., P. Medryzycki, et al. (2005). "Relazione fra mortalità delle api e trattamenti fitosanitari in aree viticole dell'Emilia-Romagna." APOidea 2: 8.

Sgolastra, F., P. Medrzycki, et al. (2005). "Studi sulla mortalità delle api in aree viticole della regione Emilia-Romagna." LAPIS XIII(1): 16-18.

Stankus, T. (2008). "A review and bibliography of the literature of honey bee colony collapse disorder: a poorly understood epidemic that clearly threatens the successful pollination of billions of dollars of crops in America." J Agric Food Inf 9(2): 29.

Topolska, G., J. Wilde, et al. (2009). Colony losses in Poland in the winter of 2007/2008. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 33-34.

Underwood, R. M. (2007). "Colony collapse disorder: Have we seen this before?" Bee Culture 135(7): 13-15.

Van der Steen, J. J. and A. Dinter (2007). "A monitoring study to assess the acute mortality effects of indoxacarb on honey bees (Apis mellifera L.) in flowering apple orchards." Pest Manag Sci 63(11): 1095-9.

Van Engelsdorp, D., D. Cox-Foster, et al. (2006). Colony collapse disorder (CCD): Fall-Dwindle disease: Investigations into the causes of sudden and alarming colony losses experienced by beekeepers in the fall of 2006. USA, CCD Working Group: 1-22.

Van Engelsdorp, D., J. D. Evans, et al. (2009). ""Entombed Pollen": A new condition in honey bee colonies associated with increased risk of colony mortality." J Invertebr Pathol In Press, Corrected Proof.

Van Engelsdorp, D., J. Hayes, et al. (2009). Preliminary results: a survey of honey bee colony losses in the U.S. between September 2008 and April 2009: 1.

Van Engelsdorp, D., J. Hayes, Jr., et al. (2008). "A survey of honey bee colony losses in the U.S., fall 2007 to spring 2008." PLoS ONE 3(12): e4071.

Van Engelsdorp, D., R. Underwood, et al. (2007). "An estimate of managed colony losses in the winter of 2006-2007: a report commissioned by the apiary inspectors of America." Am Bee J July.

vanEngelsdorp, D., J. D. Evans, et al. (2009). "Colony collapse disorder: a descriptive study." PLoS ONE 4(8).

Widart, J., B. K. Nguyen, et al. (2005). Honeybee (Apis mellifera L.) mortality: determination of up to 50 pesticides in honey and beeswax by LC-MS/MS and GC-MS detection. Symposium "Entomology in Belgium", Brussels.

Wilkins, S., G. Marris, et al. (2009). Honey bee colony losses in the United Kingdom. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 43.

Winfree, R., N. M. Williams, et al. (2007). "Native bees provide insurance against ongoing honey bee losses." Ecol Lett 10(11): 1105-1113.

Priority 2 references (148)

Akca, I., C. Tuncer, et al. (2009). "Residual Toxicity of 8 Different Insecticides on Honey Bee (Apis mellifera Hymenoptera: Apidae)." J Anim Vet Adv 8(3): 436-440.

Akyol, E. and H. Yeninar (2008). "Controlling Varroa destructor (Acari: Varroidae) in honeybee Apis mellifera (Hymenoptera: Apidae) colonies by using Thymovar (R) and BeeVital (R)." Ital J Anim Sci 7(2): 237-242.

Aliano, N. P. and M. D. Ellis (2008). "Bee-to-bee contact drives oxalic acid distribution in honey bee colonies." Apidologie 39(5): 481-487.

Aliouane, Y., A. K. El Hassani, et al. (2009). "Subchronic Exposure of Honeybees to Sublethal Doses of Pesticides: Effects on Behavior." Environ Toxicol Chem 28(1): 113-122.

Amdam, G. V., K. Hartfelder, et al. (2004). "Altered physiology in worker honey bees (Hymenoptera: Apidae) infested with the mite Varroa destructor (Acari: Varroidae): a factor in colony loss during overwintering?" J Econ Ent 97(3): 741-7.

Amir, O. G. and R. Peveling (2004). "Effect of triflumuron on brood development and colony survival of free-flying honeybee, Apis mellifera L." J Appl Entomol 128(4): 242-249.

Amrine, J. W., R. C. Noel, et al. (2007). "Results of 50% formic acid fumigation of honey bee hives [Apis mellifera ligustica (Hymenoptera : Apidae)] to control varroa mites (Acari : Varroidae) in brood combs in Florida, USA." Int J Acarol 33(2): 99-109.

Anonymous (2003). "Völkersterben: Deutschlandweites Bienensterben alarmiert die Imkerschaft." Imkerei-Technik-Magazin(1): 7-9.

Anonymous (2006). Premiers résultats de l'étude multifactorielle sur le dépérissement des abeilles domestiques en Wallonie, Faculté universitaire des sciences agronomiques de Gembloux, Université de Liège: 9.

Anonymous (2008) "Bee learning behaviour affected by consumption of Bt Cry1Ab toxin." The Bioscience Resource Project.

Anonymous (2009). 2008 German network monitoring - Monitoring of Bees Germany: Deutsches Bienenmonitoring (German Honey Bee

Monitoring Network), Monsanto compagny: 19-21.

Anonymous (2009). Domesticated bee numbers rising fast. RedOrbit.

Anonymous (2009). Honeybee colonies not declining worldwide, study says. CBC News.

Anonymous. (2009, 29 July 2009). "Scientists Untangle Multiple Causes of Bee Colony Disorder " Environment News Service Retrieved 5 August 2009, 2009, from http://www.ens-newswire.com/ens/jul2009/2009-07-29-094.asp.

Ariana, A., R. Ebadi, et al. (2002). "Laboratory evaluation of some plant essences to control Varroa destructor (Acari : Varroidae)." Exp Appl Acarol 27(4): 319-327.

Aronstein, K., T. Pankiw, et al. (2006). "SID-I is implicated in systemic gene silencing in the honey bee." J Apic Res 45(1): 20-24.

Arun, K., S. Srivastava, et al. (2001). "Infestation phenology of Tropilaelaps clareae Delfinado and Baker and Acarapis woodi (Rennie) in Apis mellifera L. and Apis cerana Fab." J Entomol Res 25(1): 41-46.

Aubert, M., J. P. Faucon, et al. (2008). Enquête prospective multifactorielle: influence des agents microbiens et parasitaires, et des résidus de pesticides sur le devenir de colonies d'abeilles domestiques en conditions naturelles. Sophia-Antipolis, AFSSA.

Aumeier, P., W. H. Kirchner, et al. (2006). Topsy-turvy brood combs - Impact on population dynamics of honey bees (Apis mellifera L.) and Varroa destructor. Second European conference of apidology.

Aupinel, P., D. Fortini, et al. (2007). "Toxicity of dimethoate and fenoxycarb to honey bee brood (Apis mellifera), using a new in vitro standardized feeding method." Pest Manag Sci 63(11): 1090-1094.

Bacandritsos, N., I. Papanastasiou, et al. (2007). "Efficacy of repeated trickle applications of oxalic acid in syrup for varroosis control in Apis mellifera: Influence of meteorological conditions and presence of brood." Vet Parasitol 148(2): 174-178.

Bahreini, R., G. Tahmasebi, et al. (2004). "A study of the efficacy of formic acid in controlling Varroa destructor and its correlation with temperature in Iran." J Apic Res 43(4): 158-161.

Bailey, J. C., C. S. Dupree, et al. (2003). "Relative impact on foraging honey bees of integrated strategies for control of European corn borer, Ostrinia nubilalis." Am Bee J 143(4): 317.

Bakonyi, T., R. Farkas, et al. (2002). "Detection of acute bee paralysis virus by RT-PCR in honey bee and Varroa destructor field samples: rapid screening of representative Hungarian apiaries." Apidologie 33(1): 63-74.

Barbançon, J.-M. (2005). "Département du Cher, juillet 2004 - 3000 ruches victimes de toxiques!" Abeilles et Fleurs(667): 12-14.

Barlic-Maganja, D. and A. Gregorc "Evidence of acute bee paralysis virus and deformed wing virus in honey bees (Apis mellifera carnica) and Varroa destructor mites from collapsing colonies in Slovenia."

Baxter, J. R., M. D. Ellis, et al. (2000). "Field evaluaton of Apistan(R) and five candidate compounds for parasitic mite control in honey bees." Am Bee J 140(11): 898-900.

Békési, L. and E. S. Matray (2009). First results of the monitoring program on the health status of the Hungarian honeybee colonies. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 22.

Bellucci, V. (2008). Rediconto sul workshop - Sindrome dello spopolamento degli alveari in Italia. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Berenyi, O., T. Bakonyi, et al. (2006). "Occurrence of six honeybee viruses in diseased Austrian apiaries." Appl Environ Microbiol 72(4): 2414-2420.

Bessi, E. (2008). Sindrome da spopolamento e patologie microbiche: possibili correlazioni con Nosema ceranae. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Blanchard, P., F. Schurr, et al. (2008). "First detection of Israeli acute paralysis virus (IAPV) in France, a dicistrovirus affecting honeybees (Apis mellifera)." J Invertebr Pathol 99(3): 348-350.

Boecking, O. and E. Genersch (2008). "Varroosis - the ongoing crisis in bee keeping." J Verbraucherschutz Lebensmittelsicherh 3(2): 221-228.

Bonmatin, J. M., P. A. Marchand, et al. (2005). "Quantification of imidacloprid uptake in maize crops." J Agric Food Chem 53(13): 5336-41.

Bortolotti, L., R. Montanari, et al. (2003). "Effects of sub-lethal imidacloprid doses on the homing rate and foraging activity of honey bees." Bull Insectology 56(1): 63-67.

Bortolotti, L., A. G. Sabatini, et al. (2008). Spring bee losses in Italy. FIITEA Apimondia, Bucharest (Romania).

Bowen-Walker, P. L. and A. Gunn (2001). "The effect of the ectoparasitic mite, Varroa destructor on adult worker honeybee (Apis mellifera) emergence weights, water, protein, carbohydrate, and lipid levels." Entomol Exp Appl 101(3): 207-217.

Branco, M. R., N. A. C. Kidd, et al. (2006). "A comparative evaluation of sampling methods for Varroa destructor (Acari : Varroidae) population estimation." Apidologie 37(4): 452-461.

Brighenti, D. M., C. F. Carvalho, et al. (2007). "Bioactivity of Bacillus thuringiensis var. kurstaki (Berliner, 1915) to adults of Apis mellifera Linnaeus, 1758 (Hymenoptera : Apidae)." Cienc Agrotech 31(2): 279-289.

Brodsgaard, H. F., C. J. Brodsgaard, et al. (2003). "Environmental risk assessment of transgene products using honey bee (Apis mellifera) larvae." Apidologie 34(2): 139-145.

Bromenshenk, J. J., C. Henderson, et al. (2006). Fall Dwindle Disease: A preliminary report, Bee Alert, Florida Department of Agriculture, The Pennsylvania State University, Pennsylvania Department of Agriculture, The USDA/ARS.

Brouard, I. and N. Russier (2002). Gros plan sur les intoxications dans le sud-ouest. CNDA Infos: 2-3.

Bruck, D. J., L. F. Solter, et al. (2008). "Effects of a novel microsporidium on the black vine weevil, Otiorhynchus sulcatus (F.) (Coleoptera : Curculionidae)." J Invertebr Pathol 98(3): 351-355.

Bruneau, E. (2003). "Réseau de suivi, un outil indispensable." Abeilles et Cie 93 (2): 10-15.

Bruneau, E. (2007). "Un printemps silencieux." Abeilles et Cie(123): 4.

Büchler, R., S. Berg, et al. (2005). Anfälligkeit von Honigbienen gegenüber Varroa und Viren. Das „ Bienensterben " im Winter 2002/2003 in Deutschland. Bundesamt für Verbraucherschutz und Lebensmittelsicherheit, Bundesamt für Verbraucherschutz und Lebensmittelsicherheit (Federal Office for Consumer Protection and Food Safety): 45-51.

Calatayud, F. and E. Simò. (2006, After 2006). "Una varroa cada vez mas virulenta." Retrieved July 2009, 2009.

Calderon, R. A., R. A. Ortiz, et al. (2000). "Effectiveness of formic acid on varroa mortality in capped brood cells of Africanized honey bees." J Apic Res 39(3-4): 177-179.

Calderon, R. A., J. van Veen, et al. (2003). "Presence of deformed wing virus and Kashmir bee virus in Africanized honey bee colonies in Costa Rica infested with Varroa destructor." Bee World 84(3): 112-116.

Calderon, R. A., L. G. Zamora, et al. (2007). "The reproductive rate of Varroa destructor in drone brood of Africanized honey bees." J Apic Res 46(3): 140-143.

Calderone, N. W. (2000). "Effective fall treatment of Varroa jacobsoni (Acari: varroidae) with a new formulation of formic acid in colonies of Apis mellifera (Hymenoptera: apidae) in the northeastern United States." J Econ Ent 93(4): 1065-1075.

CARI (2003). Suivi sanitaire d'urgence de ruchers présentant des symptômes de dépérissement - Rapport final, Projet FF 02/15 (414) du Fonds Budgétaire des Matières Premières - Avec la participation de la Région Wallonne (équipe PRIME) et du programme européen 1221/97 "Miel": 16.

Ceballos, L. (2008). Cultures transgéniques Bt et abeilles, Rés. OGM info: 8.

Charvet, R., M. Katouzian-Safadi, et al. (2004). "Insecticides systémiques : de nouveaux risques pour les insectes pollinisateurs." Ann Pharm Fr 62(1): 29-35.

Chauzat, M. P., P. Carpentier, et al. (2009). "Influence of pesticides residues on honey bee (Hymenoptera: Apidae) colony health in France." Popul Ecol 38(3): 514-523.

Chauzat, M. P., P. Carpentier, et al. (2009). "The influence of pesticide residues on honey bee (Hymenoptera: Apidae) colony health in France." Environ Entomol 38(3): 514-523.

Chauzat, M. P., J. P. Faucon, et al. (2007). "I pesticidi, il polline e le api." LAPIS XV(5): 13-24.

Cintra, P., O. Malaspina, et al. (2005). "Oral toxicity of chemical substances found in Dimorphandra mollis (Caesalpiniaceae) against honeyboos (Apis mellifera)." Sociobiology 45(1): 141-149.

Connor, L. (2008). "The traveling beekeeper." Am Bee J 148(9): 793-795.

Cox-Foster, D. and D. vanEngelsdorp (2009) "Solving the Mystery of the Vanishing Bees." Sci Am.

Cutler, G. C. and C. D. Scott-Dupree (2007). "Exposure to clothianidin seed-treated canola has no long-term impact on honey bees." J Econ Ent 100(3): 765-72.

Czekonska, K. (2007). "Influence of carbon dioxide on Nosema apis infection of honeybees (Apis mellifera)." J Invertebr Pathol 95(2): 84-86.

De Vericourt, M. (2007). Abeilles: pourquoi meurent-elles toujours? Sciences et vie. 1073: 78-81.

Dechaume Moncharmont, F. X., A. Decourtye, et al. (2003). "Statistical analysis of honeybee survival after chronic exposure to insecticides." Environ Toxicol Chem 22(12): 3088-94.

Desneux, N., A. Decourtye, et al. (2007). "The sublethal effects of pesticides on beneficial arthropods." Annu Rev Entomol 52: 81-106.

Duan, J. J., M. Marvier, et al. (2008). "A meta-analysis of effects of Bt crops on honey bees (Hymenoptera: Apidae)." PLoS ONE 3(1): e1415.

Dupont, G. (2009). Le déclin des abeilles ne touche pas tous les pays, selon les chiffres de la FAO. Le Monde.

Ellis, J. D. (2009). Plight of the honey bee: CCD in the U.S. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 6.

Farkas, R., T. Bakonyi, et al. (2001). "Questionnaire examination for the infection of honey bee (Apis mellifera L.) with Varroa jacobsoni Oudemans in domestic apiaries." Magy Allatorv Lapja 123(6): 348-353.

Faucon, J. P., C. Aurieres, et al. (2005). "Experimental study on the toxicity of imidacloprid given in syrup to honey bee (Apis mellifera) colonies." Pest Manag Sci 61(2): 111-25.

Felicioli, A. (2008). La biologia e la possibilità di controllo della Senotainia tricuspis in apiari. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Forster, R., E. Bode, et al. (2005). Das Bienensterben im Winter 2002/2003 in Deutschland - Zum Stand der wissenschaftlichen Erkenntnisse, Bundesamt für Verbraucherschutz und Lebenssicherheit, Braunschweig.

Frazier, M., C. Mullin, et al. (2008). "What have pesticides got to do with it?" Am Bee J 6: 521-523.

Garedew, A., I. Lamprecht, et al. (2002). "The varroacidal action of propolis: a laboratory assay." Apidologie 33(1): 41-50.

Gobin, B., K. Heylen, et al. (2008). "Sublethal effects of crop protection on honey bee pollination: foraging behaviour and flower visits." Commun Agric Appl Biol Sci 73(3): 405-8.

Greatti, M. (2008). Gli insetticidi impiegati nella concia del seme di mais: effetti sulle api e dispersione nell'ambiente. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Greatti, M., R. Barbattini, et al. (2006). "Presence of the a.i. imidacloprid on vegetation near corn fields sown with GauchoReg. dressed seeds." Bull Insectology 59(2): 99-103.

Greatti, M., A. G. Sabatini, et al. (2003). "Risk of environmental contamination by the active ingredient imidacloprid used for corn seed dressing. Preliminary results." Bull Insectology 56(1): 69-72.

Gross, M. (2008). "Pesticides linked to bee deaths." Curr Biol 18(16): R684.

Guzman, E. (2008). Decline of the Honeybees. Kitchener-Waterloo Field Naturalists Talk.

Haubruge, E., B. K. Nguyen, et al. (2006). "Le dépérissement de l'abeille domestique, Apis mellifera (Hymenoptera: Apidae): faits et causes probables." Notes fauniques de Gembloux 59(1): 3-21.

Hester, P. G., K. R. Shaffer, et al. (2001). "Efficacy of ground-applied ultra-low-volume malathion on honey bee survival and productivity in open and forest areas." J Am Mosq Control Assoc 17(1): 2-7.

Higes, M., P. Garcia-Palencia, et al. (2007). "Experimental infection of Apis mellifera honeybees with Nosema ceranae (Microsporidia)." J Invertebr Pathol 94(3): 211-217.

Higes, M., H. Martin, et al. (2006). "La sindrome dello spopolamento in Spagna." APOidea 3: 59-67.

Higes, M., R. Martín-Hernández, et al. (2008). Honey bee pathogens and presence of pesticides in honey bee colonies in Spain. Third European Conference of Apidology EurBee, Belfast.

Higes, M., R. Martín-Hernández, et al. (2006). An approach to Nosema neranae control with fumagillin in field conditions. Second European Conference of Apidology EurBee, Pragua.

Hileman, B. (2007). "Why are the bees dying?" Chem Eng News 85(25): 56-61.

Hoc, E., P. Hucorne, et al. (2007). Rapport du groupe de travail conjoint Politique Sanitaire Abeilles/Abeilles et pesticides - 2007, Program for reduction of pesticides and biocides.

Iwasa, T., N. Motoyama, et al. (2004). "Mechanism for the differential toxicity of neonicotinoid insecticides in the honey bee, Apis mellifera." Crop Prot 23(5): 371-378.

Johnson, R. (2007). Recent honey bee colony declines. WikiLeaks, Congressional Research Service: 1-10.

Kievits, J. (2007). 4.

Kopernicky, J. and R. Chlebo (2009). Slovakian honey bee colony-loss in the season 2007-2008. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 37.

Kroft, S. (2008). What's wrong with the bees? Sixty minutes. CBS.

Le Conte, Y. and M. Navajas (2008). "Climate change: impact on honey bee populations and diseases." Rev Sci Tech 27(2): 499-510.

Lewis, G. B. (2003). "Minutes of the meeting - Session 1: the effect of imidacloprid on honey bees - Discussion session." Bull Insectology 56(1): 9-11.

Liebig, G., T. Kustermann, et al. (2008). Bee monitoring during and after the 2008 maize flowering season in the rhine valley, Universität Hohenheim: 37.

Lodesani, M., C. Costa, et al. (2008). Efficacy of thymol and resveratrol on the development of Nosema ceranae in honeybees in laboratory conditions. Third European Conference of Apidology EurBee, Belfast.

Maistrello, L., M. Lodesani, et al. (2008). "Screening of natural compounds for the control of nosema disease in honeybees (Apis mellifera)." Apidologie 39(4): 436-445.

Malone, L. A. and M. H. Pham-Delegue (2001). "Effects of transgene products on honey bees and bumblebees." Apidologie 32(4): 287-304.

Marinelli, E. (2008). Sindrome dello spopolamento degli alveari in italia: approccio multidisciplinare alla individuazione delle cause e delle strategie di contenimento - influenza della gestione dell'alveare. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Martin-Hernandez, R., A. Meana, et al. (2007). "Outcome of colonization of Apis mellifera by Nosema ceranae." Appl Environ Microbiol 73(20): 6331-8.

Mayack, C. and D. Naug (2009). "Energetic stress in the honeybee Apis mellifera from Nosema ceranae infection." J Invertebr Pathol 100(3): 185-188.

Müller, A., S. Diener, et al. (2006). "Quantitative pollen requirements of solitary bees: Implications for bee conservation and the evolution of bee-flower relationships." Biol Conserv 130(4): 604-615.

Mutinelli, F. (2009). Coloss - Monitoring in Italy. Coloss Workshop 2009 - Bee Monitoring, Amsterdam (The Netherlands).

Mutinelli, F., A. G. Sabatini, et al. (2009). "Italian government issues precautionary ban on neonicotinoids." Am Bee J 149(3): 269-270.

Nazzi, F. (2008). "Varroa e CCD: considerazioni sul possibile ruolo di Varroa destructor nella sindrome del collasso della colonia." APOidea 5(2): 64-69.

Nearing, B. (2007). Rash of vacant hives spurs new crop fears - New Paltz beekeepers believes threat seen in 11 states may be here. Albany Times Union. Albany (NY).

Nguyen, B. K. and E. Haubruge Results of the survey run from 2004 to 2006 in Belgium, Gembloux Agricultural University: 3.

Nguyen, B. K. and E. Haubruge (2005). Le dépérissement des abeilles en Wallonie: une attention particulière portée à la présence de Loque Américaine et de Varroase dans les ruchers. Le Canard Déchaîné du Kauwberg. 54: 18-19.

Nguyen, B. K., J. Mignon, et al. (2009). Belgian beekeeping situation and the symptomatology as discriminatory tools. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 8.

Nguyen, B. K., J. Widart, et al. (2007). Dépérissement de nos abeilles? Les nouvelles de l'été: 2.

Oldroyd, B. P. (2007). "What's killing American honey bees?" PLoS Biol 5(6): e168.

Otten, C. (2004). Facts and figure on population loss. International Conference on bee mortality phenomenon, Basel.

Palacios, G., J. Hui, et al. (2008). "Genetic analysis of Israel acute paralysis virus: Distinct clusters are circulating in the United States." J Virol 82(13): 6209-6217.

Paxton, R. J., J. Klee, et al. (2007). "Nosema ceranae has infected Apis mellifera in Europe since at least 1998 and may be more virulent than Nosema apis." Apidologie(38): 558-565.

Pennacchio, F. (2008). Patologi virali, immunocompetenza dell'ape e sindrome da spopolamento. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Pierantonio, B. (2008). Proirità di intervento nello studio e nel controllo della sindrome dello spopolamento degli alveari. Workshop: Sindrome dello spopolamento degli alveari.

Porrini, C. (2008). Il ruolo degli agrofarmaci e degli altri fattori nella sindrome della scomparsa della api in italia. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Porrini, C. and A. G. Sabatini (2005). "Api e tossicità da agrofarmaci." APOidea 2: 79-84.

Ribiere, M., V. Olivier, et al. (2008). "Les effondrements de colonies d'abeilles: le cas du CCD ("colony collapse disorder") et du virus IAPV (Israeli acute paralysis virus)." Virologie 12(5): 319-322.

Ritter, W. (2007). Summary of general activities related to the bee disease. Annual reports of OIE Reference Laboratories and Collaborating Centres. Freiburg, Chemisches Veterinäruntersuchungsamt Freiburg: 6.

Rogers, R. E. L., P. Medrzycki, et al. (2006). "I fattori che influenzano lo stato di salute dell'alveare." APOidea 3: 3-9.

Sammataro, D., U. Gerson, et al. (2000). "Parasitic mites of honey bees: life history, implications, and impact." Annu Rev Entomol 45: 519-48.

Schmuck, R. (1999). "No causal relationship between GauchoND seed dressing in sunflowers and the French bee syndrome." Pflanzenschutz-Nachr 52/99(3): 257-299.

Schmuck, R. (2004). "Effects of a chronic dietary exposure of the honeybee Apis mellifera (Hymenoptera: Apidae) to imidacloprid." Arch Environ Contam Toxicol 47(4): 471-8.

Schmuck, R., R. Schoning, et al. (2001). "Risk posed to honeybees (Apis mellifera L, Hymenoptera) by an imidacloprid seed dressing of sunflowers." Pest Manag Sci 57(3): 225-38.

Schmuck, R., T. Stadler, et al. (2003). "Field relevance of a synergistic effect observed in the laboratory between an EBI fungicide and a chloronicotinyl insecticide in the honeybee (Apis mellifera L, Hymenoptera)." Pest Manag Sci 59(3): 279-86.

Scott, J. (2009, 18 May 2009). "Pesticides indicted in bee deaths." Retrieved 5 August 2009, 2009, from http://www.salon.com/env/feature/2009/05/18/bees_pesticides/.

Semeniuk, I. (2007). "Buzzed off." New Sci 196(2635-2636): 22-22.

Shultz, D. (2007). Silence of the Bees, P.B.S.

Siede, R. and R. Buchler (2004). "First detection of Kashmir bee virus in Hesse." Berl Munch Tierarztl Wochenschr 117(1-2): 12-15.

Spivak, M. and G. S. Reuter (2001). "Varroa destructor infestation in untreated honey bee (Hymenoptera: Apidae) colonies selected for hygienic behavior." J Econ Ent 94(2): 326-331.

Stefanidou, M., S. Athanaselis, et al. (2003). "The toxicology of honey bee poisoning." Vet Hum Toxicol 45(5): 261-5.

Stokstad, E. (2007). "Genomics. Puzzling decline of U.S. bees linked to virus from Australia." Science 317(5843): 1304-5.

Streit, S., J. Tautz, et al. (2000). Modelling the dynamic of spread and virulence of Varroa destructor in a honey bee population using SeSAm (Shell for Simulated Agent Systems). Euroconference on MOMEDTO Molecular Mechanisms of Disease Tolerance in Honeybees. Prague, Czech Republic, Bee Research Institute: 175-181.

Sumpter, D. J. T. and S. J. Martin (2004). "The dynamics of virus epidemics in Varroa-infested honey bee colonies." J Anim Ecol 73(1): 51-63.

Thompson, H., R. Ball, et al. (2003). "Varroa destructor resistance to pyrethroid treatments in the United Kingdom." Bull Insectology 56(1): 175-181.

Thompson, H. M., M. A. Brown, et al. (2002). "First report of Varroa destructor resistance to pyrethroids in the UK." Apidologie 33(4): 357-366.

Thompson, H. M. and C. Maus (2007). "The relevance of sublethal effects in honey bee testing for pesticide risk assessment." Pest Manag Sci 63(11): 1058-61.

Thompson, H. M., S. Wilkins, et al. (2007). "Modelling long-term effects of IGRs on honey bee colonies." Pest Manag Sci 63(11): 1081-4.

Todd, J. H., J. R. de Miranda, et al. (2007). "Incidence and molecular characterization of viruses found in dying New Zealand honey bee (Apis mellifera) colonies infested with Varroa destructor." Apidologie 38(4): 354-367.

Topolska, G., A. Gajda, et al. (2008). "Polish Honey Bee Colony-Loss During the Winter of 2007/2008." J Apic Sci 52(2): 95-104.

Unknown (2007). Bee-ing there. The community farm. 38.

Vejsnaes, F. and P. Kryger (2009). Colony loss in Denmark. IV Prevention of Honey Bee Colony Losses Conferences. Zagreb (Croatia): 13-14.

Wehling, W., W. Von der Ohe, et al. (2006). Intoxications of honeybees - Interactions of plant protection products and other factors. Second European Conference of Apidology EurBee, Pragues.

Williams, N. (2008). "Bee fears heighten." Curr Biol 18(16): R682-R683.

Yue, C., M. Schroder, et al. (2007). "Vertical-transmission routes for deformed wing virus of honeybees (Apis mellifera)." J Gen Virol 88: 2329-2336.

Zhong, H., M. Latham, et al. (2003). "Impact of naled on honey bee Apis mellifera L. survival and productivity: aerial ULV application using a flat-fan nozzle system." Arch Environ Contam Toxicol 45(2): 216-20.

Priority 3 reference (10)

Behrens, D., E. Forsgren, et al. (2007). "Infection of drone larvae (Apis mellifera) with American foulbrood." Apidologie 38(3): 281-288.

Bruneau, E. (2005). "Dépérissement des ruchers en Région wallonne: état des lieux." Abeilles et Cie(104): 8-11.

Canteneur, R. (2000). "Mortalités hivernales: Les mortalités hivernales et printanières." La Santé de l'Abeille(No 175): 27-40.

Charrière, J. D. (2003). "La culture de tournesol est-elle problématique pour les abeilles?" Rev Suisse Apic 124(10): 20-21.

Charrière, J. D., A. Imdorf, et al. (2004). "Umfang und Ursachen des grossen Bienensterbens im Winter 2002/03." Schweiz Bienenztg 127(8): 19-22.

Chauzat, M. P. (2005). Multifactorial prospectiv survey on bee troubles in France, Dublin, Ireland apimondia, apimondia2005.com.

Chen, Y. P., J. S. Pettis, et al. (2004). "Transmission of Kashmir bee virus by the ectoparasitic mite Varroa destructor." Apidologie 35(4): 441-448.

Genersch, E., C. Yue, et al. (2006). "Detection of Deformed wing virus, a honey bee viral pathogen, in bumble bees (Bombus terrestris and Bombus pascuorum) with wing deformities." J Invertebr Pathol 91(1): 61-63.

Gisder, S., P. Aumeier, et al. (2009). "Deformed wing virus: replication and viral load in mites (Varroa destructor)." J Gen Virol 90: 463-467.

Nordstrom, S. (2003). "Distribution of deformed wing virus within honey bee (Apis mellifera) brood cells infested with the ectoparasitic mite Varroa destructor." Exp Appl Acarol 29(3-4): 293-302.

Priority 0 references (307)

Aavy (2000). "Gaucho 1998." LAPIS VIII(8): 13-17.

Aavy (2003). "Domani avremo ancora le api?" LAPIS XI(4): 15.

Abramson, C. I., I. S. Aquino, et al. (1999). "The effect of insecticides on learning in the Africanized honey bee (Apis mellifera L.)." Arch Environ Contam Toxicol 37(4): 529-535.

Accorti, M. (1994). "Le api e il monitoraggio ambientale valutazioni a lungo termine sulle gabbie per la raccolta delle api morte." Apicoltura 9: 19-29.

Accorti, M., R. Guarcini, et al. (1989). The bees as a biological indicator and test insect. European Ecology Symposium. Siena, Italy. X (3-4): 130.

Accorti, M. and F. Luti (1994). "Problemi nel controllo della varroasi: reinfestazione, resistenza ed efficacia degli acaricidi." Apicoltura 9: 147-161.

Accorti, M., F. Luti, et al. (1991). "Methods for collecting data on natural mortality in bee." Ethol Ecol Evol 1: 123-126.

Agricultural Research Council (2009). APENET - Analysis of bee health risk factors. Coloss Workshop 2009 - Bee Monitoring, Amsterdam (The Netherlands).

Alix, A., M. Delos, et al. (2008). Risks to bees from dusts emitted at sowing of coated seeds: concerns, risk assessment and risk management. ICPBR meeting, hazards of pesticides to bees. Bucarest (Romania).

Alix, A., S. Duchard, et al. (2008). Risk to bees from soil/seed treatments. ICPBR meeting, hazards of pesticides to bees. Bucarest (Romania).

Allsopp, M. (1996). "What is killing honeybee colonies?" Landbounuus: 8-8.

Ambolet, B., J. F. Crevat, et al. (1997). Recherche d'eventuels effets secondaires d'un traitement de semences a base d'imidaclopride sur le comportement des abeilles domestiques sur les fleurs de tournesol, Paris, France; Association Nationale pour la Protection des Plantes (ANPP), ANPP-4 eme Conference internationale sur les ravageurs en agriculture.

Anderson, A. J. and M. H. Allsopp (1999). "A preliminary evaluation of the organic control of Varroa jacobsoni in Cape honeybees." S Afr Bee J 71(1): 12-20.

Anderson, C. and F. L. W. Ratnieks (1999). "Task partitioning in insect societies. I. Effect of colony size on queueing delay and colony ergonomic efficiency." Am Nat 154(5): 521-535.

Andersson, H. C., S. Arpaia, et al. (2008). "Request from the European Commission related to the safeguard clause invoked by Greece on maize MON810 according to article 23 of Directive 2001/18/EC. Scientific Opinion of the Panel on Genetically Modified Organisms (Question No EFSA-Q-2008-313)." EFSA J 757: 1-12.

Anen, N. (2008). Les abeilles battent de l'aile. LaVoix: 3.

Anonymous (2004). "Francia prohibe el polemico "Gaucho"." (75): 82.

Anonymous (2005). "Los apicultores piden ayuda a las administraciones ante una sitiacion "asfixiante y dramatica"." El Colmenar(78): 74.

Anonymous (2007). Bienensterben in den USA, Bayerische Landesanstalt für Weinbau und Gartenbau: 22 slides.

Anonymous. (2007, Unknown). "España resuelve el enigma del sindrome de despoblamiento." Retrieved 5 August 2009, 2009, from http://www.aprodalp.com.ar/articulos.htm.

Anonymous (2007). "Piden che el Nosema ceranae sea considerada como "enfermedad exotica"." El Colmenar(85): 81.

Anonymous (2008). 45.

Anonymous (2008). Cruiser, la ecatombe continua: Vientos de panico en el Noreste de Italia. El Zangano: 3-4.

Anonymous (2008). "Drei jahre monitoring: erste beurteilung." Deutsches Bienen J 4.

Anonymous (2008). "Erhöhte Winterverluste zeichnen sich ab." Deutsches Bienen J 4.

Anonymous (2008). "Forschungsprojekte gegen Völkerverluste." Deutsches Bienen J 04.

Anonymous (2008). Honey bee poisoning incidents and maize production-background and facts. ICPBR meeting, hazards of pesticides to bees. Bucarest (Romania).

Anonymous (2008). Monitoring-Projekt, Völkerverluste - Untersuchungsjahre 2004 - 2008. Zusammenfassung und vorläufige Beurteilung der Ergebnisse: 16.

Anonymous (2008). "Wie steht es um die Bienenverluste in anderen Ländern." ADIZ/db/IF 4.

Anonymous (2009). "Bislang keine ernteverluste durch Bestäuberrückgang." Deutsches Bienen J 1.

Anonymous (2009). L'étrange disparition des abeilles. Pourquoi magazine.

Arapia, S. (1996). "Ecological impact of Bt-transgenic plants: 1. Assessing possible effects of CryIIIB toxin on honey bee colonies." J Genet Breed 50(4): 315-319.

Arnold, G. (1976). "Mechanisms in the group effect of honeybees." C R Seances Acad Sci III 283(12): 1433-1435.

Augustijn, C. H. (1997). Flight activity and mortality of honey bee colonies during winter, Plantage Middenlaan 64/1018 DH Amsterdam/Netherlands, Nederlandse Entomologische Verniging (N E V).

Babendreier, D., J. Romeis, et al. (2006). Nouvelles connaissances au sujet des effets du maïs Bt transgénique sur les abeilles, Centre suisse de recherches apicoles - Agroscope Liebefeld-Posieux.

Bailey, L. (1958). "The epidemiology of the infestation of the honeybee, Apis mellifera L., by the mite Acarapis woodi Rennie and the mortality of infested bees." Parasitology 48(3&4): 493-506.

Bailey, L. (1961). "The natural incidence of Acarapis woodi (Rennie) and the winter mortality of honeybee colonies." Bee World 42(4): 96-100.

Bailey, L. and D. C. Lee (1959). "The effect of infestation with Acarapis woodi (Rennie) on the mortality of honey bees." J Insect Pathol 1(1): 15-24.

Bamrick, J. F. and W. C. Rothenbühler (1961). "Resistance to American foulbrood in honey bees. IV. The relationship between larval age at inoculation and mortality in a resistant and susceptible line." J Insect Physiol 3(4): 381-390.

Barbattini, R. and M. Greatti (1995). "La mortalità delle api e il monitoraggio dell' inquinamento agricolo." Inf Fitopatol 45(6): 13-17.

Barbattini, R., M. Greatti, et al. (1994). Efficacia di diversi modelli di gabbie per la raccolta di api morte: Verifica mediante l'utilizzo di api marcate allo sfarfallamento, Atti Congr.naz.it.Entomol., Udine.

Barbattini, R., N. Milani, et al. (1989). "Prove di campo con diversi acaricidi nell'Italia nord-orientale: efficacia verso Varroa jacobsoni Oud. e tollerabilita da parte delle api." Apic Mod 80(1): 3-11.

Barbero, R. (2007). "A proposito di avvelenamenti." LAPIS XV(9): 5-10.

Barbero, R. (2009). "La strega disse a Biancaneve: assaggia una goccia d'acqua." LAPIS XVII(2): 14-15.

Barnett, E. A., A. J. Charlton, et al. (2007). "Incidents of bee poisoning with pesticides in the United Kingdom, 1994-2003." Pest Manag Sci 63(11): 1051-7.

Baxter, J. R., J. Ibarra, et al. (1999). "Amitraz or coumaphos efficacy tests in Guatemala for control of Varroa jacobsoni Mesostigmata : Varroidae in honey bees?" Southwest Entomol 24(4): 309-313.

Beattie-Moss, M. (2009, 29 January 2009). "What's causing the massive bee die-offs that are threatening American agriculture? Penn State researchers are working tirelessly to find answers." Retrieved 5 August 2009, 2009, from http://www.rps.psu.edu/indepth/bees1.html.

Beckendorf, S. (2003). "Kongree zum Bienensterben in Basel - Situation ist nicht ganz so schlimm wie befürchtet." Deutsches Bienen J 7: 1-2.

Beetsma, J., R. de Vries, et al. (1988). Effects of Varroa jacobsoni Oud. on colony development, workerbee weight and longevity and brood mortality. Commission of the European Communities, Udine, Italy.

Békési, L., B. V. Ball, et al. (1999). "Acute paralysis virus of the honey bee (Apis mellifera) in a Hungarian apiary infested with Varroa jacobsoni mite." Magy Allatorv Lapja 121(10): 601-603.

Békési, L., B. V. Ball, et al. (1999). "Occurrence of acute paralysis virus of the honey bee (Apis mellifera) in a Hungarian apiary infested with the parasitic mite Varroa jacobsoni." Acta Vet Hung 47(3): 319-324.

Ben Hamida, T. (2008). Maladies emergentes de l'abeille. First Mediterranean apiculture and research encounters. Montpellier (France): 42 slides.

Bendahou, N., C. Fleche, et al. (1999). "Biological and biochemical effects of chronic exposure to very low levels of dietary cypermethrin (Cymbush) on honeybee colonies (Hymenoptera : Apidae)." Ecotoxicol Environ Saf 44(2): 147-153.

Bernal Yague, J. L., M. J. Del Nozal Nalda, et al. (2008). Agrotoxicos en productos apicolas y su relacion con el despoblamiento de las colmenas. II Jornada de Transferencia Tecnológica Sobre Investigación en Apicultura. Madrid (Spain).

Bernal Yague, J. L., M. J. Del Nozal Nalda, et al. (2009). Agrotoxicos en productos apicolas y su relacion con el despoblamiento de las colmenas. III Jornada de Transferencia Tecnológica Sobre Investigación en Apicultura. Madrid (Spain).

Bernard, C. (2000). Le Gaucho, reconnu tueur officiel des abeilles, 450 000 ruchers ont disparu depuis 1996. Libération.

Bessi, E. (2007). "La malattia da spopolamento degli alveari." Apimondia Italia 2(6): 10-13.

Bienefeld, K. (1996). "Berücksichtigung des Anteils beschädigter Varroamilben bei der Selektion varroatoleranter Honigbienen." (8-9): 209-215.

Bienefeld, K., F. Zautke, et al. (1999). "Recording the proportion of damaged Varroa jacobsoni Oud. in the debris of honey bee colonies (Apis mellifera)." Apidologie 30(4): 249-256.

Biesmeijer, J. C., M. Born, et al. (1999). "The response of the stingless bee Melipona beecheii to experimental pollen stress, worker loss and different levels of information input." J Apic Res 38(1-2): 33-41.

Binder-Köllhofer, B. (2006). "Winterverluste bis Dezember 2005 (Bewertung der Institute)." ADIZ/db/IF 142(2): 8.

Bindokas, V. P., J. R. Gauger, et al. (1988). "Mechanism of biological effects observed in honey bees (Apis mellifera, L.) hived under extra-high-voltage transmission lines: implications derived from bee exposure to simulated intense electric fields and shocks." Bioelectromagnetics 9(3): 285-301.

Boecking, O. (2003). "Bienen an Rapsflächen - Untersuchungen zu mit Imidacloprid gebeiztem Saatgut." ADIZ/db/IF 37(8): 9-11.

Bolchi Serrini, G., G. Palmieri, et al. (1985). "Mortalita di api in rapporto all'uso di antiparassitari in vigneti e meleti." Apicoltura 1: 75-91.

Bombonato, S. (2000). Api sotto sorveglianza speciale. Lombardia verde. 5: 3.

Bonfanti, E. and E. Lucchelli (1998). "Nuove sperimentazioni sull'ossalico." Apis 6(2): 12-15.

Boot, W. J., M. van Baalen, et al. (1995). "Why do Varroa mites invade worker brood cells of the honey bee despite lower reproductive success?" Behav Ecol Sociobiol 36(4): 283-289.

Bounias, M., N. M. Navone, et al. (1995). "Toxicology of cupric in honeybees: I. Hormesis effects of organic derivatives on lethality parameters." Ecotoxicol Environ Saf 31(2): 127-132.

Bowen-Walker, P. L. and A. Gunn (1998). "Inter-host transfer and survival of Varroa jacobsoni under simulated and natural winter conditions." J Apic Res 37(3): 199-204.

Bowen-Walker, P. L., S. J. Martin, et al. (1997). "Preferential distribution of the parasitic mite, Varroa jacobsoni (Oud.) on overwintering honeybee (Apis mellifera L) workers and changes in the level of parasitism." Parasitology 114(2): 151-157.

Boyko, A. K. (1939). "Larva of Senotainia triguspis Meig. causing heavy losses of bees." C R Acad Sci 24(3): 304-306.

Branco, M. R., N. A. C. Kidd, et al. (1999). "Development of Varroa jacobsoni in colonies of Apis mellifera iberica in a Mediterranean climate." Apidologie 30(6): 491-503.

Brasse, D. (2003). "Poisoning incidents involving honeybees in Germany (1999-2002) and new problems for beekeeping." Bull Insectology 56: 199.

Brodsgaard, C. J. and H. F. Brodsgaard (1998). "Monitoring method as a basis for need-based control of varroa mites (Varroa jacobsoni) infesting honey bee (Apis mellifera) colonies 15483." Altern Lab Anim 26(4): 413-419.

Brodsgaard, C. J., W. Ritter, et al. (1998). "Response of in vitro reared honey bee larvae to various doses of Paenibacillus larvae larvae spores." Apidologie 29(6): 569-578.

Bruderer, C. and Y. Hermieu (2008). Les abeilles vont-elles disparaître? L'Oiseau magazine: 24-27.

Bruneau, E. (2004). "Moria e sparizione delle api: spiegare l'inspiegabile!" LAPIS XII(6): 6-11.

Bruneau, E. (2009). E. B. Coordination.

Bruneau, E. (2009). "2008 sous la loupe." Abeilles et Cie 128: 4.

Büchler, R. (1994). "Investigations into a method of standardized colony infestation for the test of Varroa population development." Apidologie 25(5): 461-462.

Büchler, R. (1996). "Empfehlungen zur Varroatoleranzprüfung. Ergäzung zu den Empfehlungen zur Leistungsprüfung." Imkerfreund(6): 12-14.

Büchler, R. (2008). "Varroabefall... ermitteln und Schadschwellen beachten." ADIZ/db/IF 7: 10-11.

Büchler, R. and V. Maul (1991). "The after-effect of bayvarol treatment in honey bee colonies on varroa mites introduced later on." Apidologie 22(4): 389-396.

Bühlmann, G. (1985). "Assessing population dynamics in a honeybee colony." Mitt Dtsch Ges Allg Angew Entomol(4): 312-316.

Bühlmann, G. (1987). "Nouvelles notions sur le développement des colonies." L'abeille de France(715): 218-220.

Burdick, E. and D. M. Caron (2007). MAAREC beekeeper survey, Mi-Atlantic Apiculture Research and Extension Consortium: 11.

Burgett, D. M. and P. A. Rossignol (1990). "A model of dispersion and regulation of brood mite (Tropilaelaps clareae) parasitism on the giant honeybee (Apis dorsata)." Can J Zool 68(7): 1423-1427.

Butt, T. M., N. L. Carreck, et al. (1998). "Honey-bee-mediated infection of pollen beetle (Meligethes aeneus Fab.) by the insect-pathogenic fungus, Metarhizium anisopliae." Biocontr Sci Techn 8(4): 533-538.

Byrne, D. N. and G. D. Waller (1990). "Comparison of honey bee (Hymenoptera: Apidae) mortality as a result of diurnal and nocturnal applications of dimethoate." J Econ Ent 83 (4): 1267-1270.

Cabras, P., I. Floris, et al. (1997). "Fluvalinate content of Apistan(R) strips during treatment and efficacy in colonies containing sealed worker brood." Apidologie 28(2): 91-96.

Caffarelli, V. (2008). La valutazione del rischio dei prodotti fitosanitari per le api nell'ambito della Direttiva 91/414/CE, ENEA - Dip. BAS (Biotecnologie, Agroindustria e protezione della Salute) - Sez. Sicurezza Alimentare Sanitaria e Ambientale - Centro Ricerche della Casaccia: 10-11.

Calatayud, F. (2006). "Reflexiones sobre el despoblamiento de las colmenas." El Colmenar(81): 12-18.

Calatayud, F. and M. J. Verdu (1993). "Hive debris counts in honeybee colonies: A method to estimate the size of small populations and rate of growth of the mite Varroa jacobsoni Oud. (Mesostigmata: Varroidae)." Exp Appl Acarol 17(12): 889-894.

Calatayud, F. and M. J. Verdu (1994). "Survival of the mite Varroa jacobsoni Oud. (Mesostigmata: Varroidae) in broodless colonies of the honey bee Apis mellifera L. (Hymenoptera: Apidae)." Exp Appl Acarol 18(10): 603-612.

Calderone, N. W. and M. E. Nasr (1999). "Evaluation of a formic acid formulation for the fall control of Varroa jacobsoni (Acari : Varroidae) in colonies of the honey bee Apis mellifera (Hymenoptera : Apidae) in a temperate climate." J Econ Ent 92(3): 526-533.

Calderone, N. W., W. T. Wilson, et al. (1997). "Plant extracts used for control of the parasitic mites Varroa jacobsoni (Acari: Varroidae) and Acarapis woodi (Acari: Tarsonemidae) in colonies of Apis mellifera (Hymenoptera: Apidae)." J Econ Ent 90(5): 1080-1086.

Calis, J. N. M., W. J. Boot, et al. (1994). Evaluation of varroa control methods based on trapping mites in honey bee brood. New perspectives on Varroa. A. Matheson. Cardiff, UK, International Bee Research Association: 106-188.

Calvarese, S. and V. Langella (2007). "La sindrome degli acari: una stretta alleanza tra varroa e infezioni secondarie." LAPIS XV(6): 5-10.

Campero, M. (2008). "Ma tu, che ne pensi? Sempre a proposito della moria delle api." Apimondia Italia 3(3): 8-9.

Cantwell, G. E., D. A. Knox, et al. (1966). "Mortality of the honey bee, Apis mellifera, in colonies treated with certain biological insecticides." J Invertebr Pathol 8(2): 228-233.

Cantwell, G. E., D. A. Knox, et al. (1964). "Mortality of honey bees, Apis mellifera Linnaeus, fed exotoxin of Bacillus thuringiensis var. thuringiensis Berliner." J Insect Pathol 6(4): 532-536.

Charrière, J. D. and A. Imdorf (2003). Pertes de colonies en Suisse 2002 / 2003. C. S. d. R. Apicoles. 57.

Charrière, J. D., A. Imdorf, et al. (2006). "Cultures de tournesol et développement des colonies d'abeilles mellifères." Rev Suisse Apic 38(5): 269-274.

Chauvin, R., J. P. Lafarge, et al. (1985). "L'intervention d'une hormone, la survivone, dans la mortalité des abeilles (Apis mellifica L.) isolées (effet de groupe)." Apidologie 16(1): 77-87.

Cirone, R. (2007). "Brivido globale: la morte delle api sta scuotendo l'opinione pubblica." Apimondia Italia 2(3): 4.

Cirone, R. (2007). "Su collasso e morte degli alveari, valga per tutti la lezione australiana." Apimondia Italia 2(5): 4.

Cirone, R. (2008). "La sindrome da collasso degli alveari. Un report dal congresso internazionale Apimondia." Apimondia Italia 3(3): 10-13.

Cirone, R. and M. Ilari (2001). "Girasole come la mela di Biancaneve? In Francia è allarme, in Italia non ancora." Apitalia(4): 16-22.

Conterio, M. Scomparse di api: perdita di biodiversita e danni economici. Regioni e ambiente: 55-57.

Cougard, M. J. (1999). La disparition mystérieuse des abeilles. Le Figaro.

Cox, C. (2002). "Imidacloprid e ambiente." LAPIS X(5): 12-22.

D'Agaro, M. and R. Sebastianutto (1998). "'Gabbia underbasket': modifica per il rilevamento della mortalità delle api." Ape Nostra Amica 20(2): 6-8.

D'Agostino, S. (2008). Prot. n. 2. 1. 08: 4.

D'Agostino, S. (2008). Uniti per l'apicoltura. Workshop: Sindrome dello spopolamento degli alveari, Roma.

De Guzman, L. I., T. E. Rinderer, et al. (2005). "Russian honey bee (Hymenoptera: Apidae) colonies: Acarapis woodi (Acari: Tarsonemidae) infestations and overwintering survival." J Econ Ent 98(6): 1796-801.

Decourtye, A., J. Devillers, et al. (2005). "Comparative sublethal toxicity of nine pesticides on olfactory learning performances of the honeybee Apis mellifera." Arch Environ Contam Toxicol 48(2): 242-50.

Delaguila, C., F. Izquierdo, et al. (2006). First steps towards the in vitro cultivation of Nosema ceranae. Second European Conference of Apidology EurBee, Prague.

Deprost, M. (2008). Abeilles: les pertes hivernales 2007-2008 ont été supérieures à 30% en Rhône-Alpes: 1.

Devillers, J., A. Decourtye, et al. (2003). "Comparative toxicity and hazards of pesticides to Apis and non-Apis bees. A chemometrical study." Environ Res(14): 389-403.

Dronet, G. (2007). Compte-rendu de la journée Nosémose. Journée Nosémose, Laxou.

Eischen, F. A. (1987). "Overwintering performance of honey bee colonies heavily infested with Acarapis woodi (Rennie)." Apidologie 81(4): 293-304.

Erickson, E. H., B. J. Erickson, et al. (1997). "Effects of selected insecticide formulations, phased application and colony management strategies on honey bee mortality in processing sweetcorn." J Apic Res 36(1): 3-13.

Everts, S. (2008) "Honeybee loss." Chem Eng News, 10.

Farrar, C. L. (1936). "Influence of pollen reserves on the surviving populations of over-wintering colonies." Am Bee J 76: 452-454.

Faucon, J. P. and M. Ribière (2003). "Les causes d'affaiblissement des colonies d'abeilles." Bull Group Tech Vet 20: 15-18.

Fleche, C. and J. P. Faucon (1995). "Le réseau d'épidémiosurveillance apicole national (RESAN * 1991-1993)." Epidemiol Sante Anim(27): 69-79.

Fluri, P. and R. Frick (2001). Pertes d'abeilles liées à l'utilisation de faucheuses rotatives, Centre suisse de recherche apicole: 11.

Food, B. m. o. A. a. (2008). Registered findings of mass murrain of bees and bee family in Republic of Bulgaria resulting from plant protection products treatment, Ministry of Agriculture and food (Bulgaria) - National Service For Plant Protection: 2.

Forster, R. (2008). Bee poisoning caused by insecticidal seed treatment in Germany in 2008. ICPBR meeting, hazards of pesticides to bees. Bucarest (Romania).

Frazier, M., J. Finley, et al. (1994). "The incidence and impact of honey bee tracheal mites and Nosema apis on colony mortality in Pennsylvania." Bee Sci 3: 94-100.

Friedmann, G. (2003). "Wie viele Bienen hast du noch?" ADIZ/db/IF.

Fries, I., R. Martin, et al. (2006). "Natural infections of Nosema ceranae in European honey bees." J Apic Res 45(4): 230-232.

Gardi, T. and M. C. Lorenzetti (2007). "Interventi fitosanitari e possibili danni all'apicoltura." Apimondia Italia(7): 10-13.

Garrido Bailón, E., R. Martin-Hernandez, et al. (2008). Development of a duplex PCR to detect Melisoccoccus plutonius and Ascosphaera apis in bee brood. Third European Conference of Apidology EurBee, Belfast.

Garrido, C. (2007). "Klein, aber gemein - die Bedeutung von Virusinfektionen für die Überwinterungsfähigkeit von Bienenvölkern." ADIZ/db/IF 143(9): 10.

Gerritsen, L., T. Blacquière, et al. (2007). Op tijd bestrijden van varroa redt de winterbijen 6.

Ginevan, M. E., D. D. Lane, et al. (1980). "Ambient air concentration of sulfur dioxide affects flight activity in bees." Proc Natl Acad Sci U S A 77(10): 5631-5633.

Girolami, V. (2008). Guttazione: perle letali della primavera. Forum fitoiatrici - Giornate di studio: 3.

Gotti, M. and R. Barbero (2008). "Gli avvelenamenti delle api: “subire passivamente o agire per salvare i nostri alveari?”." LAPIS XVI(3): 7-9.

Gozalo, J. M. (2005). "Epoca critica para los apicultores del a region (Castilla-Leon)." El Colmenar(77): 76.

Gozalo, J. M. (2007). "El riesgo de una apicultura moderna." (86): 82.

Gozalo, J. M. (2007). "Plan para luchar contra la varroa." El Colmenar(87): 72.

Gozalo, J. M. (2009). "El parasito che amenaza las abejas." El Colmenar(94): 72.

Greatti, M., R. Barbattini, et al. (2008). "Dispersione nell’ambiente del conciante Gaucho 350FS (s.a. imidacloprid) durante la semina del mais." Apimondia Italia 3: 21-25.

Greig-Smith, P. W., H. M. Thompson, et al. (1994). "Incidents of poisoning of honeybees (Apis mellifera) by agricultural pesticides in Great Britain 1981-1991." Crop Prot 13(8): 567-581.

Haefeker, W. (2007, 08/12/2000). "Betrayed and sold out - German bee monitoring." Retrieved 04/05/2007, 2007, from http://www.beekeeping.com/articles/us/german_bee_monitoring.htm.

Haefeker, W. (2008). Co-existence of GM-crops with beekeeping - Impact of GM-crops on the supply chain for honey and other bee products. Implications of GM-Crops Cultivation at Large Spatial Scales, Bremen, Peter Lang Frankfurt.

Hall, J. (2009). Frightening buzz of honeybee demise unfounded. Toronto Star.

Harst, W., J. Kuhn, et al. (2006). "Can electromagnetic exposure cause a change in behaviour? Studying possible non-thermal influences on honey bees - An approach within the framework of educational informatics." Acta systemica - IIAS International Journal 6(1): 1-6.

Heimann, C. (2003). "Bienensterben - bisher nur unbefriedigte Antworten." DNB 8: 238-239.

Heitfuss, R. and S. Heitfuss (2003). "Saatgutbeizmittel im Raps - schaden sie den Bienen?" Deutsches Bienen J 5: 18-19.

Henderson, C., J. Bromenshenk, et al. (2007). National Honey Bee Loss Survey, Bee Alert Technology, Inc.: 17.

Higes, M., P. García Palencia, et al. (2008). Pathology due to natural infection of Apis mellifera honeybees with Nosema ceranae (Microsporidia). Third European Conference of Apidology EurBee, Belfast.

Higes, M., R. Martin, et al. (2007). "Nosema ceranae en Espana y su relacion con el despoblamiento de las colmenas." El Colmenar(85): 44-51.

Higes, M., R. Martin, et al. (2006). "Nosema ceranae, a new microsporidian parasite in honeybees in Europe." J Invertebr Pathol 92(2): 93-95.

Higes, M., R. Martin, et al. (2005). Le syndrome de dépeuplement de ruches en Espagne. La Santé de l'abeille. 211: 26-37.

Higes, M., R. Martin, et al. (2005). "El síndrome de despoblamiento de las colmenas en España. Consideraciones sobre su origen." Vida Apícola 133: 15-21.

Higes, M., R. Martin-Hernandez, et al. (2008). "Regurgitated pellets of Merops apiaster as fomites of infective Nosema ceranae (Microsporidia) spores." Environ Microbiol 10(5): 1374-9.

Higes, M., R. Martín-Hernández, et al. (2007). "Analisis retrospectivo de la infeccion microesporidiana respaldada por la colonizacion de la Apis mellifera por el Nosema ceranae en Espana." El Colmenar(88): 47.

Higes, M., R. Martín-Hernández, et al. (2007). "Colapso de la colonia a causa de Nosema ceranae." El Colmenar(88): 50.

Higes, M., R. Martin-Hernandez, et al. (2008). "Detection of infective Nosema ceranae (Microsporidia) spores in corbicular pollen of forager honeybees." J Invertebr Pathol 97(1): 76-8.

Hopquin, B. (2002). Les apiculteurs accusent un insecticide de tuer les abeilles. Le Monde.

Huang, Z. Y., A. V. Hanley, et al. (2004). "Field and semifield evaluation of impacts of transgenic canola pollen on survival and development of worker honey bees." J Econ Ent 97(5): 1517-23.

Hung, A. C. F., J. R. Adams, et al. (1995). "Bee parasitic mite syndrome (II): the role of Varroa mite and viruses." Am Bee J 136: 874-876.

Imdorf, A., J. D. Charrière, et al. (2007). Quelles sont les causes possibles des pertes de colonies de ces dernières années?, Centre suisse de recherche apicole - Station de recherche Agroscope Liebefeld-Posieux: 7.

Imdorf, A., M. Rickli, et al. (1996). Dynamique des populations d'abeilles, Centre Suisse de Recherches Apicoles: 49.

Jeffree, E. P. (1955). "Observations on the decline and growth of honey bee colonies." J Econ Ent 48: 723-726.

Jorgensen, A. S. "Le perdite delle colonie di api." Apimondia Italia 2(4): 4.

Jorgensen, A. S. (2008). "Response by Asger Jorgensen, Danish Beekeepers Federation and President of Apimondia." Retrieved 5 August 2009, 2009, from http://www.beesfordevelopment.org/info/info/enviro/half-of-honey-bees-in-den.shtml.

Karise, R., E. Viik, et al. (2007). "Impact of alpha-cypermethrin on honey bees foraging on spring oilseed rape (Brassica napus) flowers in field conditions." Pest Manag Sci 63(11): 1085-9.

Kasperek, K., G. Borsuk, et al. (2009). Analiza przyczyna giniecia rodzin pszczelich w Polsce? XLVI Naukowa Konferencja Pszcelarska, Pulawy.

Kauffeld, N. M., J. H. Everitt, et al. (1976). "Honey bee problems in the Rio Grande Valley of Texas." Am Bee J 116(5): 220-232.

Keil, S., J. Romeis, et al. (2006). Les abeilles sont-elles menacées par l'utilisation de plantes transgéniques résistantes aux insectes? Berne, Centre suisse de recherches apicoles - Station de recherche Agroscope Liebefeld-Posieux ALP: 9.

Kevan, P. G. (1999). "Pollinators as bioindicators of the state of the environment: species, activity and diversity." Agric Ecosyst Environ 74(1-3): 373-393.

Kievits, J. and E. Bruneau (2007). "Neurotossici sistemici, un rischio per le api?" LAPIS XV(7): 11-18.

Koch, H. and P. Weiber (1997). "Exposure of honey bees during pesticide application under field conditions." Apidologie 28 439-447.

Kopernicky, J. (2008). Stanovisko SCPV, Ústavu včelárstva v Liptovskom Hrádku k oslabeniu a stratám včelstiev od leta 2007 do jari 2008. Bratislava, Slovak Beekeepers Association: 3.

Koprivnikar, M. and J. Drofenik (2008). Report on bee pesticide poisoning incidents, Ministry of Agriculture, Forestry and Food (Republic of Slovenia) - Phytosanitary Administration: 7.

Korpela, S., A. Aarhus, et al. (1992). "Varroa jacobsoni Oud. in cold climates: population growth, winter mortality and influence on the survival of honey bee colonies." J Apic Res 31(3/4): 157-164.

Kristiansen, P. (2003). "Vinterförlusterna 2002/2003." Gadden: 5.

Kristiansen, P. (2003). "Vinterförlusterna 2002/2003." Bitidningen.

Kristiansen, P. (2005). "Om socker och bidöd." Gadden: 30.

Kristiansen, P. (2009). Kartläggning av vinterförluster. Bitidningen: 24-25.

Kristiansen, P. (2009). "Statistik over verksamheten i Sveriges Biodlares Riksförbund (year)." Bitidningen.

Kucharcsyk, P. (2009). Czlowiek pszczole wilkiem. Gosc Niedzielny. 15.

Kulincevic, J. M. and W. C. Rothenbuhler (1982). "Disappearing disease part I - Effects of certain protein sources given to honey bee colonie in Florida." Am Bee J: 189-191.

Kulincevic, J. M. and W. C. Rothenbuhler (1983). "Disappearing disease II - Effects of certain protein sources on brood rearing and lenght of life in the honey bee under laboratory conditions." Am Bee J: 50-53.

Kulincevic, J. M., W. C. Rothenbuhler, et al. (1984). "Disapearing disease III. A comparison of seven different stocks of the honey baa (Apis mellifera)." Ohio State University Research Bulletin 1160: 1-21.

Kulincevic, J. M., G. R. Stairs, et al. (1969). "A disease of the honey bee causing behavioral changes and mortality." J Invertebr Pathol 14(1): 13-7.

Lean, G. and H. Shawcross (2007). Are mobile phone wiping out our bees? The Independant.

Lefebvre, M. and E. Bruneau (2005). Etat des lieux du phénomène de dépérissement des ruches en Région wallonne, Convention entre la Région wallonne (DGRNE) et le CARI: 50.

Levy, S. (2006). The vanishing bee - The future of agriculture depends on the smallest of creatures. OnEarth Magazine.

Lewis, G., H. Thompson, et al. (2007). "In focus: pesticides and honeybees - the work of the ICP-BR Bee Protection Group Editorial." Pest Manag Sci 63: 4.

Liebig, G. (2005). "Völker verloren - was war die Ursache?" Deutsches Bienen J 8: 29-30.

Lodesani, M., L. Maistrello, et al. (2006). Effects of natural compounds on Nosema diseased honeybees in laboratory conditions. Second European Conference of Apidology EurBee, Prague (Czech Republica).

Lozowicka, B. and P. Kaczynski (2009). Zatrucia pszczol srodkami ochrony roslin. XLVI Naukowa Konferencja Pszcelarska.

Malone, L. A. (2004). "Potential effects of GM crops on honey bee health." Bee World 85(2): 29-36.

Mangum, W. A. (1999). "Honey bee biology; clues to some causes of winter colony deaths." Am Bee J 139(2): 117-120.

Manville, A. (2007). U.S. Fish and wildlife service concerns over potential radiation impacts of cellular communication towers on migratory birds and other wildlife - Research opportunities. Congressional staff briefing on the environmental and human health effects of radiofrequency (RF) radiation, Washington (USA).

Marchetti, S., R. Barbattini, et al. (1984). "Comparative effectiveness of treatments used to control Varroa jacobsoni Oud." Apidologie 15(4): 363-377.

Marletto, F., A. Arzone, et al. (1995). "Azione del fenoxycarb sulla covata delle api." Apitalia(5): 19-23.

Martin, R., A. Meana, et al. (2005). "Increase of nosemosis prevalence in Spain." Acta Parasitol Port 12: 50.

Martin, S. (1998). "A population model for the ectoparasitic mite Varroa jacobsoni in honey bee (Apis mellifera) colonies." Ecol Model 109(3): 267-281.

Martin, S., A. Hogarth, et al. (1998). "A scientific note on Varroa jacobsoni Oudemans and the collapse of Apis mellifera L. colonies in the United Kingdom." Apidologie 29(4): 369-370.

Martin-Hernandez, R. (2009). Etiopatogenia de las nosemosis de las abejas meliferas y su incidencia en el sindrome de despoblamiento de las colmenas. III Jornada de Transferencia Tecnológica Sobre Investigación en Apicultura. Madrid (Spain).

Martin-Hernandez, R., M. Higes, et al. (2006). Reliability of diagnostic methods to detect Nosema spp. spores in honey bees: molecular identification versus visual observation. Second European Conference of Apidology EurBee, Prague.

Martin-Hernandez, R., M. Higes, et al. (2006). Influence of sampling in the detection of Nosema ceranae spores. Second European Conference of Apidology EurBee, Prague.

Martin-Hernandez, R., A. Meana, et al. (2009). "Effect of temperature on the biotic potential of honeybee microsporidia." Appl Environ Microbiol 75(8): 4.

Martín-Hernández, R., A. Meana, et al. (2007). "Diagnostico diferential de los microesporidios de la abeja." El Colmenar(88): 49.

Mattila, H. R. and G. W. Otis (2006). "Effects of pollen availability and nosema infection during the spring on division of labour and survival of worker honey bees (Hymenoptera: Apidae)." Environ Entomol 35(3): 708-717.

Maus, C., G. Curé, et al. (2003). "Safety of imidacloprid see dressings to honey bees: a comprehensive overview and compilation of the current state of knowledge." Bull Insectology 56(1): 51-57.

Meana, A., R. Martín-Hernández, et al. (2007). "Asociacion causativa entre los sintomas de las colonias y la presencia de Nosema spp." El Colmenar(88): 48.

Mendez Siverio, R. (1995). Incertidumbre. Revista Apicola: 1.

Mengassini, A. (2009). "Nuove prospettive di cura per gli spopolamenti." Apimondia Italia 4(3): 10-13.

Messer, A. E. (2009) "Pesticide build-up coul lead to poor honey bee health." EurekAmert!, 2.

Metz, S. (2008). Massives Bienensterben? Luxemburger Wort: 23.

Mollier, P., M. Sarazin, et al. (2009). "Le déclin des abeilles, un casse-tête pour la recherche." INRA mag(9): 13-24.

Monaco, L. (2003). "Avvelenamenti che fare?" LAPIS XI(4): 12.

Moosbeckhofer, R. (1994). "Individuell oder koordiniert - mehrjährige Erfahrungen mit dem Einsatz von Pyrethroidstreifen zur Kontrolle der Varroatose in Österreich." ADIZ 10: 6-11.

Mutinelli, F. (2003). "La situazione sanitaria dell'apicoltura in Europa e Nord America: aggiornamento a maggio 2003." LAPIS XI(6): 13-15.

Mutinelli, F. (2008). "Bienensterben: Italien verhängt Pestizid-Verbot." ADIZ 42(15).

Mutinelli, F. (2008). Fattori che possono causare fenomeni di spopolamento. Situazione nel mondo e in Italia. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Mutinelli, F. (2008). "La moria delle api: cause e concause." L'Apicoltore Italiano 1: 7-11.

Mutinelli, F. (2008). "La sindrome dello spopolamento degli alveari (CCD)." Bollettino IASMA VII: 1-2.

Mutinelli, F. and A. Granato (2009) "*Nosema ceranae*: quale terapia alla luce delle nuove conoscenze?." L'Apicoltore Italiano 2, 7-9.

Mutinelli, F., A. G. Sabatini, et al. (2008). "Neonicotinoids precautionary suspension in Italy." Buzz Extra(5): 4-5.

Nordstrom, S., I. Fries, et al. (1999). "Virus infections in Nordic honey bee colonies with no, low or severe Varroa jacobsoni infestations." Apidologie 30(6): 475-484.

Oertel, E. (1965). "Many bee colonies dead of an unknown cause." Am Bee J 105: 48-49.

Oomen, P. A. (1999). Honey bee poisonings incidents over the last ten years as reported by bee keepers in the Netherlands. Hazard of pesticides to bees. Inra. Avignon (France): 129-135.

Otten, C. (2003). "Das Völkersterben: Daten und Fakten." Deutsches Bienen J 8: 4-6.

Otten, C. (2006). "Umfrage zu Verlust von Bienenvölkern im Herbst 2008." Retrieved June 2009, 2009, from http://www.bienenkunde.rlp.de/Internet/global/themen.nsf/0ba6fb837371e3fdc1256f4200252e0d/3a5802d9e0eb62ecc12575270023bad1?

Otten, C. (2006). "Völkerverluste liegen bei 20%." Deutsches Bienen J 6.

Otten, C. (2009). "Verluste im Herbst 2008 geringer als in den letzen Jahren." ADIZ/db/IF.

Overdick, J. (2008). Überwinterungs-problematik der bienenvölker, Institut für Geistedwissenschaften: 12.

Panella, F. (2000). "Fitosanitari e concia delle sementi: allarme rosso." LAPIS VIII(8): 12.

Panella, F. (2008). Api e agrofarmaci: dall'efficace monitoraggio in campo la conferma dell'effettiva compatibilità. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Panella, F. (2008). "La crisi mondiale delle api: quali le cause principali e determinanti?" LAPIS XVI: 4-10.

Perez, H. (2005). "Detectados focos de mortandad." El Colmenar(80): 71.

Perez, H. (2006). "Apicultores conqueses elogian la labor del Centro de Marchamalo." El Colmenar(81): 71.

Piccirillo, G. A. (1997). "Conditions of management of Africanized honeybees in northwestern Venezuela." Interciencia 22(2): 81-86.

Pinzauti, M. (2008). "Le morie italiane. Alcune riflessioni sulle criticità dell'apicoltura." Apimondia Italia(16): 12-17.

Pinzauti, M. and D. Frediani (1989). Honey bee colonies in confined environment. III Convegno Nazionale A.I.S.A.S.P. Ferrara.

Plaza, J. R. (2004). "El pag niega tajantemente una mortandad anomala de abejas." El Colmenar(74): 77.

Pohorecka, K., A. Bober, et al. (2009). Masowe straty rodzin pszczelich w Polsce (2007/2008) - analiza czynnikow chorobotworczych. XLVI Naukowa Konferencja Pszcelarska, Pulawy.

Porrini, C. and L. Monaco (2001). "Effetti dell'imidacloprid nei confronti delle api." LAPIS IX(1): 8-12.

Puerta, P., G. M. Ruz, et al. (2008). "Sindrome di spopolamento degli alveari. Lo stato delle ricerche." LAPIS XVI(1): 5-12.

Puerta, P., M. Ruz, et al. (2007). "Síndrome de Despoblamiento de Colmenas. Situación de las investigaciones." Vida Apícola: 49-52.

Puerta Puerta, F., J. Ruz Luque, et al. (2007). Investigacion sobre el sindrome de despoblamiento de las colmenas en España. Evaluacion de factores epidemiologicos, ambientales y nutricionales. II Jornada de Transferencia Tecnológica Sobre Investigación en Apicultura. Madrid (Spain).

Puerta Puerta, F., J. Ruz Luque, et al. (2009). Investigación sobre el Síndrome de despoblamiento de las colmenas en España. Evaluación de factores epidemiológicos, ambientales y nutricionales. III Jornada de Transferencia Tecnológica Sobre Investigación en Apicultura. Madrid (Spain).

Radtke, J. (2003). "Population dynamics of Varroa destructor: study of the development of the level of infestation of Apis mellifera colonies in different years." Apidologie 34(5): 506-507.

Radtke, J. (2008). "Schlecht ausgewinterte Völker schröpfen?" Deutsches Bienen J 16(4): 154-155.

Radtke, J. and M. Schröder (2000). "The influence of the removal of brood on the Varroa jacobsoni population and honey production of bee colonies." Apidologie 31(5): 625-627.

Radtke, J., M. Schröder, et al. (2002). Zum Einfluss der Varroa-Bekämpfung mittels Kombination aus Ablegerbildung und modifiziertem Fangwabenverfahren auf Leistungsparameter von Bienenvölkern. Vortragstagung der Deutschen Gesellschaft für Züchtungskunde e. V. und der Gesellschaft für Tierzuchtwissenschaft (Symposium of the German Society for Animal Production E.V. and the Society of Animal Genetics), Halle (Germany).

Ritter, W. (2003) "Warum sterben unsere Bienenvölker?" Deutsches Bienen J 2.

Ritter, W. (2007). "Bienen untersuchen lassen! Völkerverluste scheinen auch in Deutschland zuzunehmen." Imkerfreund 3: 11.

Ritter, W. (2007). "Bienensterben im Presserummel - und was es für uns bedeutet." D.I.B. AKTUELL 3: 18-19.

Ritter, W. (2007). "Checkliste: Varroa-Winterbehandlung." Deutsches Bienen J 1: 27.

Ritter, W. (2007). "Ist die Honigbiene in Gefahr? Kenntnisstand zum Bienensterben in den USA." Bienenpflege(9): 299-301.

Ritter, W. (2007). "Kahlfliegen ist kein neues Phänomen." Deutsches Bienen J 9: 394-395.

Ritter, W. (2007). "Moria delle api negli USA: l'ape mellifera." Apimondia Italia 2(4): 8.

Ritter, W. (2007). "Überwinterung 2006/2007, ein Zwischenbericht." Deutsches Bienen J 1: 26.

Ritter, W. (2007). Varroa-Bekämpfung im Winter ist wichtig. Neue Bienenzucht.

Ritter, W. (2008). "Hohe Bienenverluste nun auch in Deutschland." Deutsches Tierärzteblatt 4: 462-463.

Robinson, F. A. (1979). "The effects of repeated spray applications of Dimilin W-25 on honey bee colonies in cotton fields." Am Bee J 119(3): 193-194.

Rosenkranz, P. (2004) "Ist Imidacloprid eine Ursache für Völkerverluste?" ADIZ/db/IF.

Rosenkranz, P. (2004). Pertes d'abeilles et de colonies en Allemagne. Premier colloque technique apicole. Roissy (France): 68-91.

Royce, L. A. and P. A. Rossignol (1990). "Honey bee mortality due to tracheal mite parasitism." Parasitology 100 Pt 1: 147-51.

Russel, D., R. Meyer, et al. (1998). "Potential impact of microencapsulated pesticides on New Jersey apiaries." Am Bee J 138(3): 207-210.

Schiro, J. (2008). La publication scientifique du savant dresseur de puces, Miel de France: 17.

Schmidt, H. W. and R. Schmuck (2000). "Factors involved in the French bee malady." Hivelights 13(3): 22-24.

Schmuck, R., C. Maus, et al. (2008). A multifactorial analysis approach to quantify the impact of environmental stress factors on bee health. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Scott-Dupree, C. D. and M. S. Spivak (2000). The impact of GAUCHO ND and TI-435 Seed-treated Canola on honey bees, Apis mellifera, Bayer: 16.

Seefeld, F. (2006). "Chemische Untersuchungen zur Aufklärung von Schäden an Honigbienen durch Pflanzenschutzmittel." Nachr Dtsch Pflanzenschutzd 58(2): 59-66.

Servel, F. (2002). Les intoxications des abeilles en Provence. Le courrier de la nature. 196.

Seube, E. Questionnaire envoyé par mail par Elina Seube à Jean Fedon: 3.

Sevilla, R. T. (2006). "El 60% de las abejas extremenas transhumadas a los girasoles andaluces mueren por causas desconocidas." El Colmenar(83): 79.

Sgolastra, F., C. Porrini, et al. (2004). "Pericolosità e tossicità di diversi agrofarmaci nei confronti delle api." LAPIS XII(4): 23-28.

Shabanov, M. and D. Georgiev (1979). "[Role of mildew and mildewed honey in summer-fall mortality in bee hives]." Vet Med Nauki 16(10): 88-95.

Siede, R. and R. Büchler (2004). "Bienenschwund durch Nosema und vergesellschaftete Viren." ADIZ/db/IF 140(9): 7-9.

Stanrod, S. (2009). "Portées disparues... Qu'arrive-t-il à nos abeilles?" Sacrée Planète: 5.

Stever, H., J. Kuhn, et al. (2005). Modifications du comportement des abeilles sous l'effet d'exposition électromagnétique, Institut de Mathématiques de l'Université de Koblenz-Landau: 21.

Stokstad, E. (2007). "Entomology. The case of the empty hives." Science 316(5827): 970-2.

Tardieu, V. (1998). Les apiculteurs accusent le Gaucho d'empoisonner leurs abeilles. Le Monde.

Testu, P. (2009). Bilan des jachères apicoles dans l'Indre - La création de "réserves de fleurs" permet aux abeilles de mieux se porter. L'Aurore paysanne hebdo.

Thompson, H. and C. Brown (1999). "The role of the National Bee Unit in controlling statutory bee diseases." Bee World 80 (3): 133-139.

Topolska, G. and A. Gajda (2009). Cukier, choroby czy CCD jest przyczyna giniecia rodzin pszczelich w Polsce? Pszczelarz Polski. 148: 14-16.

Topolska, G. and A. Gajda (2009). Czy zespol masowego giniecia rodzin pszczelich (CCD) jest w Polsce obecny? Pszczelarstwo. 59: 2-3.

Trematerra, P. (2008). Integrated pest management di precisione e salvaguardia della biodiversita agraria. Workshop: Sindrome dello spopolamento degli alveari, Roma.

Van der Steen, J. J. (2006). Meerjarig onderzoek naar wintersterfte. De resultaten van de wintersterfte-enquete 2004 – 2005 en de aankondiging van een nieuwe wintersterfte-enquete in 2006: 6.

Van der Steen, J. J. (2007). Uitwerking van der resultaten van de enquêtes april, juli en oktober 2006 en maart 2007, gehouden voor de evaluatie van de wintersterfte 2006 - 2007 en de resultaten van de diagnose van bijenziekte van ingezonden monsters in 2006 en 2007. : 25.

van der Zee, R. (2009). Some remarks about the COLOSS basic questionnaire 2008/2009. Coloss Workshop 2009 - Bee Monitoring, Amsterdam (The Netherlands).

van Engelsdorp, D., J. Hayes, et al. (2008). Apiary inspectors of America, Apiary Inspectors of America: 2.

Van Engelsdorp, D., R. M. Underwood, et al. (2008). "Short-Term Fumigation of Honey Bee (Hymenoptera: Apidae) Colonies with Formic and Acetic Acids for the Control of Varroa destructor (Acari: Varroidae)." J Econ Ent 101(2): 256-264.

Vérot, D. and J. Nadan (2009) "L'abeille disparaît à cause des pesticides, il est malhonnête de le contester... Et la situation continue à se dégrader..." Passerelleco, 7.

Vidano, C. (1985). "Apicidi da antiparassitari in agrosistemi e in ecosistemi." Apic Mod 76: 125-130.

Villa, J. (2009). Answer to: multiple causes of bee colony disorder. Promedmail, Promedmail: 2.

Voltini, B. (2008). Moria d'api e spopolamento degli alveari: lo stato delle cose in Regione Toscana. Workshop: Sindrome dello spopolamento degli alveari, Roma.

von der Ohe, W. (2003). "Völkerverluste im Sommer und Herbst 2002." Deutsches Bienen J 11(1): 4-6.

von der Ohe, W. (2003). "Was sind die Ursachen von Völkerverlusten." ADIZ/db/IF 37(9): 8-10.

von der Ohe, W. (2006). Mögliches Zusammenwirken von Stressoren - ein multifaktorieller Erklärungsansatz für die Ursachen der Völkerverluste im Herbst/Winter 2002. Das Bienensterben im Winter 2002/2003 in Deutschland, BVL Braunschweig: 20-24.

von der Ohe, W. (2007). Stress factors - interaction of plant protection products and other factors. 40th Apimondia International Apicultural Congress. Melbourne.

von der Ohe, W. and M. Janke (2009). "Bienen im Stress." ADIZ 43(4): 10-11.

Wenning, C. (2001). "Autumn hive depopulation revisited." Am Bee J 141(8): 557-559.

Wilde, J. (2008). Straty ekonomiczne powodowane przez Varroa destructor i sposoby zapobiegania. Pszczelarstwo. 59.

Wilkins, S., M. A. Brown, et al. (2007). "The incidence of honey bee pests and diseases in England and Wales." Pest Manag Sci 63(11): 1062-8.

Wilson, W. T. and D. M. Menapace (1979). "Disappearing disease of honey bees: a survey of the United States." Am Bee J 119(2): 184-186.

Zacchetti, F. (2008) "Spopolamento degli alveari: ci vorrebbe poco a monitarlo." LAPIS 16, 9-12.

APPENDIX 9. EXAMPLE OF A FILLED LITERATURE DATA EXTRACTION GRID.

Bee Surveillance Reference Study

Name of the reader		Marion DEBIN
Code name_year of the reference		Charrière_2003
First author *If specified, mention his agency*		**Jean-Daniel Charrière** **Centre Suisse de recherche apicole**
Date of publication		**2003**
Title		**Pertes de colonies en Suisse 2002/2003**
Country concerned by the reference		**Switzerland**
Journal or source, and kind of source (1, 2 or 3) *Precise 1 if the reference has been published in a peer-reviewed journal, 2 if it has been published in a public available but non peer-reviewed document (government reports, abstracts of meetings...), 3 if it has not been published in a public document.*		**Report (communication n°57)** **2** **Available on www. alp.admin.ch**
Criteria		Comments
1	Which event(s) is (are) investigated/studied (weakening, mortality, collapse, diseases…)? *Please precise the definition used (and if necessary, the disease).* *Go to question 2.*	Mortality
2	Which indicator is used (mortality rate, morbidity rate…) to explore this phenomenon? *Please precise the duration and place of dead bees observation (inside or outside of the beehive).* *Go to question 3.*	Mortality rate per apiary, per county, for the country. No detail about calculation method.
3	Does this article deal with: only diseases / only poisonings / both / none? *Go to question 4.*	Only disease (only *Varroa* for the study on the cause of mortalities, all causes for the question about bee-keepers feelings, but no detail about the percentage of people who answered “poisonings”)
4	Does this article deal with environmental factors? *Go to question 5.*	Yes
5	Does the author seem objective? *The author is objective if his personal opinion doesn’t influence the conclusion of his study.* *Precise: yes, maybe, no, you don’t know.* *Go to question 6.*	Yes
6	Is this reference only an abstract? If Yes, go to question 11. If No, go to question 7.	No

7	Does the reference describe one (or several) episode(s) of colony mortality, weakening or collapse? *If Yes, go to question 38.* *If No, go to question 8.*	Yes
8	Does the reference describe a European surveillance network? *If Yes, go to question 48.* *If No, go to question 9.*	No
9	Does the reference describe primary research? If Yes, go to question 10. *If No, go to question 21.*	No
10	Does this study investigate risk factors for colony mortality, weakening or collapse? *If Yes, go to question 12.* *If No, go to question 26.*	Yes
For abstracts		
11	Should the authors be contacted for further information? *If Yes please indicate the questions to be asked.* *Go to question 6 and please try to answer as many questions as possible. For data that are not available in the abstract, do not fill in the boxes.*	
For risk factors epidemiological studies about colony mortality, weakening or collapse		
12	Write down the research question that is being investigated by this study. *Go to question 13.*	Which factor could explain honey bee colony mortality in Switzerland in winter?
13	Make a list of the risk factors (including their sub-classes or sub categories) investigated and name the approach (i.e. questionnaire, observations etc.) and the methodology (case control study, cohort study…) used to study them. *Go to question 14.*	Questionnaire. Pseudo case-control study. - altitude of the apiary: NS - localisation: NS - colza or maize field near the beehive: NS - sunflower field near the beehive: weak influence - late honeyflow with insufficient feeding (<10L): influence - insufficient treatment against Varroa: NS
14	If analyses have been done, were sufficient samples taken (e.g. has a sample size calculation been conducted and what is the expected power of the statistical outcome?)? *Go to question 15.*	
15	List the points that have been sampled (i.e. in beehive, in field, products) and how often in time. *Go to question 16.*	

16	Was the methodology for detecting diseases or contaminants valid? What was the detection limit? *If it is not valid, precise why.* *Go to question 17.*	
17	From the list in question 12, add their measures of association such as odds ratios including their 95% confidence intervals and P values, if available. *Go to question 18.*	P not given in the article.
18	Have the biases been studied in the reference? *If Yes please quote them.* *Go to question 19.*	Sampling bias.
19	Do you see major biases that have not been studied? *If Yes, please precise them.* *Go to question 20.*	No details about statistical test, P... So we can't evaluate the analysis!
20	Does the statistical analysis appear: Correct, incomplete, wrong, non-existent or unspecified? *If incomplete or wrong explain why and then, go to question 57.*	Unspecified
For other references		
21	Is this a review? *Go to question 22.*	
22	Make a list of the main conclusions of this reference that are relevant to identification of risk factor of colony mortality, weakening or collapse; causative factor or epidemiology. *If some risk or causative factors are detailed, please precise if according to the author they are: unlikely, not likely, probable, very likely.* *Go to question 23.*	
23	Do these conclusions appear justified? If no, why not? *Go to question 24.*	
24	Does the author raise personal hypothesis on the phenomenon? *If Yes, please give them.* *Go to question 25.*	
25	Make a list of novel, relevant references of primary research quoted in the review that should be checked to ensure that they have been included in our screening process? *Go to question 57.*	
For primary research		
26	Write down the research question that is being investigated by this study. Go to question 27.	

27	*Was the research question addressed at the* in vitro *or* in vivo *level?* Go to question 28.	
28	*Was the research question addressed at the laboratory or field level?* If analyses have been done, please answer to question 14 to 16 and then go to question 29.	
29	Are enough details given on the methods to assess study validity on a quantitative (i.e. measured or measurable) basis? *If Yes, precise if the study appears valid on a quantitative basis and why.* *Go to question 30.*	
30	Is the methodology appropriate to assess validity on a qualitative (i.e. descriptive) basis? *If Yes, precise if the study appears valid on a qualitative basis and why.* *Go to question 31.*	
31	Describe details of the methodology employed or approach used. *Go to question 32.*	
32	*Were the methods used appropriate for the study question (i.e. randomized groups, control groups, accurate measurements, reproducibility, blind assessment of outcomes...)*? If No please supply comments. *Go to question 33.*	
33	Make a list of the statistical analyses methods applied to analyze the data. These may be referred to experts for assessment. *Go to question 34.*	
34	Does the statistical analysis appear: Correct, incomplete, wrong, non-existent or unspecified? *If incomplete or wrong explain why and then, go to question 35.*	
35	What is/are the conclusion(s) of the study? *Go to question 36.*	
36	Have the biases been studied in the reference? *If Yes, please quote them.* *Go to question 37.*	
37	Do you see major biases that have not been studied? *If Yes, please precise them.* *Go to question 57.*	

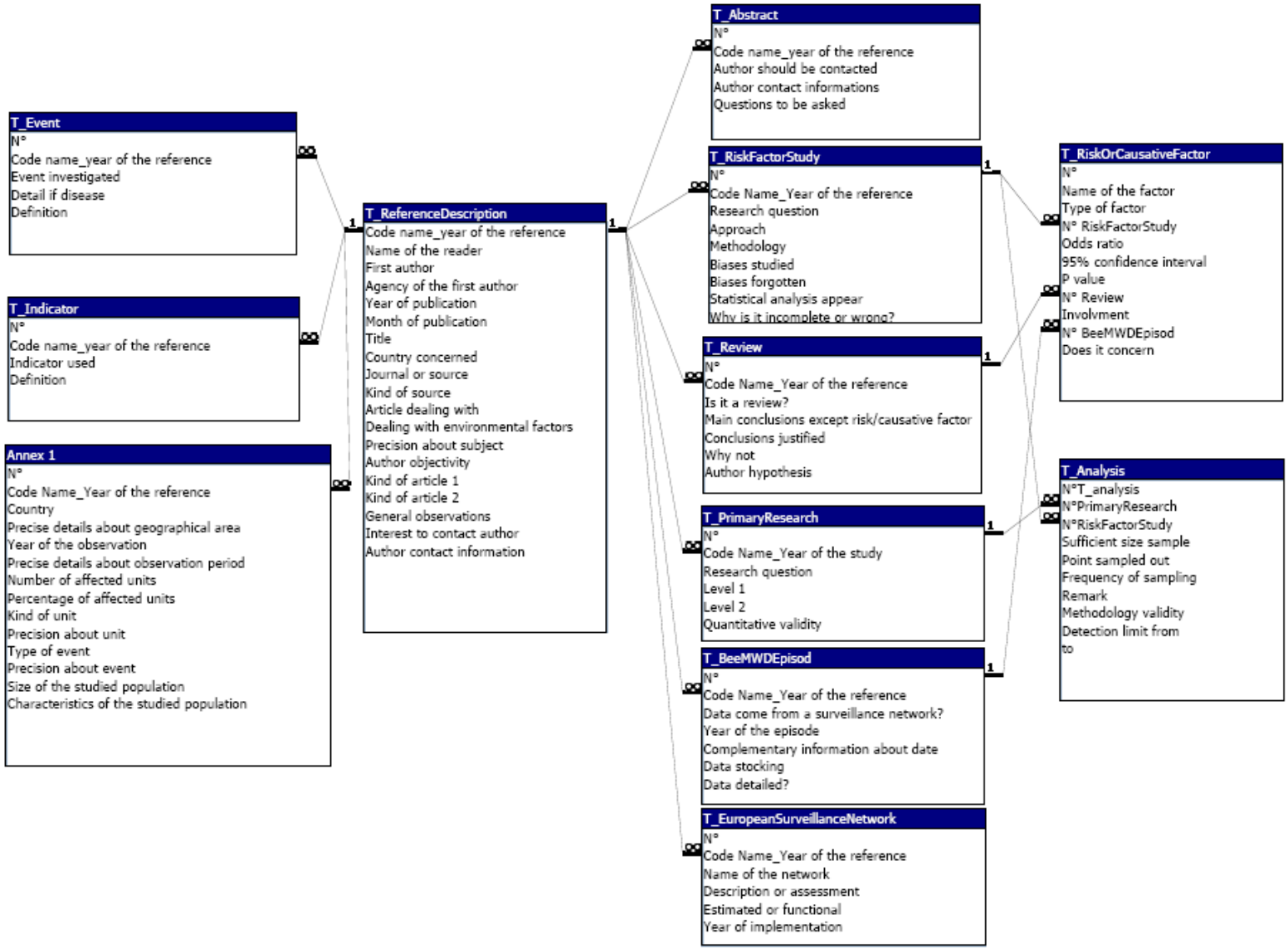
For report on colony mortality, weakening or collapse episode(s)		
38	Do data of the reference come from a surveillance network? *If Yes, please give its name and if data came from active or passive surveillance.* *Go to question 39.*	No
39	When did this episode occur? *Go to question 40.*	Between summer 2002 and spring 2003.
40	How data of this/those episode(s) are stocked (in a database, on paper…)? *Go to question 41.*	?
41	Are data detailed in the article? Would it be possible to access to complete data? *If Yes, please precise who we should contact to obtain them.* *Go to question 42.*	Yes ?
42	What is the geographical area concerned by the reference? *Go to question 43.*	Different counties all over Switzerland
43	What is the general incidence/prevalence of the phenomenon? *Please fill in annex 1.* *Go to question 44.*	Switzerland: 17.6% for winter Switzerland: 23.2% if we include late summer and fall mortalities Per county: from 7 to 64% (for winter only) 64 apiaries with > 60%
44	Has the cause of the colony mortality, weakening or collapse episode been identified? *If yes, precise the cause and go to question 46.* *If no, go to question 45.*	No
45	Are hypothesis raised on the cause of the phenomenon? *If Yes, please give them.* *Go to question 46.*	Several causes together (synergy). Virus. Beekeepers top five reasons: varroa (18%), weather (12%), “management” (8%), agriculture (6%), other (66%)
46	What are the conclusions of the reference? *Go to question 55.*	Mortality rates are higher than “normal mortality”, but lower than what the authors feared.
47	Do the conclusions seem biased? *If yes precise why.* *Go to question 57.*	No
For report on a European surveillance network		
48	What is the name of this surveillance network? *Go to question 49.*	
49	Does this article make a description or an assessment of this network? *Go to question 50.*	

50	Is it an estimated network or a functional one? *If it is a functional network, go to question 51, if not go to question 55.*	
51	Since when this network has been used? *Go to question 52.*	
52	How data of this network system are stocked (in a database, on paper…)? *Go to question 53.*	
53	Is it possible to access to those data? *If Yes, please precise who we should contact to obtain them.* *If data are given in the reference, please fill in annex 1.* *Go to question 54.*	
54	What is the geographical area concerned by this surveillance network? *Go to question 55.*	
55	What are the major points set out in the reference? *Go to question 56.*	
56	What are the conclusions of the reference? *Go to question 57.*	
For all references		
57	If you have some observations, please write them here. *Go to question 58.*	Cf. the following study: “Cultures de tournesol et développement des colonies d’abeilles mellifères” → realized in order to precise the effect “sunflower field closed to the beehive”.
58	Do you think it could be interesting to contact the author? If yes, how can we proceed? *Do not proceed further.*	No

Appendix to the reading grid

Geographical area	Date and duration of observation period	Characteristics of the studied population	Size of the studied population	Type of event (mortality, weakening, collapse)	Kind of unit (colony, apiary, bee keeper)	Number or % of affected unit	Comments or details / other kind of data
All Switzerland	Summer 2002-Spring 2003 (Winter 2002-2003 losses)	Colonies belonging to bee-keepers that answered to the questionnaire	9627 colonies (557 beekeepers)	Mortality	Colony	23.2% (17.6%)	Those figures are the mean of the individual percentage losses per bee-keeper
County AG			1000 (49)			21% (20%)	
County AI			24 (3)			83% (64%)	
County AR			40 (4)			40% (20%)	
County BE			2181 (133)			20% (14%)	
County BL			405 (22)			17% (10%)	
County BS			29 (3)			7% (7%)	
County FR			113 (6)			20% (19%)	
County GL			58 (3)			14% (14%)	
County GE			74 (4)			40% (40%)	
County GR			291 (14)			17% (15%)	
County JU			227 (10)			21% (16%)	
County LU			456 (26)			8% (7%)	
County NE			125 (11)			9% (7%)	
County NW			24 (2)			21% (21%)	
County OW			42 (3)			36% (36%)	
County SG			738 (53)			23% (16%)	
County SH			205 (10)			32% (28%)	
County SO			308 (14)			52% (46%)	
County SZ			111 (6)			29% (17%)	
County TG			538 (24)			27% (24%)	
County TI			50 (2)			18% (15%)	
County UR			86 (4)			26% (26%)	
County VD			592 (41)			18% (16%)	
County VS			362 (25)			18% (15%)	
County ZG			60 (3)			42% (38%)	
County ZH			1490 (82)			30% (19%)	
All Switzerland			9629 colonies (557 beekeepers)	> 20% colony mortality in an apiary	Bee-keeper	35.7% (28.2%)	
				> 40% colony mortality in an apiary		19.6% (14.2%)	
				> 60% colony mortality in an apiary		11.5% (6.8%)	
				> 80% colony mortality in an apiary		5.9% (3.2%)	

APPENDIX 10. SCHEMA OF THE DATABASE "BEE SURVEILLANCE - CRITICAL READING".



APPENDIX 11. MINUTES OF THE KICK-OFF MEETING (PARMA, JANUARY THE 26TH).

ASSESSMENT METHODOLOGY UNIT

KICK-OFF MEEETING
ON
BEE MORTALITY AND BEE SURVEILLANCE IN EUROPE

Member's Name:	**Member's Address:**	**E-mail address:**
Philippe Prigent (PP)	Agence Française de Sécurité Sanitaire des Aliments (AFSSA)	p.prigent@afssa.fr
Marie-Pierre Chauzat (MC)	Agence Française de Sécurité Sanitaire des Aliments (AFSSA)	mp.chauzat@afssa.fr
Pascal Hendrikx (PH)	Agence Française de Sécurité Sanitaire des Aliments (AFSSA)	p.hendrikx@AFSSA.FR
EFSA		
Jane Richardson (JR)	Assessment Methodology Unit	Jane.richardson@efsa.europa.eu
Didier Verloo (DV)	Assessment Methodology Unit	Didier.verloo@efsa.europa.eu
Ana Afonso (AA)	Panel on animal health and welfare	Ana.afonso@efsa.europa.eu
Karin Nienstedt (KN)	Panel on plant protection products and their residues	Karin.Nienstedt@efsa.europa.eu

Copies to:
EFSA: Hubert Deluyker (Head of SCA Directorate)

Date and place:

Date : **26th January 2009**
Time : **From 12.00 to 15.00**
Place : **EFSA – European Food Safety Authority**
Meeting room: FRTA 01/040

Agenda:

- Introduction of Consortium and Project team

Task 1: Evaluation of MDW surveillance programmes in Europe

Assessment questionnaire and assessment guide

Method of distribution of questionnaire and guide
Synthesis of returned questionnaires

Task 2: Compilation and analysis of surveillance data

Data structure and format
Validation and analysis

Task 3: Review and analysis of published literature

Research question for literature review
Inclusion and exclusion criteria

- Future meetings
- Reporting deadlines
- AOB

Minutes:

1) Introduction of Consortium and Project team

1.1) The applicants and EFSA project team members introduced themselves. The structure of the consortium and the relationship with subcontrators was explained. AFSSA will provide overall co-ordination of the project.

1.2) It was explained that the EFSA web portal (https://sciencenet.efsa.europa.eu/portal/server.pt) will be the repository for all documents relating to the project (minutes, interim reports, final reports). Previous documents including the questionnaires used to create the Bee Mortality and Bee Surveillance in Europe(http://www.efsa.europa.eu/EFSA/efsa_locale1178620753812_1211902044641.htm) are also stored in the project Bees AMU-EFSA-2008-01. **JR** will check usernames and passwords have been issued and test access to the project when distributing these minutes.

2) **Task 1:** Evaluation of MDW surveillance programmes in Europe

2.1) The SNAT tool was presented. This is a questionnaire that facilitates critcal analysis of surveillance systems and allows synthesis of the returned questionnaires

2.2) The questionnaire to be distributed to member states will be finalised at the COLOSS meeting (5 March). The questionnaire will be provided to EFSA after the meeting for any further comments or amendments prior to distribution.

2.3) The diagnostic laboratory section will include consideration of both microbiological and chemical testing

2.4) The formalization of surveillance section will include details on the collection and analysis of risk factors.

2.5) Member state contacts will be identified through the COLOSS network and from the questionnaires submitted to EFSA through the focal point network

2.6) Where possible questionnaires will be pre-filled with information already available. Video conference / teleconference will be used to assist the member state contact in completing the questionnaire

2.7) The data capture forms used in the surveillance programmes will also be collected

2.8) Synthesis of results will be at country level and European level. The SNAT tool is designed to identify gaps in a surveillance programme by evaluation against a standardised epidemiological surveillance network model. Gaps in the surveillance network will be considered at the European level without pin-pointing deficits specific to member states.

3) **Task 2:** Compilation and analysis of surveillance data

3.1) EFSA clarified that there is no legal requirement to provide data to the project. Submission of data would be on a purely voluntary basis. **AA** to check the procedures and data access agreements used in the AHAW swine fever project, potentially those methods could be applied to this project.

3.2) It is probable that for some countries no dataset will exist

3.3) A conceptual data model was presented – however it is likely that the structure may be amended once the available data has been reviewed. The time frame for the historical data collection will also be decided once a picture of the available data has been gained

3.4) The laboratory results table will include both microbiological and chemical tests if information is available

3.5) Once the data has been collected from the member states the experts from the consortium will assess the quality of each dataset and provide the quality assessment as accompanying metadata to the datasets

3.6) Spatial and temporal analysis of the data will be produced for the datasets at national level. European level analysis will only performed for comparable data.

4) **Task 3:** Review and analysis of published literature

4.1) "Mortality, collapse and weakening in bee hives" working group of AFSSA published their report last week. This will be used as a foundation document and the definition of MDW (mortality, depopulation and weakening) will be used to select relevant reports for inclusion in the review.

4.2) Keywords for the search of peer reviewed published literature to be agreed at COLOSS meeting (5 March).

4.3) Grey literature to be identified through experts in COLOSS network. EFSA commented that this should be a transparent process and references identified carefully documented.

4.4) Standardised form to enable evaluation and extraction of data from identified references to be finalised at COLOSS meeting (5 March).

5) Project timetable

Action	Date
Consortium workshop	5 March (Zagreb)
3 month report submitted	End April
1st interim meeting	14 May (Parma)
7 month report submitted	End August
Consortium workshop	Sept to be confirmed
2nd interim meeting	16 Sept (Parma)
Final report submitted	End Oct
Presentation of final report	18 November (Parma)

5.1) **PP** to invite EFSA representative (JR) to Consortium workshops.

5.2) EFSA explained that experts not involved in the COLOSS network would be invited to peer review the submitted reports and attend the interim and report presentation meetings to be organised in Parma.

APPENDIX 12. MINUTES OF THE FIRST INTERIM MEETING (PARMA, MAY THE 14TH).

ASSESSMENT METHODOLOGY UNIT

INTERIM MEEETING
ON
BEE MORTALITY AND BEE SURVEILLANCE IN EUROPE

Date and place:

Date : **14th May 2009**
Time : **From 13.00 to 16.00**
Place : **EFSA – European Food Safety Authority**
Meeting room: FRTA 01/039

Agenda:

1) WP1:Assessment of surveillance programmes – overview by AFSSA

2) WP1:Assessment of surveillance programmes – comments from EFSA

3) WP2:Compilation and analysis of surveillance data – overview by AFSSA

4) WP2:Compilation and analysis of surveillance data – comments from EFSA

5) WP3:Review and analysis of published surveillance data – overview by AFSSA

6) WP3: Review and analysis of published surveillance data – comments from EFSA

7) Administrative issues

8) Date for the presentation of the final report

9) AOB

Attendees:

Member's Name:	Member's Address:	E-mail address:
Marie-Pierre Chauzat (MC)	Agence Française de Sécurité Sanitaire des Aliments (AFSSA)	mp.chauzat@afssa.fr
Pascal Hendrikx (PH)	Agence Française de Sécurité Sanitaire des Aliments (AFSSA)	p.hendrikx@AFSSA.FR
Marion Debim	Agence Française de Sécurité Sanitaire des Aliments (AFSSA)	m.debin@afssa.fr
EFSA		
Jane Richardson (JR)	Assessment Methodology Unit	Jane.richardson@efsa.europa.eu
Ana Afonso (AA)	Panel on animal health and welfare	Ana.afonso@efsa.europa.eu
Milen Georgiev (MG)	Panel on animal health and welfare	Milen.Georgiev@efsa.europa.eu

1) WP1:Assessment of surveillance programmes

1.1) Presentation of SNAT tool.

1.2) Process for completion of SNAT tool was clarified. Contact in member receives questionnaire for completion. Consortia partner responsible for that member state arranges telephone call/meeting to address questions and finalize completion of the SNAT tool. Completed SNAT tool received by project coordinator for final vaidation. The member state may be contacted again through the partner to address data validation issues.

1.3) The information will be extracted from the SNAT tool and stored in an Access database located in the Bees project within Sciencenet.

1.4) On the request of EFSA changes will be made to the SNAT tool to ensure information relating to the surveillance of factors other than disease (e.g. pesticide poisoning) can be captured.

1.5) The project coordinators confirmed that the organisation completing the SNAT tool would be required to provide case definitions for all disease monitored.

1.6) The project coordinators explained the importance of considering all components of the surveillance network. The steering committee is required for effective decision making and planning within the network, additionally a steering committee can faciliate stakeholder participation.

1.7) In the section Field Institutional Organisation – Field Actors – an additional question will be added to record the geographical area covered for programmes that are not national in extent

1.8) The active surveillance section is to be expanded to capture information in a similar way to the passive surveillance section

1.9) The project coordinators confirmed that the annexed reporting forms will provide information on the risk factors assessed by the surveillance networks

1.10) The SNAT tool will be checked for clarity with regard to the use of the word "network"

2) WP2:Compilation and analysis of surveillance data

2.1) The project coordinators emphasised that there may be problems with this work package. Data can only be collated where it exists.

2.2) A section has been added to the SNAT tool to address the request for datasets. Once contact between member state and partner has been established through the completion of the SNAT tool, the project coordinators will make dataset requests.

2.3) EFSA offered to co-sign letters if this could assist in requesting data.

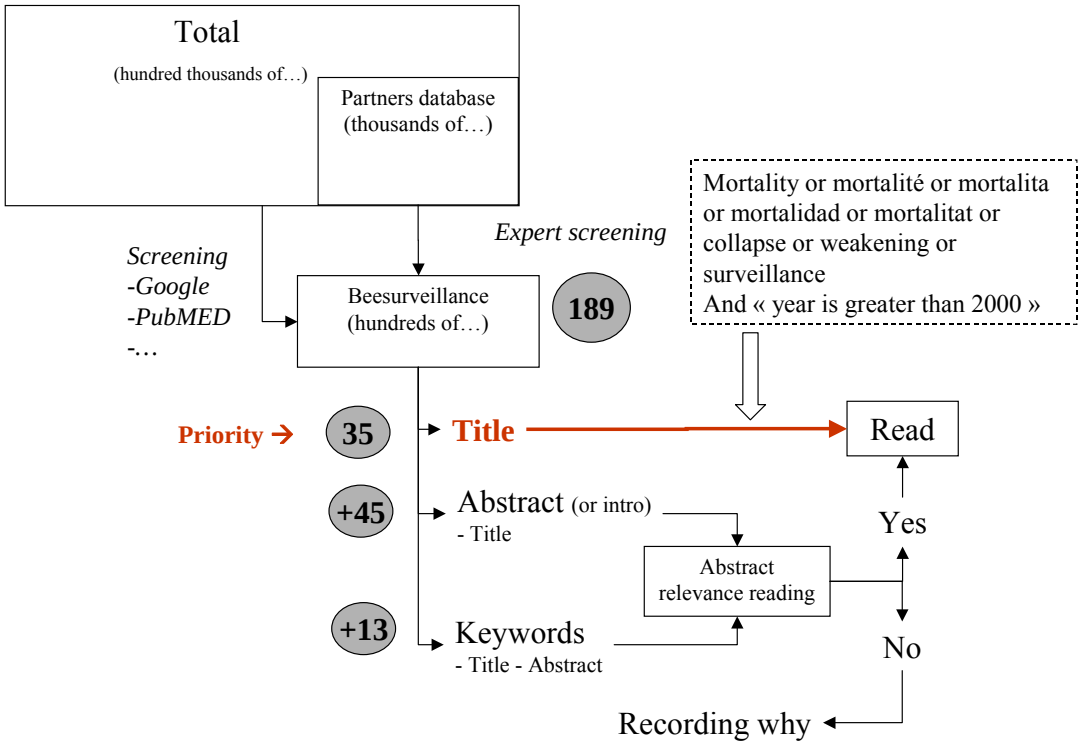
2.4) EFSA stated the importance of this project objective and proposed requesting datasets from the project partners as the first step in the data collection process.

2.5) The data standardisation procedures cannot be finalised until data is received, it is proposed to transform the dataset into the three table data model proposed in the project proposal submitted to EFSA.

3) WP3:Review and analysis of published surveillance data

3.1) The Reading decision tree was presented (see slide below). EFSA agreed this was a transparent method for identifying relevant papers.

Figure 1 : Reading decision tree



3.2) EFSA sought clarity on the research question, proposing the use of the text in page 3 of the interim report - "Critical review and selection of relevant literature on the possible causes of honey bee colony collapse, weakening and mortality"

3.3) For the search string used to identify reports/literature EFSA requested the amendment of the search string to (bee or beehive) and (mortality or collapse or weakening or losses).

3.4) The project co-ordinators confirmed they will include in the final report a complete list of databases used to identify literature and include the search history in an annex.

3.5) The project co-ordinators confirmed that the references identified in the EFSA report will be included in the literature review.

3.6) EFSA reported that European bee keeping representatives wished to submit reports. It was agreed that Marion Debin would be the contact point for this.

3.7) By e-mail Agnes Rotaris indicated the CNRS, Paris has undertaken an analysis of media sources for honeybee mortalities. The project co-ordinators expressed an interest in this project. Agnes Rotaris recommends contacting Claire Secail (http://www.lcp.cnrs.fr/html/bio/secail.htm).

3.8) The project co-ordinators proposed to collect statistical information from relevant papers to populate the data table RiskOrCausativeFactor. This may help to redress the problems experienced in WP2. This would potentially allow meta-analysis in future studies.

3.9) In the light of the proposal to extract detailed statistical information from reviewed literature, EFSA agreed to set the cut off year for literature at 2000.

3.10) Q3 of the literature grid will be amended to enable the recording of factors other than poisoning or disease (e.g. environmenal factors)

4) Surveys by AHAW

4.1) The AHAW unit representatives presented their data collection initiatives

4.2) The project co-ordinators expressed interest in survey portlet contained in Sciencenet portal. They will contact EFSA if they wish to explore this option further.

5) Administrative Issues

5.1) The project co-ordinators are using Sciencenet to store all relevant project documents and databases. Marion Debin will provide e-mail addresses for Mike Brown and the Swiss representative to EFSA, their login credentials will then be obtained.

5.2) The project co-ordinators asked about the rules in relation to the presentation of the project findings at conferences and the publication of project findings. EFSA will ask the legal team for clarification of the rules and inform the project coordinators.

5.3) After contact with a member of the finance team it was determined that a amendment to the contract agreement will need to be made. Due to the delay between signing the agreement and arranging the kick-off meeting the final report will be ready 1.5 months after the project deadline. EFSA is in the process of initiating the agreement amendment.

5.4) It was agreed to finalise the date for presentation of the final report once the amendment to the contract agreement had been arranged.

2nd INTERIM MEETING
ON
BEE MORTALITY AND BEE SURVEILLANCE IN EUROPE

Date and place:

Date : **23rd September 2009**
Time : **From 13.00 to 16.00**
Place : **EFSA – European Food Safety Authority**
Largo N. Palli 5/A – 43100 Parma
(Meeting room: FRTA 01/039)

Agenda:

a) **Publication of results**

b) **Presentation of draft final report**

Task 1: Evaluation of MDW (Mortality, Weakening and Colony collapse) surveillance programmes in Europe

Discussion points:

1.a Table summarising countries excluded (reason), contacted, types of information received
1.b References to previous use of SNAT (Surveillance Network Analysis Tool) tool to evaluate surveillance programmes
1.c Data entry forms

Task 2: Compilation and analysis of surveillance data

Discussion points

2.a Data received from members of the consortium (Germany, UK)
2.b Section 3.4 more details on the ten indicators
2.c Summary table of indicators and definitions used in the programmes and datasets
2.d Temporal analysis

Task 3: Review and analysis of published literature

Discussion points

3.a Allocation of references to reviewers
3.b Comments on relevance criteria
3.c Explanation of probability degrees

3.d Priority 2 references

c) Report format

Template
Glossary

d) Meetings

Workshop - Paris 29-30 Sept
Final report presentation – Parma 18 Nov
Bee interservice group of the European Commission – Brussels ?27 Nov

e) Finance – project deadline 16 October 2009

f) AOB

Member's Name:	**Member's Address:**	**E-mail address:**
Philippe Prigent	Agence Française de Sécurité Sanitaire des Aliments (AFSSA)	p.prigent@afssa.fr
Marie-Pierre Chauzat	Agence Française de Sécurité Sanitaire des Aliments (AFSSA)	mp.chauzat@afssa.fr
Pascal Hendrikx	Agence Française de Sécurité Sanitaire des Aliments (AFSSA)	p.hendrikx@AFSSA.FR
EFSA		
Jane Richardson	Assessment Methodology Unit	Jane.richardson@efsa.europa.eu
Didier Verloo	Assessment Methodology Unit	Didier.verloo@efsa.europa.eu
Ana Afonso	Panel on animal health and welfare	Ana.afonso@efsa.europa.eu
Agnes Rortais	Emerging Risks	Agnes.Rortais@efsa.europa.eu

Minutes:

a) Publication of results

It was explained that EFSA would encourage the publication of the results in peer-reviewed journals. According to the agreement signed written approval by EFSA should be sought prior to any publication of information from the project. It was agreed that after the final report had been accepted by EFSA, posters, presentations and manuscripts would be uploaded into Sciencenet and the Scientific Officer informed. The Scientific Officer would then seek the necessary approval and subject to approval being granted provide a letter agreeing to the publication of the work. A link to the "published work" folder can be found below.

https://sciencenet.efsa.europa.eu/portal/server.pt/gateway/PTARGS_32_0_229_0_-1_47/http;/bea-aps.efsa.eu.int;11930/collab/do/document/overview?projID=79697&folderID=391470

b) Presentation of draft final report

Task 1: Evaluation of MDW surveillance programmes in Europe

- An update on the number of SNAT tools completed was provided. It has not been possible to contact the relevant person from Romania. The coordinators have contacted the Latvian beekeeping representative identified at Apimondia. They are awaiting the questionnaire from Austria.

- EFSA requested a summary table describing which countries were contacted, why countries were not contacted, the method of contact, whether information was provided and the types of information provided. The organisers suggested the inclusion in the table of a measure of completeness of the information.

- The organisers explained that the data capture forms had not be received from all countries, however they would include those available in the Appendix of the report

- The organisers will include references to previous use of the SNAT tool in the final report.

- The organisers explained that they wished to discuss further the assessment of the surveillance procedures with the consortium. They explained that they felt only five programmes were representative and that the programmes could be divided into either surveys and surveillance. They propose to include clear definitions for the concept of surveys and surveillance in the report. EFSA requested tables showing the number of programmes that fell into each category and tables summarising strengths, weaknesses and bias of the programmes and the number of programmes in these groups.

- There was a discussion about the ability of the SNAT tool to assess the sensitivity and specificity of the systems. The organisers explained that without further developments of the SNAT tool a quantitative assessment could not be made. They explained this was the first time the SNAT tool had been used without face-to-face contact between the assessor and the programme manager. They agreed to clearly state the limitations in the interpretation of the results from the SNAT tool.

Task 2: Compilation and analysis of surveillance data

- The organisers explained that they are still expecting data from some countries (UK, Spain, Italy).

- EFSA requested a description of each of the ten indicators captured in the database and the number of programmes that record this indicator. The organisers explained that the indicator, percentage winter losses, seemed the most suitable indicator to use in surveillance programmes. This indicator is more reliable as it is not substantially affected by bee keeping practices which

change the number of colonies monitored (dividing colonies, buying new colonies). EFSA asked about indicators for summer losses. The organisers explained this is rarely assessed and agreed to provide evidence from the SNAT and epidemiological database to support this.

- The organisers explained that due to the weaknesses of the surveillance system identified in WP1 the data should be interpreted with caution

- The organisers presented temporal analysis of the percentage winter losses for 2000 onwards where data was available. They also presented analysis from the programmes that were considered to be representative. It was noted that the representative programmes were all from Northern Europe and therefore could not be considered to representative for Europe as a whole.

Task 3: Review and analysis of published literature

- The organisers explained that references are still being read by the reviewers and so not all the reading grids have been completed. The organisers explained that only the priority 1 references will be reviewed, of these 112 references a few articles are unobtainable. The organisers will provide a complete list of references organised according to their reading priority in the appendix of the report.

- The methodology for the allocation of articles to reviewers was discussed. Each reference was only reviewed by one reviewer due the human resources available. It was agreed this could be source of bias and should be described in the report. It was explained that validation of the reading grids is performed during the data entry phase.

- The use of the probability degree was explained (row 22 of the reading grid), this variable describes the degree of belief of the author as to whether a factor causes colony losses. This is a subjective variable for use when statistical data is not included in the article

- The applicants explained that the screening for articles from the internet was difficult to perform. EFSA requested a matching analysis between the number of articles identified from internet screening and those articles identified by the consortium experts.

- EFSA requested the inclusion in the report of the number of references that were from primary research.

- When considering the causative factors assessed in the articles it was pointed out that some areas of research are well funded and produce many publications and others such as genetic diversity and bee keeping practices due to the organisation of the research system may generate few papers.

- The organisers proposed a descriptive summary of the literature. EFSA suggested reviewing the reporting methodology used in the study (Campylobacter in the UK) for which the reading grid was designed. It was

proposed that since detailed information had been extracted from the articles analysis of the number of articles by the criteria extracted in the reading grid should be included in the report, for example type of article, region covered, summary of available statistics, causative factors and indicators.

- The organisers explained that case definitions were unclear and frequently not used in the surveillance programmes, surveys and articles. EFSA requested a proposal for standardised case definitions for surveillance programmes and research to be included in the report.

c) Report format

- The organisers have a copy of the EFSA template for Article 36 projects. It was agreed that the organisers would provide EFSA with the final report on the 16 October 2009. EFSA would then provide comments in the following two weeks (deadline 1 Nov 2009). The organisers would then address these comments in time for the presentation of the final report on the 18 Nov 2008.

d) Meetings

- Workshop - Paris 29-30 Sept - Jane Richardson will attend this meeting from EFSA

- Final report presentation – Parma 18 Nov – The organisers will provide a presentation of the results of all three work packages – EFSA will extend the invitation to this meeting to heads of units and directorates

- Bee interservice group of the European Commission – Brussels ?27 Nov –The organisers are happy to present their results at this meeting – EFSA will contact the Commission to confirm the date of the meeting

e) Finance – project deadline 16 October 2009

- The AFSSA finance dept will contact Charles Picquet in the EFSA finance dept to ensure all relevant documentation have been submitted to EFSA by the 16 October 2009

APPENDIX 14. RESULTS OF THE COPA-GECA QUESTIONNAIRE SURVEY

Questions	AT	BE	DK	FI	FR (UNAF)	FR (SNA)
1. Do you receive information from the members of your association about problems in the health and production of their bee colonies?	Yes	Yes	Yes	Yes	Yes	Yes
2. Where are these problems located in your country?	Everywhere, mostly in intensive agricultural areas	Everywhere, mostly in intensive agricultural areas	No specific region	In all country	Mostly in intensive agricultural areas next to sunflowers and corns fields	Different areas: alsace, provence, alpes, rhone, ile de France
3. When did they appear?	losses usually appears fall/winter. 2002/03 greater losses and in the time when mais seed is treated with neonicotinoides	Ponctual from 1998 and generalisation from 2002	Winter spring 2007/08	Durring winter period	Starting in 1995 when the neonicotinoids appeared	4 years ago
Have you observed differences in the timing from on year to another?	no	Yes	No	Yes	Yes	Yes
If yes, give more details - (year X: Y% losses)		The localisation change from years to years and the intensity of the CCD		We make a questionnaire for our members every year and have contunieous data for 20 years. See file for last 10 years	before 1995 : 5% losses, from 1995 to 2008: 30% losses / year	It depends on the part fo the country; spring (march-april) rhone, alpes; autumn (end november)
4. What kind of problems it is observed?	Autum/Winter: Varroosis, combined with viruses; in spring, when mais seed ist treated with neonicotinoides	Springtime: depopulation, mortality, colony weakness unable to regain also if stimulated, loss of production; Summer: Instead of natural development,	Mortality	Mainly mortalities, caused b many reasons	Bees trembling, mortality of bees and colonies, decreasing colonies susceptible to pathologies, less of honey production	Mortality (march april), weak colony (january or october). Existance of Foulbrood or Sachbrood

Questions		AT	BE	DK	FI	FR (UNAF)	FR (SNA)
			decreasing colonies, bees trembling, susceptibility to pathologies requeening...				
5. How important are these problems?						very important problems	
	How many colonies are affected?	10 % winterlosses plus 3500 by neonicotinoidees (+ certainly a remarkable unknow figur not documented)	up to 80 % in the apiaries of a department	Spring 2008 - 33% loss	Average losses are between 10 and 15%	more than 30% of the colonies	10-40%
	How much does these colonies represent in the total of your country's production (%)?	3% (just pesticides without winterlosses)	Max 35 - 40 %	Due to strong build up of colonies estimate 20%		30%	15%
	How many colonies have approximately died in your country?	15% (varroosis + maize seed)	30.000	30.000 - 50.000	Annual average 5000-8000	40 000	-
	How much is approximately the loss of production (in Tonnes)?	900 to	700 t	Hives that survived gave normal yield		Honey importation : 6000T in 1993, 17000 in 2004. Stable consumption : 40 000 T	-
	How much is approximately the loss of production per hive (Kg)?	total production	total production		Average crop is 40Kg/hive	30 Kg or total production	-
	How much is approximately the loss of production (in Euro) per hive?	200	200		1/3 is sold to packers, this price is about 3,5 Euro/Kg rest is sold packed by beekeepers, average price for that is 8	120€ (honey) + 120€ (colony) = 240 €	-

Questions		AT	BE	DK	FI	FR (UNAF)	FR (SNA)
					Eruos (all prices without VAT). Average loss 260 Eutos/hive		
	Has the average lifespan of the queens changed?	no figures available	Yes	No	No	Yes	Yes, queens cannot stay more than 2 years and they lay only male eggs
	Has the percentage of requeening changed?	yes	Yes	No	No	Yes, more important	Yes, 15%
	Which loss percentage can be reached during winter (range, example: 5-95%)?	5 to 95	Locally from 5 to 95 %	33%	Winter 2003-2004 was the hardest more than 30% losses	5-70% locally	15-20%
	Which percentage of beekeepers in your country experienced losses of colonies larger than 50% in the worst year (please add the year)?		20%, in 2006				
	Which percentage of beekeepers in your country experienced losses of colonies larger than 90% in the worst year (please add the year)?		5%, in 2006				
	Have been observed any changes in the percentage of loss of beehives during winter in the last years?	no	Yes, it change every year	No	Yes		Yes

Questions		AT	BE	DK	FI	FR (UNAF)	FR (SNA)
	If so in what extend?		From 5 to 40% for the country	Copy of losses during many years attached	See file		In teh same area there can be a variation between 10-40%
	Have there been any changes in the number of beehives per beekeeper?	basicly not, but a lot of beekeepers with small hivenumbers stop keeping bees	Yes	Yes	Yes	Yes	Yes
	If so, what extend or percentage?		20 % in 10 years	Increasing with less beekeepers	Small beekeepers are decreasing, average amount of hives/beekeeper goes up	Professional beekeepers have got more beehives+ 30%	Most of professional increase the number of their hives from 15% to 30%
	Was it necessary to increase the number of beehives during winter in order to keep production in the same level?		Yes	Yes	No	Itisn't enough to keep the production in the same level . Chronics mortalities (environnement pollution) are too important	Yes
	If so, in which percentage?		15%			30%	15-35%
6. Has the origin or cause been officially identified?		partly	No	No	Yes, but not from all viruses	Yes	Yes
	If yes, which are them?	Viruses		Lack of pollen in late summer-autumn. Bad weather conditions in autumn-winter. Varroa and secondary diseases.	Varroa + viruses, Nosema ceranae, AFB, BBP (bad beekeeping practices)	For independants scientifics : Systemic insecticide lead to pathologies. For AFSSA : Multifactorial	Multifunctional: Environement and climate, varroa, but most important in the air, water and plants
	Do you agree with these causes?	partly			Yes	Yes	Yes
	If not, in your opinion, in which percentage do the						

Questions		AT	BE	DK	FI	FR (UNAF)	FR (SNA)
	following contribute as a cause for loss of beehives (%):						
	Varroa	10-20%	3 (2 - 10) %	30%	30%	30%	20-30%
	Nosemiosis		0,5 (0 - 2) %		30%	5%	<10%
	European Foulbrood		0		5%	5%	1%
	American Foulbrood		0,01		15%	5%	5%
	Total		± 3, 5 %				
	Climate		3 (0-10) %	30%	10%	5%	1%
	Pesticides	2-3%	8 (0-25) %			50%	20-30%
	Other		2(1-5)%	Lack of pollen 30%	10%		Pollution of air,water, ... 5%
7. Are you in contact / collaborating with any scientific project on the CCD matter?		yes	Yes	Yes	Yes		No
	If yes, please mention the name of the project	Project "Melissa" reguarding Pesticides + project "unexplainable beelosses" both by AGES	Projet of EFSA	Coloss	COLOSS		Annual questionnaire made to their members

Questions	IT (Conapi)	IT2 (Unaapi/AAPI)	IT3	LV	SE	UK
1. Do you receive information from the members of your association about problems in the health and production of their bee colonies?	Yes	Yes	Yes	Yes	Yes	Yes
2. Where are these problems located in your country?	Everywhere, mostly in intensive agricultural areas	Everywhere, mostly in intensive agricultural areas	2 out of 7 in Lombardia, in the provinces of Bergamo and Cremona showed serious problems of CCD	Everywhere, but more information are form beekeepers border region by Lithuania	Especially in areas/regions where varroa has been present fro 3-6 years	Everywhere in the UK. There are some areas such as Wales and Scotland which are more prone to losses due to adverse weather conditions (periods of cold/wet weather). As well as significant losses in each of the last three years there is also a problem with queen performance with many colonies having failing queens.
3. When did they appear?	Starting from 2000	Starting from 2000	Year 2008, first incidence. Year 2009, very hard damage (february-april)	2007, Autumn	losses usually appears fall/winter. 2002/03 heavy losses	2006/7 winter losses = 30%, 2007 summer queens failing after mating May/June. 2007/8 winter losses = 30%, 2008 summer queens failing after mating May/June. 2008/9 winter losses = 20%, 2009 summer queens from 2008 failing.
Have you observed differences in the timing from on year to another?	Yes	Yes	Yes	No	No	Winter losses are always counted in March/April. Summer queen performance tends to follow adverse weather during peak mating months.
If yes, give more details - (year X: Y% losses)	In 2009 they didn't outcome in corn fields areas, where this year seed dressing with neonocotinoids was prohibited (huge springtime mortalities recorded the previous years).	In 2009 they didn't outcome in corn fields areas, where this year seed dressing with neonocotinoids was prohibited (huge springtime mortalities recorded the previous years).	2008: fall in the number of hives by 5%. 2009: fall by 55%. Bees fly out of the cells and queen dies.			

Questions	IT (Conapi)	IT2 (Unaapi/AAPI)	IT3	LV	SE	UK
4. What kind of problems it is observed?	Springtime: depopulation, mortality, colony weakness, loss of production, bees trembling, susceptibility to pathologies; Summer: Instead of natural development, decreasing colonies, susceptible to pathologies and unable to regain also if stimulated	Springtime: depopulation, mortality, colony weakness, loss of production, bees trembling, susceptibility to pathologies; Summer: Instead of natural development, decreasing colonies, susceptible to pathologies and unable to regain also if stimulated	At the end of winter 2008/09 check of vitality has shown some dead beehives, other strongly declining and other normal	Mortality (unclear losses of colonies) Weakness of the colony	Higher mortality	Colony deaths in winter, bad mating/queen failure in summer. Diseases such as nosema, reported in up to 20% of colonies of some beekeepers
5. How important are these problems?						
How many colonies are affected?	35-40.000	100-200.000 (2008)	55%-60% were lost between early spring (already without families) and early april	Annual losses: 2600 colonies with not clear causes	15%-20% mortality of abour 125000 colonies	120,000 including diseases such as Nosema
How much does these colonies represent in the total of your country's production (%)?	20-30%	20-30%	33%	about 5%	?	30%
How many colonies have approximately died in your country?	20 000	60-80.000	35 000	Annually 5200-7800 winter losses, from these about 260-290 with unclear causes of death	15%-20% mortality of abour 125000 colonies	80,000 p.a. (30% of total)
How much is approximately the loss of production (in Tonnes)?	700	3-6.000	30Kg/hive	78-117 Tonnes	?	Average yields in UK are 20-40kg per hive, dependent on weather and location. In addition yields are affected by having to split colonies to make up numbers again.

Questions	IT (Conapi)	IT2 (Unaapi/AAPI)	IT3	LV	SE	UK
How much is approximately the loss of production per hive (Kg)?	30-35 Kg	30-35 Kg	30Kg/hive	0,015 T/hive	?	
How much is approximately the loss of production (in Euro) per hive?	90-100 Euros	90-100 Euro; Total 9-18 Mln Euros	105 Euros	36,75 Euro/hive	?	200 Euros
Has the average lifespan of the queens changed?	Yes	Yes	Yes, the queens after 3 years are not efficient any more	No	?	Yes – significantly shorter average life. More swarming / weak queen / drones affected by varroa/chemicals need investigating.
Has the percentage of requeening changed?	Yes	Yes	Yes, 5-10%	Yes	?	Yes – much higher rates of re-queening needed. No statistics available but 50% increase is reasonable
Which loss percentage can be reached during winter (range, example: 5-95%)?	190% **(?)**	90%	30%		About 20% some winters	30% - BBKA figures
Which percentage of beekeepers in your country experienced losses of colonies larger than 50% in the worst year (please add the year)?						
Which percentage of beekeepers in your country experienced losses of colonies larger than 90% in the worst year (please add the year)?						
Have been observed any changes in the percentage of loss of beehives during winter in the last years?	Yes	Yes	Yes	Yes	Yes	Yes
If so in what extend?	From 5-10% to 20-30%	From 5-10% to 20-30%	30%	Some 2-3%	From 10%-12% to 15%-20%	Historically average winter losses have been around 5%

Questions		IT (Conapi)	IT2 (Unaapi/AAPI)	IT3	LV	SE	UK
	Have there been any changes in the number of beehives per beekeeper?	Yes	Yes	Yes	Yes	Yes	No significant changes because beekeepers tend to use summer months to try and make up numbers. However many older beekeepers are giving up and not making up numbers.
	If so, what extend or percentage?		Professional beekeepers owerwintes 30% of colonies in addition; More hives kept during active season	55-60%	Some 10%	Generaly higher number of hives/beekeepers	
	Was it necessary to increase the number of beehives during winter in order to keep production in the same level?	Yes	Yes	Yes	No	Yes	It has not been possible to make up numbers and keep production levels up. In general, where a beekeeper has made up numbers production has halved. Overall production of UK honey is down by 30-40% over the last 3 years. The period in which increase can be made is limited to April-July. Beekeepers generally have insufficient equipment, time or bees to over-increase colonies in anticipation of winter losses.
	If so, in which percentage?	25-30%	25-30%			Replace the losses with teh same number as lost	
6. Has the origin or cause been officially identified?		Partly	Partly	No	No	?	The National Bee Unit tracks notifiable diseases using test kits and has very good diagnosis laboratories. There have been outbreaks of disease (Scotland EFB/AFB 2009) in areas that do not usually have disease and overall there has been an significant increase in detected cases of Nosema. Varroa remain implicated in many instances of colony loss.

Questions		IT (Conapi)	IT2 (Unaapi/AAPI)	IT3	LV	SE	UK
	If yes, which are them?	Pathologies (varroa); Pesticides (neonicotinoids)	Pathologies (varroa); Pesticides (neonicotinoids)				
	Do you agree with these causes?	Yes	Yes		No		Yes
	If not, in your opinion, in which percentage do the following contribute as a cause for loss of beehives (%):						
	Varroa	50	50		80%	80%	90%
	Nosemiosis	10	10			2-5%	20%
	European Foulbrood						3%
	American Foulbrood					<1%	close to 0%
	Total	60	60				
	Climate	40	40				significant factor but % effect not known
	Pesticides						No - There is no confirmed evidence that in recent years correctly used plant protection products have been a cause of loss of beehives in the UK.
	Other					15%	There are a limited number of instances each year, typically less than 5 (0.01% losses), of incorrectly or maliciously used pesticides affecting honeybee colonies. There has been a downward trend in reported incidents over the last 30 years. There are currently two cases under investigation.
7. Are you in contact / collaborating with any scientific project on the CCD matter?		Yes	Yes	No	No	Yes	

Questions		IT (Conapi)	IT2 (Unaapi/AAPI)	IT3	LV	SE	UK
	If yes, please mention the name of the project	Progetto Apenet http://www.reterurale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/861	Progetto Apenet http://www.reterurale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/860			COLOSS-Cost action FA0803	The National Bee Unit is working with EU research institutions, as are bee researchers generally.

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QUESTIONNAIRE ABOUT COLONY COLLAPSE DISORDER (CCD)

During our last meeting of the WP on Honey we had the chance to hear the EFSA projects on beekeeping, mainly those dealing with Bee Colony Decline. The importance of having beekeepers involved in studies and projects was highlighted, due to the additional input that years of experience on the field can bring. Therefore, we hereby send you a short questionnaire about the situation in your country regarding bee colony decline. P lease give as more detailed information as you can. It should be sent back to m e (noa.simon@copa-cogeca.eu) duly completed by the 15th of August 2009.

When you send your information to me, please attach any other publication, study, data that your organisation/you might have done or know about.

1. Do you receive information from the members of your association about problems in the health and production of their bee colonies?

☐ Yes

☐ No

If yes, please go to question 2.

If no, please go to question 8.

2. Where are these problems located in your country? (everywhere, or specify regions)

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3. When did they appear (year and season)?

Have you observed differences in the timing from one year to another?

☐ Yes

☐ No

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If Yes, give more details.

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4. What kind of problem it is observed? (ej. Mortality, weakness of the colony, loss of production, sensibility to pathologies, etc.)

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5. How important are these problems?

a. How many colonies are affected? ---

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b. How much does these colonies represent in the total of your country's production (%)?

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c. How many colonies have approximately died? ---

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d. How much is approximately the loss of production (in Tonnes) per beehive?

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e. How much is approximately the loss of production (in Euros) per beehives?

☐ Yes

☐ No

f. Has the average lifespan of the queens changed?

If so, in what extend? ---

---

g. Has de percentage of requeening changed?

☐ Yes

☐ No

If so, in what extend? ----------

h. Which loss percentage can be reached during winter? ----------

i. Have been observed any changes in the percentage of loss of beehives during winter in the last years?

☐ Yes

☐ No

If so, in what extend? ----------

j. Have there been any changes in the number of beehives per beekeeper?

☐ Yes

☐ No

If so, in what extend or percentage? ----------

k. Was it necessary to increase the number of beehives during winter in order to keep production in the same level?

☐ Yes

☐ No

If so, in which percentage? ----------

6.Has the origin or cause been officially identified?

☐ Yes

☐ No

If yes, which are them?

Do you agree with these causes?

☐ Yes

☐ No

If not, in your opinion, in which percentage do the following contribute as a cause for loss of beehives:

a. Varroa (%)

b. Other diseases

i. Nosemiosis (%)

ii. European Foulbrood (%)

iii. American Foulbrood (%)

iv. Total (%)

c. Other causes(%)

i. Climate

ii. Pesticides

iii. Other

7. Are you in contact/collaborating with any scientific project on the CCD matter?

☐ Yes

☐ No

If yes, please mention the name of the project:

Thank you very much!!

APPENDIX 16. LIST OF CONTACT PERSONS OF THE SURVEILLANCE SYSTEMS IN EUROPE

Country	Name of contact person	Organisation	Address
AT	Dr. Elisabeth Marsch	Austrian Federal Ministry of Health	department II/B/6 Tierschutz, Tierseuchen- und Zoonosenbekämpfung Radetzkystraße 2, 1030 Wien Austria
BE-Fl	Dries Laget	Informatiecentrum voor Bijenteelt	Krijgslaan 281, S33, 9000 Gent, Belgium
CH	Jean-Daniel Charrière	Agroscope Liebefeld-Posieux ALP Swiss Bee Research Centre	3003 Bern
CZ	Dalibor Titera	Czech Beekeepers Union (CBU)	Křemencova 8 CZ 115 24 Praha 1 Czech Republic
DE	Werner von der Ohe	Arbeitsgemeinschaft der Bienenwissenschaftlichen Institute	Herzogin-Eleonore-Allee 5 29221 Celle
DK	Per Kryger	University of Aarhus, Depart IPM	University of Aarhus, Research Centre Flakkebjerg, Forsøgvej 1, 4200 Slagelse, Denmark
EE	Arvi Raie	Veterinary and Food Board of Estonia	Väike-Paala 3, 11415 Tallinn
ES	Luis Jose Romero Gonzales	Unit of Primary Sector Health Ministry of environmental and rural and marine affairs (from now on MARM)	C/Alfonso XII nº 62 Floor 1 MADRID 28014
FI	Heikki Vartiainen	Finnish Beekeepers Association	Kasarmikatu 26C34, 00130 Helsinki, Finland
FR-Pbl	Paquita Mancho	Direction générale de l'alimentation - Ministère de l'agriculture et de la pêche	251 rue Vaugirard 75015 PARIS
FR-Pro	Fabrice ALLIER	CNDA	149 rue de Bercy, 75595 PARIS Cedex 12
GB-E&W	Mike Brown	The Food and Environment Research Agency (FERA) National Bee Unit	FERA National Bee Unit, Sand Hutton York, North Yorkshire, England YO 41 1LZ
GB-Sco	Nick Ambrose / Peter Johnston	Scottish Government Animal Health and Welfare Division – Rural Directorate	Pentland House, 47 Robbs Loan, Edinburgh, EH1TY
GB-Nir	Thomas Williamson	Department of Agriculture and Rural Development	Dundonald House Upper Newtownards Road Belfast BT4 3SB Northern Ireland, UK
GR	Fani Hatjina	Hellenic Institute of Apiculture (NAGREF)	N. Moudania, 63 200 Greece
HR	Nikola Kezić	Faculty of Agriculture University of Zagreb, Department for fishery, beekeeping and special zoology	Svetosimunska cesta 25, 10000 Zagreb, Croatia
HU	Tamás Bakonyi	Faculty of Veterinary Science, Szent István University	István u. 2, H-1078 Budapest
IT	Gaetana Ferri	Ministry of Employment Health and Social Affairs, Department of public veterinary health nutrition and food safety	Via G. Ribotta, 5 00144 Roma
LU	A. Huberty	ASV : State veterinary services	211 route d'Esch BP1403 Luxembourg
NL	Romée van der Zee	ICR Beemonitoring (Netherlands Centre for Bee Research)	Durk Dijkstrastr. 10, 9014 cc Tersaal

Country	Name of contact person	Organisation	Address
NO	Bjørn Dahle	Norwegian Beekeepers Association	Dyrskuevegen 20, 2040 Kløfta, Norway
PL	Grazyna Topolska	Warsaw University of Life Sciences – SGGW (WULS - SGGW)	Nowoursynowska 166, 02-787 Warsaw, Poland
SE	Preben Kristiansen	Swedish Beekeepers Association	Trumpetarevägen 5, SE-59019 MANTORP
SI	Masa Zagar	Beekeeping Association of Slovenia – public extension service for beekeeping	
SK	Ján Kopernický	Institute of Apiculture in Liptovský Hrádok	Gasperíkova 599, 033 80 Liptovský Hrádok