

Apimondia

Working for the benefit
of bees and apiculture







PRESENTATION

The genesis of this publication is somewhat peculiar as the idea of producing something for the benefit of bees and beekeeping had been simmering in Apimondia for quite some time without seeing the light at the end of the tunnel or a possible announced date of birth.

Then a flash! What best opportunity to address these issues in conjunction with the first celebration of the World Bee Day!

At that point and on the wings of the consensus of all the members of the Executive Council of Apimondia everything went very swiftly.

This publication is a first and therefore still suffering from some inevitable teething problems, not last the fast timespan in which it saw its birth as it was concocted and assembled in a very short time to meet the deadline of 20 May, World Bee Day.

The next editions will certainly be more polished and also have a bit more ambition in the messages that they purport to deliver.

The scientific contributions in this publication are the expression, by all means not exhaustive of the entire spectrum of apicultural issues at stake, of the various and most important themes that revolve around the apicultural sector in different scientific domains as well as geographical regions. We only tried to put them nicely and conveniently all together in a single and hopefully useful publication.

There is not one single way of practicing beekeeping round the world that fits all scenarios. There is instead a host of different realities that need to be properly and consistently contextualised to ensure that beekeeping thrives in a sustainable fashion and passes the hard test of time against the reckless assaults that mankind is delivering to the environment and to the bees.

Our hope and wish is that this collection of insights, reflections and informed recommendations from the experts of Apimondia may act as a guiding and reference tool for all those who operate as policy-makers or hold stakes in the apicultural sector wherever they are located.

Respecting the bees entails taking very good care of the environment thus ensuring a bright and sustainable future also to mankind in the process.

Riccardo Jannoni-Sebastianini
Secretary-General of Apimondia



KEY MESSAGES FROM APIMONDIA

The list of issues that impact beekeepers globally continues to grow, become more complex and ever more interrelated.

The Executive Committee of Apimondia recently spent time examining bee and beekeeping related issues and trying to prioritise the impact of the issues on beekeeping globally.

Whilst this list is not designed to be totally exhaustive, it is clear that there are five main issues that impact all regions of the world. Apimondia is focusing on some of the biggest issues facing beekeepers and discussion of global issues helps people around the world find global solutions to these problems. Greater global collaboration, leadership, focus and actions can help to lessen their impact on beekeepers and through this improve the outlook of food security for all.

Perhaps the greatest challenge for beekeepers is operating in an **environment of increasing agricultural intensity negatively impacted by climate change**. The landscape for bees is being driven by the dilemma of feeding a growing global population. Never before has the environment for bees become so hostile in so many parts of the world. The impact is keenly felt for beekeepers as they navigate issues such as pesticide and chemical use and their impact on bees. Apimondia also notes that the issue of the environment is in many ways the most challenging to solve but we must continue to strive for a better environment for our bees to exist and thrive.

The next challenge to the viability of beekeeping is that of **honey fraud (adulteration) in all its various forms and declinations**. Adulteration of honey (and bee products more generally) and the impact on the market it produces has led to dysfunctional beekeeping economics in almost every corner of the world. Honey fraud threatens the basis upon which natural quality beehive products compete and sadly much of the value chain is still blind to the threats of fraudulent honey and bee products. Apimondia will play an increasingly important role in driving solutions to honey fraud into the future as it is the voice that represents the beekeepers globally.

Apimondia recognises that the key to solving many of the challenges facing beekeeping and bees lies in the hands of **increased awareness of both the public and policy makers** across many topics. To this end we can not focus enough on strategies that improve awareness and lead to a more informed and educated global community who hold the bee at the core of food production and food security. The World Bee Day represents an ideal and vast-echoing forum for delivering messages on the state of health of the apicultural sector.

Probably eternally on the list of issues impacting bees will be that of **bee health, nutrition and biology**. The key scientific role that Apimondia plays in supporting a network of scientists and beekeepers whose lives are devoted to advancing knowledge and practices that lead to better health is crucial. Apimondia reckons that progress in these areas will be achieved through strategic partnerships to aggregate on an international scale both knowledge and financial resources to be put at the service of these key issues.

On a more positive note beekeepers do have control of many factors. Improvements in **good bee-keeping practices** and advancing knowledge helps beekeepers to do everything within their own control to take good care of their bees and improve the returns from their efforts or businesses. To this end Apimondia's networks and members play are able to provide leadership and disseminating real life examples of best practice.

Apimondia through a strategic planning process is currently exploring the best ways to build strategies to help build the profile of Apimondia and grow the peak body of the beekeeping associations of the world in a way that meets the fast paced, constantly changing beekeeping community. It is clear that Apimondia needs to play a larger role than that of organising the congresses for which it has become world renowned.

The celebration of World Bee Day is an incredible opportunity to inform people about the issues beekeepers face and will act as an increasingly important annual tool to build public awareness.

World Bee Day helps sow the seeds within the broader community to bring changes at all levels. Whilst ever our focus remains with the bee we can be sure that all of our interests will be well served.





THE HUMBLE HONEY BEE

One of the most exciting developments in beekeeping today is the recognition of the importance of the honeybee. In December 2017 at the United Nations in New York 'World Bee Day' was officially announced for the 20th May. Great credit is due to our colleagues from Slovenia for their efforts in having 'World Bee Day' declared.

Throughout history beekeeping has been part of mankind's development and in practically every century new innovations were identified. We know that the Egyptians were practicing a form of beekeeping around 2400 - 2600 years ago during the time of the 'Old Kingdom'. From drawings and writings, we know that the power of fire and smoke was identified, beekeepers were depicted blowing smoke into hives as they removed the honey-combs. The honey would then be stored in earthenware jars.

Coming forward to the sixteenth century we learned that the Spanish brought the first European honey bees to South America. Through the seventeenth and eighteenth century we had major developments not least of which was the movable frame hive. George Wheler, Johann Dzierzon and Lorenzo Langstroth all added to what we now regard as modern day beekeeping. So, beekeeping continues to evolve. Across the world we continue to see the rise of '*natural beekeeping*', otherwise known as '*bee-friendly*' or '*api-centric beekeeping*'. This has, in turn, resulted in the developments of different kinds of hives, intended to allow the bees to build natural combs.

The importance of the honeybee in pollination is now recognised globally and much of our food, and indeed some fabric being produced, depends on pollination. With all this development our beloved honeybee perhaps did not get the recognition it deserved.

Apimondia, through its Scientific and Regional Commissioners, give an over view of the developments in Beekeeping globally. Beekeeping Economy, Bee Health, Apitherapy, Bee Biology, Technology & Quality, Rural Development and Pollination & Bee Flora - each addresses the issues facing beekeepers and give you an overview of the work being done on a global scale as we now face new challenges that affect not only the honeybee but also mankind itself. Each of our five Regional Commissioners can identify, in their respective areas, the difficulties that face our membership and give guidance and leadership when and where required. As the world leader in beekeeping, Apimondia, at each of its congresses, has been to the fore in presenting solutions to the myriad of problems now facing the honeybee, but we need to address these problems to the wider public.

The announcement of 'World Bee Day', approved in December by the United Nations, brings the honeybee and its importance to a whole new audience. Recognition for the fact that honeybees play such a critical role in pollination of various plants and crops, their decline across the globe means a growing risk to the nutrition of people living in areas most dependent upon those foods. They are critical pollinators: they pollinate 70 of the around 100 crop species that feed 90% of the world. Honeybees are responsible for \$30 billion a year in crops. We may lose all the plants that bees pollinate, all the animals that eat those plants and so on up the food chain.

Philip McCabe
President of Apimondia

CONTENTS



» p. 11



» p. 19

- 3 **PRESENTATION**
- 4 **KEY MESSAGES FROM APIMONDIA**
- 7 **MESSAGE FROM THE PRESIDENT OF APIMONDIA**
- 11 **ON THE INITIATIVE OF SLOVENIA 20TH MAY WAS DECLARED WORLD BEE DAY BY THE UNITED NATIONS**
Peter Kozmus
- 15 **APIMONDIA AN IMPORTANT MEETING PLACE**
Asger Søgaard Jørgensen
- 19 **AFRICA ARISING**
David Mukomana
- 23 **ISSUES OF CONCERN FOR BEEKEEPERS IN THE AMERICAS**
Misael Cuevas Bravo
- 29 **ASIA IS A HAVEN FOR BEES**
Cleofas R. Cervancia
- 33 **EUROPE: THE STATE-OF-THE-ART AMIDST THREATS AND OPPORTUNITIES**
Diego Pagani
- 37 **OCEANIA: REGIONAL INFORMATION AUSTRALIA & NEW ZEALAND**
Jodie Goldsworthy and Maureen Maxwell

International Federation of Beekeepers' Associations - Apimondia
www.apimondia.org

- 43 **APITHERAPY
CURRENT SITUATION AND PERSPECTIVES**
Cristina Mateescu
- 47 **HONEY SCIENCE**
Karl Crailsheim
- 51 **BEEKEEPING AS A SOURCE OF WELL-BEING**
Nicola Bradbear
- 57 **APICULTURE,
THE CHALLENGES OF TOMORROW**
Etienne Bruneau
- 61 **CURRENT SITUATION
OF THE INTERNATIONAL HONEY MARKET**
Norberto García
- 65 **THREATS AND IMPORTANCE OF BEE POLLINATORS
IN HUMAN-DOMINATED LANDSCAPES**
Fabrice Requier
- 69 **CHALLENGES TO HONEY BEES FROM PEST AND DISEASES**
Jeff Pettis
- 72 **GOOD BEEKEEPING PRACTICES (GBPs)
AND DISEASE PREVENTION**
Jorge Rivera-Gomis et al.



» p. 43



» p. 57



ON THE INITIATIVE OF SLOVENIA
20TH MAY WAS DECLARED

WORLD BEE DAY

BY THE UNITED NATIONS

Peter Kozmus



On 20th December 2017, 20th May was declared World Bee Day by the General Assembly of the United Nations in New York. This concluded a lengthy process, which started in 2014.

Numerous institutions had taken part in it and through it all it was clear that the saying World Bee Day unites Slovenians and connects the world is true - this was uttered by State Secretary Tanja Strniša, MSc, when the idea was presented in 2015 in Brussels

THE ROLE OF BEES

Bees and other pollinators are of extreme significance for the lives of people. As much as one third of food produced in the world depends on pollination and bees hold the most important role in this among all pollinators. Among other things, pollination makes it possible to have agricultural production that guarantees safe food supply and bees with their highly nutritious products are also important contributors to better food quality for people.

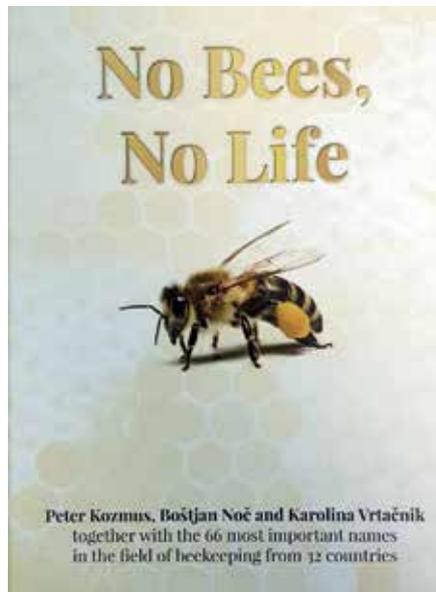
WIDER SIGNIFICANCE OF POLLINATION

Through pollination bees have positive effects on the whole ecosystem and the related preservation of biodiversity. Biodiversity is the key to the development and preservation of natural environment. Among others things, it provides food, oxygen, it purifies our water and air, it keeps the weather and climate stable and helps improve the capability of adapting to chan-

ges. Apart from that, bees are a good bioindicator of environmental conditions. By monitoring their development and health we can make assessments as to when something is going on in a particular environment and when an action has to be taken. If we fail to react to warning signs in time, the later consequences can be even more devastating. Apart from that, bees are important for many other reasons, which are presented in the new book *No bees, No Life*.

THE ENDANGERMENT OF BEES

Recently bees and other pollinators are becoming more and more endangered, especially in areas with



intensive farming. Their habitat is changing and shrinking, and this makes their living and development conditions poorer and poorer. Due

to increasing areas of land with single-crop farming and due to the changed and more intensive grass production technology there is less and less land with nectar plants; what is more, it provides bees with the necessary food of poorer variety than in the past and during shorter periods only. Apart from that, bees face global climate change, new diseases and pests, globalisation and several other threats.

People are not aware enough of these and other facts and this is one of the main reasons we need World Bee Day.

WHY 20TH MAY?

20th May was proposed because this is the birthday of Anton Janša



(1734-1773), a well-known pioneer of modern beekeeping and one of the leading experts on bees of his time. He was the first teacher of modern beekeeping in the world because he was appointed a professor at the new beekeeping school in Vienna by the Austrian Empress Maria Theresa. His work and life is described in many books on beekeeping, including *Svetovna zgodovina čebelarjenja (Global Beekeeping History)* published in 1999.

FROM THE IDEA TO THE DECLARATION

More than three years have passed from coming up with the idea to the declaration. Neither of us involved in making this happen knew at the beginning that the whole process would be so demanding and time-consuming. Between the idea and the declaration, therefore, many steps were taken; many events, meetings, visits etc. took place that helped us reach the final goal. The Ministry of Agriculture, Forestry and Food (MAFF) was involved in many activities during the whole process; to promote the initiative it also built the Bee World pavilion, which thrilled numerous visitors at various events, particularly outside Slovenia. These are the main steps or rather milestones in the process from the start until the final declaration:

14.09.2014. The Slovenian Beekeepers' Association (SBA) President comes up with the idea for World



Bee Day Declaration Initiative.

26.09.2014. The Minister of Agriculture Dejan Židan, MSc, from MAFF expresses his support for the idea.

6.10.2014. The idea receives support from Borut Pahor, the President of Slovenia.

2.04.2015. The Slovenian government, on the initiative of MAFF, approves the initiative and appoints an inter-ministerial working group to carry out the whole process.

10.6.2015. The initiative is presented to the Director-General of the Food and Agriculture Organization of the United Nations (FAO), Mr José Graziano da Silva, and to the countries associated with the FAO Regional Offices.

15.09.2015. At the 44th International Apicultural Congress in Daejeon, South Korea, the initiative receives support and endorsement from the largest international beekeeping organisation Apimondia.

30.09.2016. The presentation of the initiative to the Committee on Agriculture at the Food and Agriculture Organization of the United Nations (FAO) in Rome (1st step of the formal procedure within FAO).

9.12.2016. The presentation of the initiative to the Council of the Food and Agriculture Organization of the United Nations (FAO) in Rome, Italy (2nd step of the formal procedure within FAO).

7.07.2017. The support of FAO at the ministerial conference.

20.12.2017. In New York, United Nations declares 20th May World Bee Day.

Further information on World Bee Day (WBD), past and upcoming events, important milestones, along with various e-materials that may be useful for event organisers, is available on the following webpage: www.worldbeeday.org/si

CELEBRATING WORLD BEE DAY

The main purpose of celebrating World Bee Day is threefold:

1. making people aware of how important bees are for our survival,
2. becoming acquainted with current issues in protecting bees, and
3. informing the public about measures that have to be taken by all of us so that bees will have a better chance of surviving in the future.

Not enough has been done for the bees by simply establishing the WBD and most of the work is still unfinished. Celebrating WBDs is an opportunity that can be used to good advantage by organisations involved in beekeeping. In this respect, it would be great if as wide a public as possible was included in order to help us improve conditions for the survival of bees as best as it can and in the process of

us human beings too. Not only big steps matter here, each and every one who improves the survival of bees counts.

ACTIONS WE CAN TAKE TO IMPROVE THE SURVIVAL OF BEES:

- plant native nectar plants (the list can be obtained on SBA's web page);
- use nectar plants for decorative purposes (on balconies and other areas outside);
- preserve old meadows with greater plant variety;
- sow meadows with nectar plants.
- only mow the blossoming meadows after blooming;
- buy honey and other hive products at the nearest beekeeper;
- give moral support to beekeepers;
- set aside a suitable piece of farmland available for bees on a temporary or permanent basis;
- limit the use of pesticides that are harmful to bees;
- mow blooming plants in orchards and vineyards before spraying with pesticides.

The above-mentioned options are not suitable for everyone but I believe that each person can look through them and find an idea about what he or she can do in future to help bees survive. If we come up with ideas and then put them into practice, World Bee Day will serve its purpose.

Peter Kozmus

Vice-President of Apimondia

APIMONDIA

AN IMPORTANT MEETING PLACE

Asger Søgaard Jørgensen



*Former President
of Apimondia
1999 - 2009*

Now:

*Voluntary assistant
to the management*

*Read more about
the organisation on
the website:*

www.apimondia.com



This year Apimondia celebrates its 121 years of existence.

Many changes have happened since the first International Apicultural Congress was held in 1897 in Brussels in Belgium. But the vision of the organisation as been unchanged.

- To bring everybody involved in apiculture together irrespective of nationality, race, religion, political standpoint or other issues that so easy create borders between people.
- To facilitate the exchange of

information between practical beekeepers and scientists. In order to give the beekeepers access to the best scientific advice and to bring the experiences and problems faced by the beekeepers to the attention of the scientists.

These objectives are still evident at the many meetings organised under the umbrella of Apimondia.

The biannual congresses with thousands of participants are unique compared with the other scientific congresses, as the participants represent all aspects of the sector from small scale beekeepers to large scale producers, the bee breeders, the honey traders, the manufactures of equipment and the scientists. Lots of information is shared, lots of discussions and lots of friendships across borders are established.

In the years between the congresses, an increasing number of specialist symposia and conferences are mainly joined by scientists and advisors.

During the last decades the impor-



Through Apimondia beekeepers make friends worldwide. Here a group of Danish beekeepers visiting beekeepers in Argentina.

tance of Apimondia as an international Non Governmental Organization has increased.

Recently the importance of Apimondia has been shown in the actions taken to investigate the pro-

blems caused by the neonicotinoid pesticides. A problem that was strongly raised by practical beekeepers, who experienced massive losses of bees.

The declaration of the “World Bee

Day” by the United Nations is another example on how the actions taken by a member organisation “The Slovenian Beekeepers’ Association” with the support of Apimondia is fulfilled with success. Important to notice is that it is not just an international honeybee day. But it is a day for all bees that contributes to the pollination of plants. Just now problems with adulterated honey in the market represent an important issue that needs the close cooperation between beekeepers and scientists. Scientific studies are needed to find ways to unravel the falsifications and the lobbying on the authorities from the beekeepers to take action in order to be able to guarantee the quality of the product from apiculture.

Honey and other products from apiculture are important commodities and remedies as food supplements. But even more important is the value of bees as pollinators of agricultural and horticultural crops worldwide.



At the Apimondia symposium in Hanoi, Vietnam, the representative of FAO, Mr. HZ Lea, visited a bee yard with *Apis cerana*.

Asger Sogaard Jørgensen
Former President of Apimondia





AFRICA ARISING

David Mukomana



The African Regional Commission has been invited to attend the International Meetings of Young Beekeepers with the intention of discussing and coming up with ways of generating interest in beekeeping among the African youths.

Africa is one of the continents full of hope, potential and massive opportunities in Beekeeping that the world can take note of. Blessed with its natural forests, vast tracks of land, good bee-friendly all year-round weather conditions and natural bees make Africa the place to get bee products that are of high quality.

With the increased awareness of the potential in beekeeping, many communities in Africa have embraced initiatives governments and Development Partners have embarked on to uplift the lives of many people in rural Africa. It is with these positive developments that a number of African countries are recording higher increases of honey and bees wax exports, contributing significantly to foreign currency earnings to their economies. Of note is Ethiopia, Uganda, Tanzania and Zambia.

There are many challenges other regions are facing that has seen a decline in bee colonies. These in-

clude bee diseases, harsh weather conditions, excessive use of agro-chemicals and rapid industrialization that is taking away the natural habitat for the bees. Yet African bee colonies are increasing. The organic increase of bee colonies in Africa has seen it maintain the quality of honey that is pure and natural, free of traces of excessive antibiotics and agro-chemicals.

Governments throughout the region have realized the potential in bees as a mitigation measures for:

1. Poverty Eradication.
2. Environmental Conservation.
3. Food security.
4. Rural development.

As such, greater attention is now given to beekeeping and the honey sector resulting in a number of educational campaigns and channeling of resources towards funding beekeeping projects. Countries such as Nigeria have identified Apiculture as the economic driver. Tanzania has institutions within the Ministry of Forestry that deals with



Picture of community including Traditional Leaders, School Heads, Ministry of Education officials and School children who attended a recent Beekeeping Meeting at Muzokomba Government High School - Zimbabwe where the Regional President for Africa addressed them on the need to start beekeeping at schools in line with the New Education Curriculum in Zimbabwe.

beekeeping. Ethiopia is another example. Botswana has a Beekeeping Division within the Ministry of Agriculture. South Africa is the same with a special section within the Department of Agriculture, Forestry and Fisheries.

The surge in global demand for natural honey and bees wax has seen many African beekeepers see the potential to grow their activities organically. The African bee colonies are increasing and the demand for African honey and bees wax are surging.

To complement the efforts of African governments, there are a number of Not-for Profit organizations that have added their weight to the development and commercialization of beekeeping in Africa. ApiTrade Africa is one such organizations that is doing immense work in marketing and connecting African honey regionally and internationally. A number of Api-Expos have been held with massive re-

sults in the host countries. Uganda, Zambia, Ethiopia, Zimbabwe and Rwanda have hosted the previous Api-Expos and the results are evident, resulting in a rush by a number of countries seeking to host the next Expositions.

Nigeria is hosting the Api-Expo 2018 in the month of September 2018 where the attendance is expected to bit the previous largest gathering of 3,000 delegates in Ethiopia in 2012.

ApiTrade Africa is also making inroads in terms of marketing African beekeeping and honey industry through the African Honey Magazine (AHM) that is published quarterly. This publication provides a platform for stakeholders to share their experiences across the Apiculture sector and is widely circulated electronically and hard copies.

Africa has been slow in terms of holding Apimondia events: with an international congress held in 2001 in South Africa and one symposium held in Tanzania in November

2014; the second one planned for December 2018 in Addis Ababa - Ethiopia. A lot of work has already begun and plans are at an advanced stage to see this symposium record a success under the theme "The Role of Bees in Food Production". Seeing the results of the past symposium and the extent of the benefits other regions are getting from having a number of symposia regularly, the African Regional Commission has plans to have the region host at least one symposium every year so the rate at which Apiculture information is disseminated covering all the seven Apimondia Scientific Commissions is doubled.

The excitement in Africa about beekeeping can be rightly measured by the sharp increase in the number of enquiries from African Countries on the possibility of hosting Apimondia Congress in the near future. Governments and Stakeholders alike have been making efforts to establish how they can host Api-



David Mukomana - Apimondia Regional Commission for Africa President (left) and Mr T. Mutomba from Ministry of Education - Zimbabwe (right) with Munyaradzi Benzi (middle), one of the pupils selected to attend International Meeting of Young Beekeepers (July 2018) in France.



Mr Mathew Chigere - Apiculture Specialist responding to questions on bee pests and diseases in Zimbabwe

mondia events so as to boost their Apiculture sectors. This shows the effectiveness of the marketing and publicity various stakeholders are making about the benefits of beekeeping to the environment and the economies.

The African Regional Commission has been invited to attend the International Meetings of Young Beekeepers with the intention of discussing and coming up with ways of generating interest in beekeeping among the African youths. As such a number of African countries have been invited to attend the France meeting in July, a strategy the African Regional Commission takes seriously. So much so the commission would like to see the participation of African countries rise from just three to at least 15 by 2021.

Africa is excited about the World Bee Day. This day will bring more awareness of the importance of the bee and especially the African Bee that needs to be protected and preserved given the massive advantages attached to it. Celebrating the 20th of May each year will see a massive boost in Apiculture activities as well as a stop to the decline in natural forests in Africa when communities realize the potential they have to earn a living from these forests and the bees.

David Mukomana
President
Regional Commission
for Africa



ISSUES OF CONCERN FOR BEEKEEPERS IN THE AMERICAS



The experience gained in sanitary pilots highlights the need to promote and encourage monitoring and coordinated treatments among beekeepers

Among the issues of relevant concern of continental beekeeping is the growing vulnerability to which our bees and pollinators in general are exposed; mortality rates of hives in the apiaries have increased, mainly associated with causes linked to the indiscriminate use of pesticides, the lack of nutrition due to large areas of monoculture, the presence of parasites mainly varroa, among other causes. From the regional perspective, the following points of concern can be considered.

1. REDUCTION OF PRODUCTIVE SPACES

Bearing in mind the role assigned to Latin America in the global context associated with the production of raw materials and food for the world, in rural areas the presence of large extensions of monocultures managed mainly by multinational corporations has intensified, which directly impacts on the local econo-

mies and has very negative effects on the biodiversity of the territories. Beekeepers are affected by productive spaces because monocultures are a green desert for bees and pollinators in general. Bees do not find the diversity of nutritional elements for their maintenance, development and defense.

As organised beekeepers we have carried out diverse actions of public visibility, informing the citizens and authorities of our concern in this matter.

2. MORE COMPLEX ENVIRONMENTS FOR PRODUCTION

The current development model and monocultures in particular are characterised by the intensive use of pesticides and chemical products. The trend in Latin America is to increase the use of agrochemicals with low regulations and oversight for their import and applica-

tion, the above not only affects the bees and pollinators but also leaves its footprint on the deterioration of the environment affecting the health of the land and waters. Biodiversity is lost and risks in the quality of products and the health of people are increasing. Beekeeping organisations from various countries in the region have held public events to protest against this issue.

3. INCREASE IN PRODUCTION COSTS

The concern and action to support the care of the bees and the economic activity derived from them means that plans for nutrition, health and care of the bees are implemented with high intensity. In the same way it is necessary to implement safety management plans for the bees, the products and mechanisms for risk management. All of the above entails a sharp increase in production costs which puts the profitability of the beekeeping business at risk, especially for the small producers who are the majority of apicultural producers in the region.

4. EXPERIENCE IN HEALTH MANAGEMENT

Based on the above, we want to share an experience implemented by

the Chilean National Beekeeping Federation FG, which accounts for the test pilots to implement a health management plan for bees, whose results show considerable low levels of parasitic infestation using a methodology of territorial coordination of beekeepers among other methods that are described below.

For beekeepers linked to the Chilean Federation the fight against the varroa parasite has been one of the growing concerns because it is fought individually, with low coordination among beekeepers in the environment, where their bees interact, generating a high percentage of reinfestation among the apiaries of a territory, which has meant an increase in the number of treatments, decrease in production, weakening of bees and increase in winter mortality levels.

The proposal to combat the levels of infestation of this parasite in bees is articulated in five pilots (trials) in four regions of Chile, and seeks to incorporate the idea that “varroa is a common enemy” that must be attacked jointly since individual actions do not have an efficient or prolonged effect over time. In this way the main steps to implement

the test pilots consider four main stages.

The collection of information considered a first zonal census to incorporate all the beekeepers of the territory to the pilot, as well as incorporating its georeference to recognise the type of interaction between the apiaries detected and the reinfestation risk that is presented by the pilot.



The georeferencing of the apiaries of one of the pilots.

The second step involved the training and strengthening of knowledge related to sanitary aspects (theoretical and practical), where the double-coil sieve is made for var-

Collection of information

Strengthen knowledge of beekeepers and technicians

Evaluate bees periodically

Take joint decisions with objective information

roa counting (Source: <http://teca.fao.org/es/read8663>). In this way the same beekeeper can perform the sampling of his/her apiaries. In addition, a person is designated to collect the data of the samplings (a beekeeper or technician) periodically.



The beekeepers together with the technicians of each pilot were reviewing the levels of varroa and evolution of the beehives in order to be able to have at disposal - periodically and systematically - objective and meaningful information of that territory in the following years.



Recolección de abejas para análisis de varroa

Pilots have generated forms of monitoring led by technicians and

beekeepers who will continue to monitor and follow-up on varroa levels, thus generating a proposal for a national health plan ensuing from the concerns and actual contextual situation of different beekeepers and their territories, with the next steps being the creation of apicultural sanitary defence committees.



With the experience gained in sanitary pilots, it emerges quite evidently the need to promote and encourage monitoring and coordinated treatments among beekeepers, as these reduce the levels of varroa infestation more efficiently, in addition to generating a reduction in

the cost of treatments performed by beekeepers in their apiaries, generating a decrease in winter mortalities caused by this parasite.

The associative action carried out by the beekeepers is a generator of positive productive impacts that also strengthens the organisations that participate in the pilots because it enhances the actions with the identity of the intervening territory.

Misael Cuevas Bravo
President
Regional Commission
for the Americas



HUALAÑE



TRONGOL



CURACAUTIN



PUMANQUE

ALTO AGUAS BLANCAS





ASIA IS A HAVEN FOR BEES

Cleofas R. Cervancia



The Asian region, being in the tropics is high in pollinator diversity.

Its rich vegetation and mild climate supports the population of pollinators. Solitary and social bees are among the important pollinator species

The Asian region, being in the tropics is high in pollinator diversity. Its rich vegetation and mild climate supports the population of pollinators. Solitary and social bees are among the important pollinator species. Other insect pollinators are butterfly, moth, beetle and fly. Birds and mammals pollinate bigger flowers. However, honey bees are the most widely studied species of pollinators. Of the 12 species of honeybees, 11 are native to Asia, namely: dwarf honey bees (*Apis andreniformis* and *Apis florea*), giant honey bees (*Apis dorsata*, *Apis laboriosa*, *Apis dorsata binghami* and *Apis breviligula*) and cave nesting honey bees (*Apis koschevnikovi*, *Apis cerana*, *Apis nigrocincta*, *Apis nuluensis* and *Apis indica*). The European honey bee *Apis mellifera* is not native to Asia. Most pollination studies were focused on high value agricultural and plantation crops. The giant bees, *Apis dorsata*, *A. breviligula*, *A. dorsata binghami* and *A. laboriosa* are providing

pollinator services in forest ecosystems and are sources of livelihood opportunities derived from honey and beeswax. *Apis laboriosa*, the Himalayan giant bee is the largest bee species.

Koeniger et al. (2010) described the bees of Borneo and advocated for sustainable beekeeping with indigenous bees. The cavity-nesting honeybee *Apis nuluensis* inhabits only the highlands of Mount Kinabalu of Sabah, Borneo Island.

A promising species for crop pollination and production of valuable products such as honey, pollen and propolis is represented by the stingless bees. In the Philippines, Malaysia and Thailand stingless bees are being used for large scale orchard pollination especially mango, rambutan and lanzones. The following technologies have been developed and adopted (www.teca.fao.org): propagation of stingless bees using coconut shells, harvesting of honey, pollen



Stingless bee beekeeper.

and propolis from stingless bees and utilisation of stingless bees for pollination. Based on pollen analysis, stingless bees visit more wild and economic plants than honey bees, *Apis cerana* and *Apis*

mellifera. This shows that they are truly polylectic with 69 families and 179 genera of plants recorded as hosts in the Indo-Malayan/Australasian region (Rasmussen, 2008). Further, stingless

bees are more diverse than honey bees, consisting of 50 genera and around 600 species, with about 80 species in Southeast Asia and 11 in Australia (Heard, 2016).

In Asia, the most significant threats to local honey bee populations are deforestation, excessive hunting pressure, loss of nest sites, parasites and pathogens, climate change, forest fire, pesticides, street lighting, anthropogenic movement, tourism and competition with introduced *Apis mellifera* (Oldroyd and Nanork, 2009). The introduction of *A. mellifera* negatively impacted the population of local bees (He and Liu, 2011).

Yang (2005) reported a reduction of the population of *A. cerana* by more than 75%. While pollinator diversity is still high in China, Teichroew et al. (2016) identified

Giant bee, *Apis breviligula*, foraging on *Mimosa pudica*.



Apis breviligula.

the same threats to diversity that are now observed globally. However, despite the importance of pollinators to agriculture, scientific data regarding the pollinators in the region, including native bee species have been limited and were generated using widely varying methods. It is necessary to develop a harmonised method to survey the state of pollinators in the region (on a country by country basis), their relative density and relative abundance and health. The initiative would seek to identify the most vulnerable scenarios, determine causes and provide mitigation methods in order to protect the pollinators.

Cleofas R. Cervancia
President
Regional Commission
for Asia



REFERENCES

- He X., Liu X.Y. 2011. Factors of *Apis cerana* decline in China. *Apicult. China*. 62: 21-23.
- Heard T. 2016. *The Australian Native Bee Book. Keeping stingless bee hives for pets, pollination and sugarbag honey*. West End, Queensland: Sugarbag Bees. 246 p.
- Koeninger N., Koeninger G., Tingek S. 2010. *Honey bees of Borneo: Exploring the Centre of Apis Diversity*. Natural History Publication (Borneo) Kota Kinabalu. xix+[i]+262 pp.
- Oldroyd B.P., Nanork P. 2009. Conservation of Asian honey bees. *Apidology* 40(3): 296-312
- Oldroyd B.P., Wongsiri S. 2006. *Asian Honey Bees: Biology, Conservation and Human Interactions*, Harvard University Press, ISBN 0-674-02194-0, Massachusetts, USA.
- Rasmussen C. 2008. *Catalog of the Indo-Malayan/Australasian stingless bees (Hymenoptera: Apidae: Meliponini)*. (Zootaxa 1935@2008 Magnolia Press. 80 pp. (ISBN: 978-1-8677-295-6).
- Teichroew J.L., Xu J., Ahrends A., Huang Z.Y., Tan K., Xie Z. 2016. Is China's unparalleled and understudied bee diversity at risk? *Biological Conservation*. Elsevier Ltd. (in press).



EUROPE:

THE STATE-OF-THE-ART AMIDST THREATS AND OPPORTUNITIES

Diego Pagani



I think that today the beekeeping sector is confronted with some major problems, but at the same time it can still offer even more opportunities and satisfactions, the technical level of European beekeepers is very high and also as regards the fight against diseases...

The establishment of the World Bee Day is an important tribute to the insect that allows the life of the human species on earth through the tireless and continuous work of pollination that maintains and promotes the spread and maintenance of biodiversity. Biodiversity is nothing more than the immune system of our planet and therefore it is fundamental that one day of the year is dedicated to dialogue, promotion, discussion on problems and opportunities concerning this small insect and those who take care of it.

In the last ten years bees and beekeepers have faced very difficult challenges; in 2008 in Europe there was a substantial loss of hives mainly due to the lethal effects of neurotoxic molecules used in agricultural pesticides, the mobilization of beekeepers and the consequent media resonance have led to increased awareness of the problem of bees and better understanding of how fragile is the balance on which our ecosystem is based. The main

agents responsible for the collapse of the colonies were identified in three active neonicotinoid principles that acted on the bees' orientation system preventing their return to the hive; the beekeepers were absolutely clueless being confronted with such unprecedented problem without understanding why the bees were disappearing at such high rate. When it did not perish the colony was so weakened that the other pathologies that were normally treated could easily take over, so more causes contributed to the suppression of the family.

Some years have gone by and great progress has been made; the European Parliament has temporarily suspended the three active principles, working in close collaboration with institutions, research and associations, there have been technical fora for dialogue on these issues and, even if what we achieved today is a drop in the sea, surely now there is a clear perception of the extent of the problem.

The media overexposure that the sector has received in the darkest years continues today, as if our world had been rediscovered with all that wealth of magic and mystery that it carries inside and that puts that glimpse of enthusiasm and madness in the eyes of beekeepers when they talk about their work, this has led many young people, in a period of economic difficulty, to approach apiculture ensuring a generational change essential for maintaining the health of the sector. Reduced initial investment compared to other sectors of agriculture, combined with the unique stimuli of this unknown world, have brought new energy to the surface and it is estimated that in the last five years the number of beekeepers and hives has increased by 20%.

Certainly an important economic opportunity combined with a market that grows transversely with respect to the past, today honey has emancipated itself from the image that has distinguished it for years when it was perceived as the natural remedy for seasonal ailments, we find it as an ingredient used by top chefs, offer on the market is vast and through this they have been able to propose different monofloral honeys each with its own peculiarities and suitable for a specific use, the research carried out in recent years not only tells us that it is the healthiest sweetener, but also for example that taken daily has a remedial effect to the modifications of the DNA caused by direct exposure to pesticides (*R. Alleva*).

The last four years in Europe have



been quite critical on the production front (Spain, Italy, France being the most penalized nations); this situation was largely due to the repercussions from climate changes that are increasingly influencing and affecting honeyflows and markets. If on one hand consumers' choices keep the sector active, by evolving product requests with new specifications thus giving operators the opportunity to work on new markets, also enhancing the other products of the hive: pollen, propolis, royal jelly, supplements based on bee products, etc., on the other hand production difficulties are becoming an increasingly heavy burden on producers' shoulders. Honey shortages mainly had two effects:

- beekeepers have progressively increased the number of their production units to maintain a level of profitability that would allow them to retain the economic sustainability of their company;
 - the unavailability of honey as a commodity has encouraged an increase in average market prices.
- This, in particular, has meant that the European continent, which is

the world's largest importer and consumer of honey, would allow a massive entry into its market of a large quantity of products (mainly from Asia), with several confirmed cases of adulteration. Honey is the third most counterfeited product in the world (*C. Brusset*), and a plague for an entire sector, in Serbia it is estimated that about 70% of honey sold in organised distribution is the result of adulteration and beekeepers in an attempt to try to stem this drift have drafted a very strict set of specifications and introduced a customised jar that is supplied to those beekeeper retailers undergoing quality and traceability controls, so that the consumer can immediately recognize a honey that comes from a virtuous and certified path.

I think that today the beekeeping sector is confronted with some major problems, but at the same time it can still offer even more opportunities and satisfactions, the technical level of European beekeepers is very high and also as regards the fight against diseases (with varroasis in the first place), in recent years very effective biotechnical practices have been put in place and the re-

gistration of preparations based on organic acids and new products with synthetic active ingredients are definitely helping contrast strategies. A rather critical situation in this respect is currently being experienced in Spain and is bound to improve the status of their farms only through a thorough revision the “disease control strategy” in the light of an organic approach and in the context of integrated control. Italy is today the only European country in which the small beehive beetle *Aethina tumida* is present, and at the moment it has managed to keep it confined within the Calabria region through the strategies implemented by the Ministry of Health, the associations of beekeepers

in the area and the climate that apparently does not favour its rapid development and spread. Periodically we hear about *Aethina tumida* findings in several countries (Switzerland, France), but to date no case has been confirmed and I believe that for the time being they can be filed as fake news.

The crucial request that, as Apimondia, we should ask the policy-makers in favour of European beekeepers would be to take some steps to rethink the current agricultural model, a model that today does not take into account the future, the next generations, based as it is on monocultural extensions heavily dependent on the use of chemicals that in addition to poisoning bees,

other useful insects and amphibians, have already heavily polluted surface waters in many countries. In many cases, non-nectariferous cultivars or with very short flowering periods are preferred, reducing more and more the pastures that can be usefully foraged by the bees. This is according to an agricultural model of US derivation, where in the 1920s they had 9 mln of hives that were reduced today to about 2 mln, and where the average lifespan of a queen bee has been recorded as less than six months instead of the standard five years.

Diego Pagani

President

*Regional Commission
for Europe*





OCEANIA

REGIONAL INFORMATION

AUSTRALIA & NEW ZEALAND

Jodie Goldsworthy and Maureen Maxwell



Bees are kept primarily for honey. Most honey would qualify as 'organic' by the Pacific Organic Standard, but not typically marketed as organic. Wax is commonly a secondary product.

Apimondia is the link that brings global apiculture science to the Oceania region. Highly specialized and professional beekeepers from Australia and New Zealand forge global connections with international scientists from the world over through links made at Apimondia congresses and via the Apimondia global network. For a developing apicultural country such as Fiji Apimondia offers a unique opportunity to learn from other countries that are more mature from a beekeeping perspective. Apimondia makes the world a smaller place and the Oceania region is grateful for the Apimondia network in helping it to meet challenges and grow opportunities.

AUSTRALIA

Australia is richly endowed with over 780 species of eucalypts, angophora or myrtaceae trees indigenous only to Australia. Many of Australia's unique honeys are relatively undiscovered by the rest of the world and many Australian beekeepers

are keen to make good from the growing consumer trend that sees people wanting to know more about where their food is produced. Australian beekeepers are saddened by Australia's vast and diverse honey collection being known simply as "Eucalypt" honey globally and niche honey exporters are beginning to showcase a broader range of Australian honeys.

Australian beekeepers are the luckiest in the world because they keep bees without varroa. They are highly professional with strong traceability of their products providing the ability through good record keeping to differentiate many varietal honeys and geographic production areas. Australia has recently adopted a voluntary National Bee Biosecurity Code of Practice which incorporates mandatory ongoing pest and disease training for commercial beekeepers and compliance with the code is required to allow registration as a beekeeper.



Much of Australia's pollination of clean green food crops is currently done through incidental pollination by wild European honeybees that have established within the environment and only high value horticultural crop growers (almonds, apples, blueberries, kiwi fruits, seed growers, etc.) pay commercial beekeepers to bring their bees for pollination. Informing agriculture of the important role bees play is a task actively undertaken by Australian beekeepers who need the support of farmers to convince governments that more can be done to protect our environment from exotic bee pests that also threaten agriculture and food production. Australian research has shown that around 65% of Australia's

agricultural production relies on honey bee pollination.

Australia's unique position in the bee world makes it the only country in the world able to produce chemical free beeswax because of the absence of chemical use to control bee pests or diseases. The rest of the world is now well aware of this fact making Australian beeswax highly sought after.

The production of highly active honeys from Australia's vast *Leptospermum* plants is just in its infancy stages. Australia has over 80 cousins of the well-known Manuka (*Leptospermum scoparium*) which has been made famous by our New Zealand cousins. Recent research on Australian *Leptosper-*

mum honeys is demonstrating impressive activity levels across many *Leptospermum* species in Australia and offering the opportunity for Australia to create its own unique set of active and highly sought after honeys that would be even more varied than the active honeys originating in New Zealand. Australia is well positioned to complement the New Zealand offer with a broader range of highly sought after honeys.

Lobbying efforts of the Australian beekeeping industry are paying off with the Australian Government also recently opting to increase their budget for increased coverage of ports for the surveillance for varroa. Australia operates a sentinel hive programme where moni-

toring for varroa is jointly managed by Government and industry. The programme also includes a catch box system, floral sweeping and now with the addition of the Bee Biosecurity Programme surveillance for varroa by all registered beekeepers.

The interest in combined pollination and honey production has been the impetus for the planning by the Australian Honey Bee Industry Council for the Third Australian Bee Congress specially themed “Pollination & Beekeeping for the Future Symposium” to be held at the Royal Pines on the Gold Coast, Queensland from Wednesday 27th June to Saturday 30th June 2018. The symposium has been officially endorsed as an Apimondia Symposium.

Australia’s healthy bee populations are likely to feature more heavily in the future in global bee research. Australia may be a long way from the rest of the world but if we are all to manage global threats to bees and beekeeping we must all work together to make the world a smaller place to bring together the brightest minds and most innovative thinkers to collectively find solutions to challenges that impact every single beekeeper the world over. The regions of the world that make up Apimondia will act more importantly in the future to form the glue that holds all beekeepers together and sees us learn from experience in lands far removed.

NEW ZEALAND

The New Zealand apiculture industry is in a period of unprecedented

growth despite poor harvest conditions in the last year. Fires, floods, earthquakes and inclement weather working against the bees and their keepers.

New Zealand produces some of the finest honey in the world with many unique floral sources due to our island status including our manuka with its famous medicinal properties. Our strict no antibiotic law ensures we also have some of the purest honey globally. With vast expanses of untamed forests and unpolluted pastures, conditions for excellent honey prevail.

The increased global awareness of the unique medicinal properties of New Zealand manuka honey has led to substantial investment in the sector. Government rese-



arch, plantings of specific strains, improved infrastructure in processing and medicinal grade honey handling. Many new beekeepers are being trained and government research scientists and laboratories are investing considerable resources to identify unique factors to New Zealand manuka and other honeys to fight adulteration and fraudulent honey practices. International plantings of manuka plantations are on the rise in efforts to emulate this crop.

The trend has been of increased hive numbers and increased honey production, therefore yields and returns have tripled in the past five years. Main issues facing the industry are ongoing concerns about bee health, competition for apiary sites and maintaining the confidence of the overseas consumers and regulators in the integrity of New Zealand manuka honey.

Corporate and Iwi (Maori) investment in beekeeping enterprises via acquisitions, joint ventures and internal growth continues to drive much of the increase in hive numbers. There is a trend for larger family businesses to secure honey supply by buying land in particular land with manuka.

Other revenue sources are represented by demand for pollination with ongoing expansion in horticulture sectors including kiwi fruit, pip fruit, avocados, stone fruit and

blueberries. Covered crops are becoming more popular but less favorable with beekeepers that want to preserve bee strength for honey production, so pollination prices are rapidly increasing.

Hive theft and hive vandalism is a growing issue due to the high value of hives and colony income potential. Tension over honey production sites has in some cases led to hive vandalism. Beekeepers are increasingly experimenting with cameras and tracking technology to protect hives.

The giant willow aphid has taken hold with devastating effects on both honey production and bee survival on many traditional sites. The abundance of willow honeydew has increased wasp numbers alarmingly. A Government Sustainable Farming Fund is supporting research as to how best to combat this new problem.

Beekeepers are reporting increased expenditure and time commitments associated with implementing the Health and Safety at Work Act, 2015. There has been increasing investment in machinery and other tools to reduce heavy lifting and smaller supers are in many cases being employed to reduce weights along with purchasing of cranes and lifters.

FIJI

There are between 800 and 1,000

beekeepers in Fiji. Mostly small-scale, with approximately 20 beekeepers with 100+ hives. Almost all are keeping bees for financial gain - almost no 'hobby' beekeepers. Field work is undertaken 80% by men and 20% by women. Post-harvesting work is undertaken 50% by men and 50% by women.

There are between 10,000 and 13,000 hives in Fiji which are almost exclusively Langstroth hives. All deep or full depth hive bodies - no shallow supers. There are a few top-bar hives. Fiji is producing most boxes, covers and bottoms, but still importing 50-60% of frames and 90% of wax foundation from overseas (mostly from China and New Zealand).

Bees in Fiji are a cross-bred between the 'black bee' of northwest Europe and the Italian. It is estimated that maybe 50% are Italian genetics at this point. Until thirty five years ago, most genetics were from the black bee - very defensive, and bees moved quickly on the comb. Importation of Italian bees in the 1980s and 90s improved the genetics. There has been no import of bees into Fiji since New Zealand found varroa mites in 2001. We have a permit to import queens from Western Australia, but to date none have been imported.

Fiji has American Foulbrood (AFB), but no European Foulbrood.



od (EFB), varroa or hive beetles. No beekeeper treats bees with any medication of any kind. AFB is the only serious disease, and no serious parasites.

The major challenges to beekeeping development are access to training and access to capital. Inadequate training results in:

- a) starving bees during the rainy season;
- b) damaged comb due to wax moth from lack of hive inspections;
- c) spread of AFB;
- d) poor honey quality - high moisture honey and burnt sugar cane molasses taste are the most common quality problems.

Fiji Beekeepers Association has a training programme, but now that Fiji has an elected government almost all development funding flows

to government instead of directly to NGOs, so not much training is available now to new beekeepers. Many people express interest in starting beekeeping. Markets are good. Beekeepers can make good money if they know what they are doing.

There is a high failure rate of new beekeepers due to poorly-designed development projects and people who underestimate the work and skill involved. Failure rate of new beekeepers is estimated at 80%.

There is an active national beekeeping association (Fiji Beekeepers Association) with a mentor programme, training programme and a honey quality programme. The Association has received funding assistance in recent years from the EU, New Zealand High Commission and Australian aid. There are

several local beekeeping associations and cooperatives.

Bees are kept primarily for honey. Most honey would qualify as 'organic' by the Pacific Organic Standard, but not typically marketed as organic. Wax is commonly a secondary product. There is currently no pollination work due to small-tract farms and no significant pollen or propolis harvesting.

Jodie Goldsworthy
President
Regional Commission
for Oceania

with contributions from

Maureen Maxwell
Vice President
Regional Commission
for Oceania



APITHERAPY

CURRENT SITUATION AND PERSPECTIVES

Cristina Mateescu



Apitherapy and the standardisation of bee products with medicinal destination will open a new gate for beekeeping activity.

Standardisation includes the definition of clear standards for the handling, processing and monitoring of these products.

Apitherapy, a medical concept based on scientific approach reinforcing the traditional knowledge on bee products and their nutritional and medicinal use.

Worldwide developments in the field of bee products offer new perspectives for their increasing use in various types of products: food supplements, functional food, medicines for both humans and animals and cosmetics. Complex and diversified scientific studies related to the composition, formulation stability, dose and therapeutic activity of these complex products meant to ensure the efficacy, safety, quality and productivity have been and are currently carried out in many countries of the world.

BEE PRODUCTS AS FOOD AND MEDICINAL AGENTS

HONEY is well known for its food quality, but researches have shown that honey itself may be an excellent wound healing agent and a

good antibacterial. Honeys vary according to their plant origins and the conditions under which they are produced. In the past, the only source of food for bees was the flower nectars or honeydew secretions; nowadays, bees are kept in modern movable-frame hives, and may produce totally or partially non-floral honey if, for example, they have been fed on sugar syrup. The honey extracted from such colonies does not differ much from floral honey in colour or major components, but may have inferior curative properties. Unfortunately, more than feeding the bees with such products, honey adulteration or improper processing is deeply affecting all the natural properties of this precious product.

There are differences in the honey produced by bees from other species than *Apis mellifera* (i.e. *Apis cerana*). Consequently, differences in medicinal properties and uses are also found. Stingless bee honey is highly nutritious and is known for



Honey massage demonstration at the XXI Apislatvia congress in Almaty, Kazakhstan, 2016.



Practical demonstration for bee venom acupuncture in a multiple sclerosis patient in La Habana, Cuba.

its medicinal values (it is more acidic and has a better antimicrobial activity). The stingless bees exist in almost every continent. Originating from Asia or the Americas this honey has been widely used across time and space. It is however essential to understand the pharmacological mechanism of its actions.

PROPOLIS with its composition diversity offers itself a large variety of biological actions (antimicrobial, antioxidant, anti-tumor, wound healing to mention but a few) with direct effects on several human ailments and diseases. Specialised websites are offering hundreds, sometimes thousands of scientific studies related to its complex composition and biological, physiological or medical effects. However, international authoritative bodies do not accept health related claims as there is no specific standardisation and the composition is highly variable

as with any other natural product. European propolis, Brazilian green propolis, red Brazilian propolis and Cuban propolis are but a few types to offer scientific evidence on medicinal applications. Nutrient deficiencies and all the health problems they cause are recognised worldwide as a growing problem.

BEE COLLECTED POLLEN and its natural derivative bee bread, contains all the nutrients needed to sustain life and can be considered super-concentrated functional foods with direct effects on human health. In various cultures of the world these products are used for vitality, extending longevity and as a complement for recovery from various chronic diseases and even addictions. They can overcome mental retardation and other developmental problems in children. Studies are on the run to assess the protecting activity of bee pollen

against radiation and in cancer treatments.

ROYAL JELLY - known in many cultures as an “elixir” or a super-food shows new perspectives for human health. It is highly nutritious and, given some of its special compounds, offers open space to new remedies in severe illnesses.

BEE LARVAE - drone larvae, worker larvae and even queen larvae (following the royal jelly production) can be also considered a good source of nutrients with benefits to human and animal health.

However, all the above-mentioned products have still to be clearly defined in respect to their health claims. The international regulations related to food, novel food and medicines require a careful assessment on both their biological activities and side-effects. Currently, many studies are targeted to-



Training courses at the Faculty of Medicine and Pharmacology at Atatürk University, Erzurum, Turkey, 2018.



Visiting one of the Laboratories of the Pharmacology Department in Atatürk University, Erzurum, Turkey, 2018.

ward investigating health benefits and pharmacological properties leading to an increasing development of nutraceuticals and functional food from these products. Another important product of the bees - the venom in its natural form and apitoxin - the dry bee venom - beside of being used in treating arthritis and inflammatory diseases is already representing a hope for many patients suffering of cancer, neurological and other degenerative diseases. Worldwide scientific literature counts more than 1,500 articles on bee venom, among them reports on animal studies, meta-analysis and some, still modest, clinical trials.

TECHNOLOGIES - New technologies meant to increase the bioavailability of the active ingredients in bee products (preparative techniques, extraction methods, nanotech) are developed. Currently, pharmaceu-

tical industries have extensively explored the use of nanoparticles for the treatments against various diseases especially for the treatment of cancer, cardiovascular diseases, viral diseases (as type B and C hepatitis), metabolic syndrome diseases and also many others.

CLINICAL TRIALS with well-defined protocols are needed, but standardisation, quality and the presence of contaminants are still main drawbacks in their credible use. However, in many cases, clinical trials to investigate complementary therapies can be problematic and thus an apitherapy clinical trial could be more complex than a simple administration of a pill. Some clinical trials are also incompatible with the approach of the patient in taking part in the healing process, an essential factor in apitherapy as in many complementary therapies.

APITHERAPY A FUTURE FOR BEEKEEPERS

Apitherapy and the standardisation of bee products with medicinal destination will open a new gate for beekeeping activity. Standardisation includes the definition of clear standards for the handling, processing and monitoring of these products. This type of production is considerably more demanding than the regular beekeeping methods and, as a result, the products will have higher prices.

Spreading worldwide the value of the bees and their products, apitherapy could gain a respectful and credible position among the complementary and alternative therapies.

Cristina Mateescu
President
Scientific Commission
on Apitherapy



HONEYBEE SCIENCE

Karl Crailsheim



Different kinds of pollen have a different value for the development and the performance of the bees due to the different amount of protein, to the different ratio and content of amino acids (some of them are essential) and to different digestibility of the pollen content.

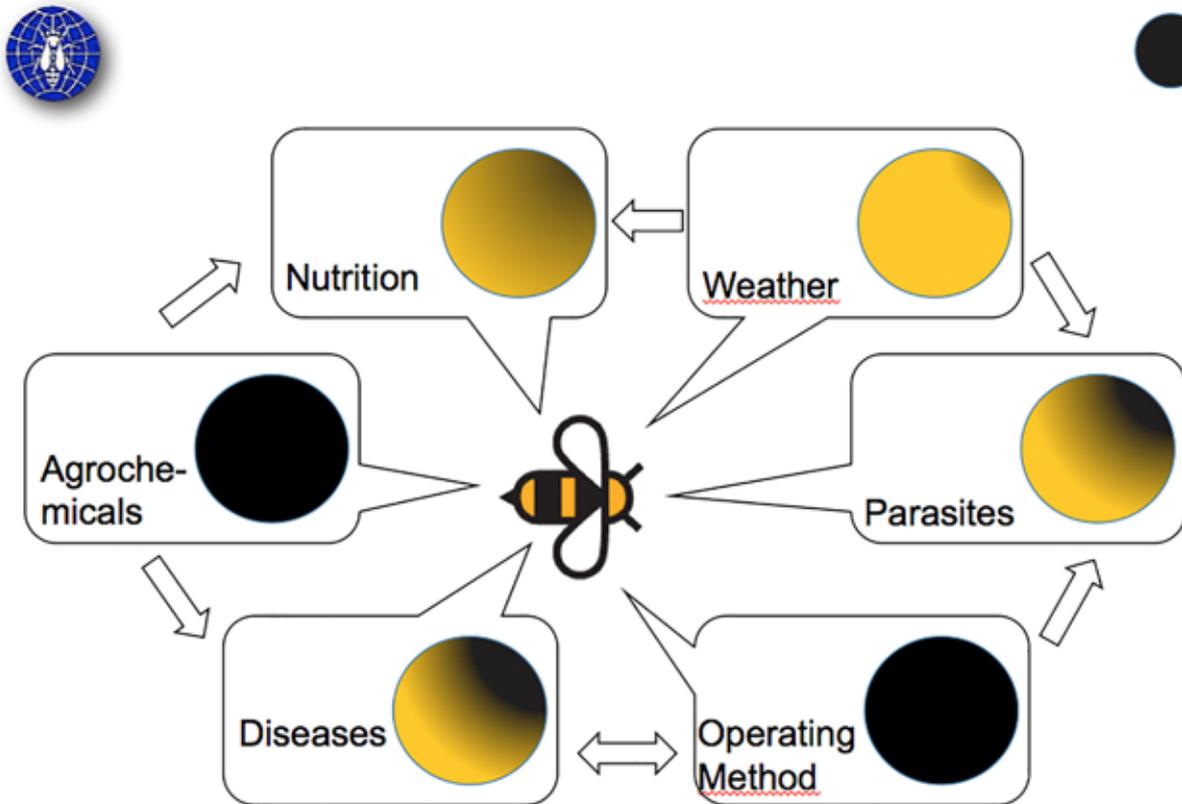
The honeybee is considered to be one of the most important animal for human nutrition. This is due not so much for the production of honey but for pollination. This and the problem bees and beekeepers are fighting with (see figure) resulted in an increasing number of scientific publications worldwide. Within the last decade more than 10,000 such papers have been published. Besides original papers also the number of reviews and summarising papers have increased, the latter are important as especially the interaction of various stressors of the honeybees seems to be extremely complex.

To give examples for nutrition (one of the important topics in the programme of the last Apimondia congress in Istanbul, Turkey 2017). Different kinds of pollen have a different value for the development and the performance of the bees due to the different amount of protein, to the different ratio and content of amino acids (some of

them are essential) and to different digestibility of the pollen content. This is especially important if bees collect only monofloral pollen. In nature bees mostly try to collect a variety of different pollens and thus a mixture of low-value pollen can finally create a high value food.

Under well controlled circumstances in the laboratory a good quality pollen or a good mixture can create a proper development regarding various parameters as life expectancy, body weight, protein content, size of brood food glands, poison production, immune competence, flight ability and many more. If you now change something in the experimental set-up, e.g. there is a sublethal amount of insecticide in the food or there is an infection, the results can change and a certain pollen or a pollen mixture - very well suitable for control situations - is not good enough anymore and some of the diets are then better or worse than others.

Factors impacting on bees



To give another example for the complexity: Varroa is still one of the biggest problems in keeping *Apis mellifera*. This parasite *per se* damages the bee at various stages by taking haemolymph from brood and adults. It transfers viruses and reduces the ability of the bees to fight against the viruses. Therefore much research is done on this complex system.

As a third example of complexity, new insights into the ability of the social insect honey bee to fight diseases are described in the literature. It is well known that bees can

detect sick brood or also sick adult bees but recently it was found that also sublethal damages from pesticides in brood and bees can be detected by hive mates and can provoke reactions.

Thus not only the contact with or the ingestion of harming substances or infectious material can cause actions, but also just the contact with bees that are under the influence of those factors can initiate reactions that are positive for the colony as a bigger unit. As an example for this: if a queen has physical contact with a diseased worker, she is upregula-

ting her immune system thus being more resistant against dangerous diseases although she herself never had contacted the cause of the infection of the worker.

Future research into these complex mechanisms will be scientific breakthroughs and also give a better understanding of how the super organism honeybee works.

Karl Crailsheim
President
Scientific Commission
on Bee Biology





A local style, home-made hive beats a frame hive in any test of profitability. This beekeeper in Rwanda places his bee hives throughout the vast forest - a highly efficient form of resource harvesting.

BEEKEEPING

AS A SOURCE OF WELL-BEING

Nicola Bradbear



Beekeepers in many rural areas of the world still have abundant bees and healthy honey bee colonies yielding harvests of residue-free honey and beeswax.

They have considerable wisdom and experience to share, and this Apimondia Commission is keen to give them a voice.

There is fresh perception of beekeeping as a craft at the forefront of transition towards a richer and more diverse global, ecological civilisation. A new generation of well-informed, ecologically aware, community-minded beekeepers are celebrating bees, and re-evaluating honey and beeswax for the fabulous and special products that they are.

I am honoured to be President of this Commission and continue to consider what we mean and expect from Beekeeping for Rural Development. When I was first elected in 1993, the Commission was named ‘Beekeeping in developing countries’. I sought to change that name because the paradigm that had dominated policy on the political and economic course of so-called ‘developing’ or ‘third world’ countries since the end of the Second World War was ending. Even the term ‘development’ implying a trajectory of change, should be considered carefully at a time when bees along with insects in general are suffering catastrophic decline in many world regions.

While nations have industrialised and become richer during the past quarter century, many people have experienced no increase in financial wealth, and the gap widens between financially rich and poor. However wealth cannot be measured only in monetary terms. Bees are part of the planet’s ecological wealth, and beekeeping has distinctive cultural value in every society. In many of the financially poorer countries, beekeeping continues to be practised in highly sustainable ways that mean that large scale losses of honey bee colonies have not occurred, and much can be learnt from them.

We need not strive for monocultural beekeeping!



Small scale beekeeping enterprises sell honey through short market chains. Here a beekeeping family in Azerbaijan sell their honey and fruits at the roadside.

The beekeeping world includes diversity of species and races of bees, and it needs to continue providing space for many different practises too - not just one globalised method based on one industrial style of beekeeping with one species of honey bee. Yet this is what has been achieved in nations like Australia, Canada, China, India, New Zealand, USA, Vietnam, where exotic European honey bees are kept on huge scale, producing similar honeys for a world market where they must compete fiercely on price and struggle to differentiate themselves from increasing counterfeit honey. In all those nations smaller scale enterprises still exist too, providing high quality and speciality honeys to local markets.

This Commission seeks to focus upon these aspects of apiculture:

- Raising the profile of beekeeping as a resilient and adaptable craft

that generates wealth and well-being;

- Achieving ecological integrity: how to keep bees well on a diverse and finite planet;
- Ensuring the contribution of indigenous beekeeping wisdom;
- Best practice in using beekeeping as a feasible way to enable people to move out of poverty.

Highly sustainable beekeeping is still practised where there remain intact, healthy populations of indigenous bees. For example in Sub-Saharan Africa honey bees are healthy and beekeepers do not suffer from loss of colonies as is commonplace elsewhere. Yet many beekeeping projects in tropical Africa continue to place emphasis on adopting so-called 'modern' hives and 'modern beekeeping'. Using this vocabulary, 'modern hives' means 'frame hives' and a beekeeping

system replicating as closely as possible that of industrialised nations. Yet the results of these projects are poor: frame hives are provided, yet the impact on poverty alleviation is negligible. At Bees for Development we witness projects in many nations where recipients report no benefit from being given frame hives. Cost benefit analyses showing that a beekeeper can pay back the cost of a frame hive after a number of years are usually based on projected figures and not from real field data, and long ago (*Svensson, 2002*) reported the failure of beekeeping projects based on poor analysis and false projections. Describing the continued success of bark-hive beekeepers in North West Zambia harvesting high quality organic honey and beeswax for export to EU markets (*Wainwright, 2018*) reported: "It would be diffi-

cult to manage the African bees in frame hives. Most importantly the high capital cost of the hives would burden beekeepers with debts they would be unable to repay”.

Yet beekeeping projects persist in focusing on changing technology (always from simple hives to more complicated hives) against evidence that this approach rarely brings long lasting or significant benefit (*Lowore & Bradbear, 2009*). The main drivers involved are:

- Planners, donors and intermediary organisations favouring projects that are easy to provide, involve delivery of capital equipment, giving tangible, visible evidence of their support;
- Beekeeping ‘experts’ who are ex-

perienced only in industrial-style beekeeping with temperate-zone bees;

- Planners believing wrongly that the style of bee hive is the key intervention point for poverty alleviation;

Throughout Africa the paradigm is for modernisation of agriculture. Modernisation of the dairy industry means shifting away from traditional breeds and extensive pastoralism, towards new breeds and stall feeding. Modernisation of horticulture means growing cash crops and investing in technologies like refrigerated trucks.

People assume that modernisation of beekeeping must necessarily call for a change in the technology and

to use so-called ‘modern’ frame hives (actually invented nearly 200 years ago and little changed since then). Yet this is not correct. It is certainly possible for beekeepers living at subsistence-level to become more commercially orientated. However this transformation is not dependent simply upon bee hive technology, and provision of free equipment that cannot be made, mended or replaced locally does not allow progress for remote, rural people.

Commercial agriculture depends upon enterprise analysis - working out the costs of production and ensuring profitability. A local style, homemade hive beats a frame hive in any profitability analysis. There



© Nicola Bradbear 2018

Boxes for stingless bees in El Salvador, protected from theft with barbed wire.



is still no evidence proving that frame hive beekeepers in sub-Saharan Africa harvest greater total volumes of honey than beekeepers with local-style hives. Bees living inside a frame hive may well be managed so that greater amounts of honey and smaller amounts of beeswax are harvested, but where bees are still abundant, a beekeeper using simple hives easily doubles honey and beeswax harvests by simply and cheaply increasing the number of hives available for harvest. What about quality? The honey bees in a frame hive or in a local hive will forage upon the same flora in the same place and make identical products. What differs is the means of extraction and sometimes post-harvest handling. It is true that some beekeepers have used careless methods of harvesting and offer low quality products to the market. However closer analysis shows that the market into which they sell accepts the standard of their product. A promoter of commercial apiculture tends to look to the supermarket as the end target for honey, and correctly observe that quality demands of supermarkets are different from those of village markets. Therefore many other changes need to take place for sub-

sistence beekeeping to transform into a commercial activity. Correct situation analysis often reveals the need for:

- Skills in harvesting and post-harvest handling to ensure quality products;
- A business approach to a profitable system whereby input costs are less than income;
- Good access to fair markets for honey and beeswax.

Making the transformation from subsistence to commercial beekeeping therefore requires many changes - although the bee hive itself is not necessarily one of them, and on its own will never ensure greater profitability. Thus many projects fail because they are not addressing the real problems.

Meanwhile research enable us to understand more about the honey bee colony as a superorganism and to realise the many factors that contribute to the health of the colony, and the health of the wider honey bee population (Seeley, 2019).

While we continuously stress honey bee colonies with less diverse and plentiful nutrition, an environment contaminated by agrochemicals, and introduce exotic predators and viruses, researchers are also under-

standing more about the need for genetic integrity of honey bee populations, their capacity for self-healing (Ritter, 2016), as well as the need for good, stress-free housing that resembles their natural nesting situation (Sharashkin, 2017).

Beekeepers in many rural areas of the world still have abundant bees and healthy honey bee colonies yielding harvests of residue-free honey and beeswax. They have considerable wisdom and experience to share, and this Apimondia Commission is keen to give them a voice.

Nicola Bradbear

President

Scientific Commission

on Beekeeping for Rural Development

REFERENCES

- Wainwright, D. (2018). Continued export success for beekeepers of North West Province of Zambia. *Symposium on research and development in beekeeping* (str. in press). Bees for Development.
- Lowore, J., & Bradbear, N. (2009). Modern hives or modern ideas? *Bees for Development Journal*, 2-5.
- Svensson, B. (2002). Income from beekeeping: examples of expectation and experience. *Bees for Development Journal*, 48, 10-11.
- Seeley, T. D. (2019). *Bees in the Forest. A 40-year Quest to Understand Our Most Important Pollinator*.
- Sharashkin, L. (2017). Natural beekeeping and ideal hives, Tom Seeley interviewed by Leo Sharashkin. *Bees for Development Journal*, 124, 3-8.
- Ritter, W. (2016). Swarming bees are healthy bees. *Bees for Development Journal*, 119, 3-7.



All equipment should be made locally. Here an artisan in Eritrea creates his livelihood by making smokers.



APICULTURE, THE CHALLENGES OF TOMORROW

Etienne Bruneau



The hope lies in the new generations of beekeepers, the beekeepers of tomorrow. We must do everything to help them. Otherwise our bees may become, like many other pollinators, less and less present.

The beekeeping situation has been changing rapidly in recent years. If in the past, one could simply follow its colonies from a distance, today to become a beekeeper requires proper training and entails much closer monitoring. The main elements that mark this evolution are the development of certain parasites and pathogens. Varroasis has profoundly changed our ways of handling bees, but the same is true of the small hive bee or viruses that pose serious threats to our colonies. In addition, the intensification of agriculture also has an enormous impact, resulting in the loss of biodiversity, which is so important for providing quality food to our bees, but also for pesticides for which we discover day after day adverse effects ranging from mortality to the creation of serious dysfunctions for our colonies. On the climate side, the disturbances already greatly modify the

biological cycles of our bees and, as a result, our apicultural practices. Faced with all this, what can we do? We can talk about two schools of thought, one advocates to overcome these problems and use treatments, syrups, sophisticated techniques for strengthening colonies or to multiply them as quickly as possible to compensate for losses. We intensify endogenous interventions and we get back into the vicious cycle. Another school goes back to basics, so to speak, by observing nature and trying to help the bee to strengthen its defence and resilience mechanisms. The observation here is an important key as well as a fine understanding of bee mechanisms. Training tomorrow will be more and more important. Fortunately, new tools will be made available to beekeepers. Non-intrusive tracking devices are developing rapidly and will become commonplace tomorrow.



It will no longer be necessary to open the hives to know their development and their problems or needs. Beekeepers will act according to the different signals sent by the colony to indicate where intervention is needed and what is needed.

In terms of products, quality will become a keyword. Without an unquestionable quality, the selling price of a product will be at the lower level. With the exception of some countries, this situation no longer allows the beekeeper to survive. To reach this good quality standard, guides of good practices are developed all around the world to answer the local specific requirements.

These good practises are already in use in many countries however, the quality standard is not always achieved. There is another area to

be addressed that of adulterated or highly degraded products not to mention those transformed or diluted to meet the minimum imposed by legislation. Only honey and wax are defined internationally. For other products, legislation is generally lacking and in such cases talking about quality becomes even more difficult. It is hoped that the new ISO group on hive products will provide satisfactory answers in this area.

Adulteration is a real scourge as it drives the prices of good quality products down and thus makes quality investments difficult if not impossible. In addition, the techniques used to adulterate a product such as honey become extremely sophisticated and therefore virtually undetectable.

The situation is close to that observed for doping in sports

where as soon as a technique is found, new types of fraud are developed. The costs of laboratory analyses for operators in the market are constantly increasing and are often passed on to the purchase price of products applied by beekeepers. These are thus once again penalized.

To cope with this, the retail trade is growing rapidly which represents a huge challenge for countries whose exports account for the bulk of their production. Another strategy is diversification but here too, investments are needed for training, equipment and the implementation of marketing channels because products such as pollen or drone larvae are very little known to the public. It therefore requires a collective effort that very few structures can offer. Yet with the evolution of our en-



vironment, we will have to juggle with different productions and varied sale channels.

Flexibility, adaptation and intelligence that is what lies ahead on tomorrow's agenda. Under such conditions, enormous efforts will have to be made to help beekeepers and the entire industry to tackle this new challenge.

The hope lies in the new generations of beekeepers, the beekeepers of tomorrow. We must do everything to help them. Otherwise our bees may become, like many other pollinators, less and less present.

Etienne Bruneau

President

Scientific Commission

on Beekeeping Technology and Quality





CURRENT SITUATION OF THE INTERNATIONAL HONEY MARKET

Norberto García



Honest beekeepers, no matter their nationality, who are mainly focused on the production of pure honey for exportation, are succumbing to the export model employed in some countries, which in turn is a model that has been encouraged by some importers and packers to achieve short-term economic gains and low prices in supermarket shelves.

The sustainability of many beekeeping operations around the world is currently challenged by the insufficient honey prices to cover the increasing costs of production derived from the growing difficulties to produce real honey.

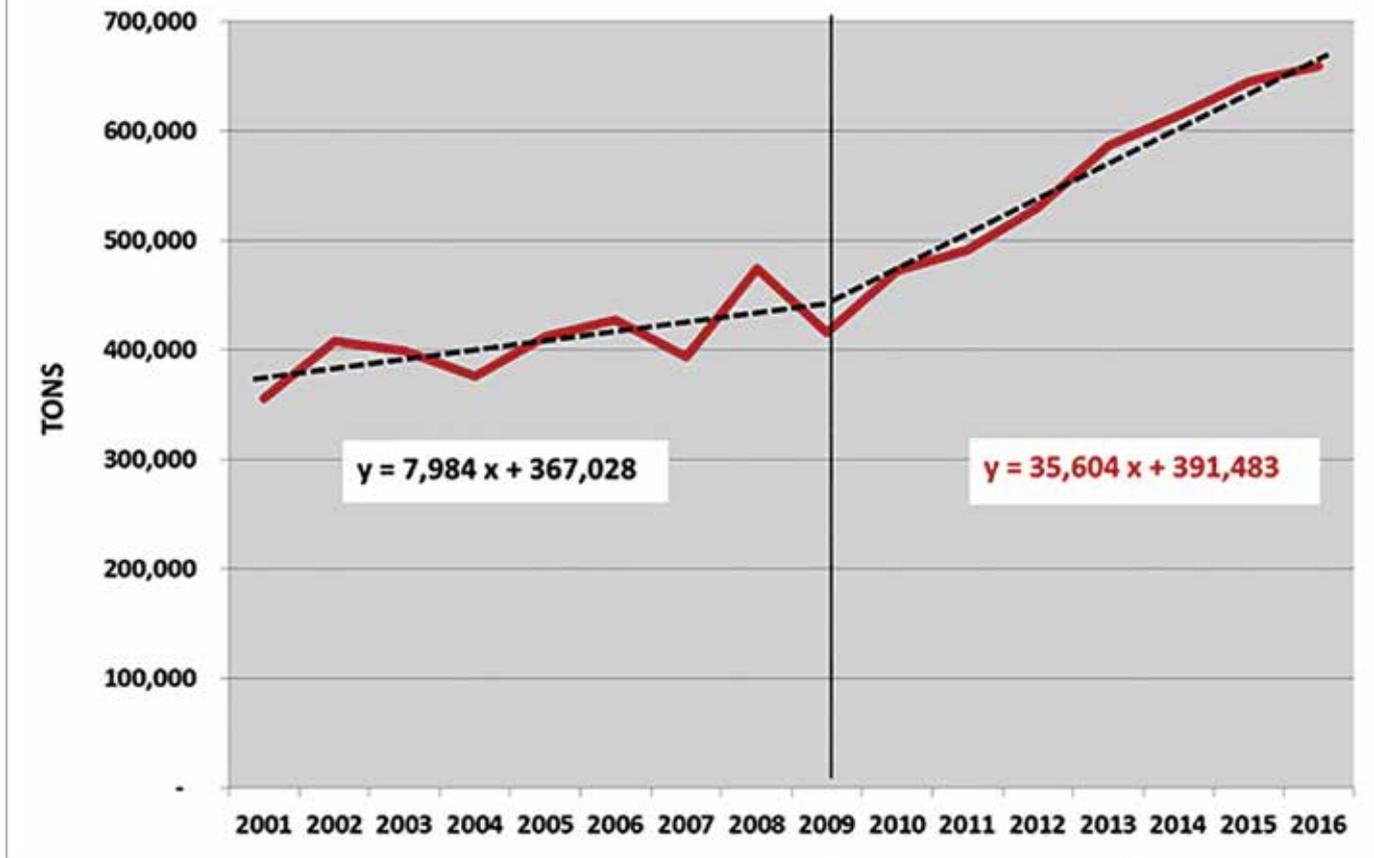
During the period 2001-2009, global honey exports increased at an average rate of 7,984 tons/year due to a growing world population and a greater preference for natural products by consumers. However, something changed after that period and world honey exports started to increase at an average rate of 35,604 tons/year (*Figure 1*).

Although world population and the preference for natural products still continued to grow, two additional factors contributed to this enormous increased growth of honey exports observed after 2009: i) a steep increase of exports by some Eastern countries, and ii) the appearance of new honey export countries in Europe (*García, 2016*).

THE INCREASE OF HONEY EXPORTS BY ASIAN COUNTRIES

The bad beekeeping practice of harvesting unripe honey, quite usual in some Asian countries, has meant an unfair competitive advantage by which one part of the transformation of nectar into honey is made by bees and ano-

Figure 1: Total World Honey Exports



ther part in “honey factories”. This “modern beehive” consists of combs and bees, but also of steel tubes and human workers. The nectar is finally industrially converted to honey in those factories.

Biologically speaking, by harvesting immature honey, storing bees are partly alleviated of their jobs and become foraging bees at an earlier age, which allows higher honey yields with reduced costs. The honey factories filter, eventually dilute, eliminate residues, dehumidify, and pack the product.

The resulting sweet product seems to be safe, but lacks many of the positive properties of natural honey. The production of honey by bees, which results in a complex product that contains around 200 different substances, is a very long and laborious process that man can

imitate but will never emulate.

The above described processing system is not in accordance with the Codex Alimentarius, the accepted international standard for foods, because intrusion and extraction of any substance from honey, as opposed to the activities of the bees themselves, is not allowed.

The process of semi-industrial honey production is also linked to an increasing use of rice syrups, specially developed to adulterate honey because they pass official tests used to check honey purity.

The temptation of honey adulterators increased in recent years because of the availability of cheap adulterants that pass the obsolete official methodologies to detect the honey fraud. The magnitude and severity of the current version of honey adulteration has a great im-

pact on prices, and puts at risk the sustainability of many beekeeping operations around the world.

The enormous and difficult-to-justify increase of honey exports from several Eastern countries, combined with the information coming from official surveys and private laboratories on the prevalence of honey adulteration, allow to conclude that fraud mechanisms may be responsible for the injection of a very important volume of cheap “manufactured” and diluted honeys into the market.

Different types of honey adulteration can be found (*Dübecke et al., 2018*):

1. intentional dilution with cheap syrups (corn, rice, beet, etc.);
2. extraction of immature honey and dehumidification by mechanical means;

3. use of Ion Exchange Resins to remove residues and lighten honey color;
4. masking the geographical and/or botanical origin of honey and
5. feeding hives during a nectar flow.

Elemental Analysis Isotope Ratio Mass Spectrometry developed some twenty five years ago, but still the official method of the main import countries, is effective for the detection of honey adulteration with syrups from C4 plants, like corn or sugar cane, but absolutely ineffective for the detection of syrups made from C3 plants, such as rice or beet.

Sugar syrups made from rice are normally produced in Asia, but are also available in many countries of the world that import those syrups, including some honey exporting countries.

Nowadays there are two possible testing strategies to detect the addition of C3 sugars to honey:

- Nuclear Magnetic Resonance (NMR) and
- a combination of targeted methods, which only look at a single or a small number of very specific parameters, e.g. honey-foreign enzymes, syrup-specific markers, honey-foreign oligosaccharides, artificial food ingredients, and acids indicative for invert sugar.

The necessity to update the official methods used by importing markets to detect honey adulteration is urgent.

THE NEW EUROPEAN EXPORTERS

During the last years, new honey export countries appeared in Europe taking advantage of the heterogeneity of honey prices according to their geographic origin, which may have created an economic incentive for some European countries to import cheap honeys from China and then re-export them as locally produced (*García, 2016*).

Honey labeling rules are not homogeneous throughout the European Union. Efforts are currently made to encourage all countries to have labelling regulations that require the declaration of all geographical origins of honeys contained in a jar. In such a way, all European consumers would have the same opportunities to know what they choose and pay for.

As mentioned before, masking the geographical origin of honey is another frequent type of fraud.

FINAL WORDS

Honest beekeepers, no matter their nationality, who are mainly focused on the production of pure honey for exportation, are succumbing to the export model employed in some countries, which in turn is a model that has been encouraged by some importers and packers to achieve short-term economic gains and low prices in supermarket shelves. This goes against defending honey's image as a natural product, and against efforts to protect honest beekeeping as an essential

component of their company's social responsibility practices. This also happens at the expense of consumers who often do not receive the product they pay for.

As long as economically motivated adulteration, customs fraud and the violation of international and national trade laws persist, the well-being and stability of world beekeepers, food security and ecological sustainability remain in jeopardy.

While maximising the efforts in combating honey fraud, the world beekeeping community also urgently needs to return to a positive and proactive agenda in order to help protect the prestige of this ancient food so related to nature and human health. Advanced modern science must be used to investigate and substantiate the variety of health benefits of honey, thus imitating very successful strategies already developed by other food industries.

Norberto García

President

*Scientific Commission
on Beekeeping Economy*

REFERENCES

- Dübecke, A., van der Meulen, J., Schütz, B., Tanner, D., Beckh, G. & Lüllmann, C. (2018). NMR Profiling a Defense Against Honey Adulteration. *American Bee Journal* 158:83-86.
- García, N. (2016). A Study of the Causes of Falling Honey Prices in the International Market. *American Bee Journal* 156: 877-882.



THREATS AND IMPORTANCE OF BEE POLLINATORS IN HUMAN-DOMINATED LANDSCAPES

Fabrice Requier



More than 35% of the global land surface is managed for agriculture production. Agriculture is expanding and intensifying in many regions to meet the needs of humans. This trend threatens the biodiversity and ecosystem services on which agriculture depends, such as crop pollination.

Indeed, recent studies have shown how these anthropogenic pressures cause the decline of wild and managed pollinators such as bees.

CRITICAL ROLE OF BEES IN CROP POLLINATION SERVICES

Flower-visiting animals provide critical pollination service with numerous benefits to humans. For instance, bees, the most important group of pollinators, sustain populations of wild plants that underpin biodiversity and ecosystem

function, produce honey and other beekeeping products, and support human-dependant crops production (Potts *et al.* 2016). Bees visit more than 90% of the leading global crop types (Figure 1), and improve the yield of approximately 75% of them, including most fruits, seeds and nuts and several high-value commodity crops such as coffee, cocoa and oilseed rape (Klein *et al.* 2007).

This pollination service is estimated at several hundred billion euros per year (Gallai *et al.* 2009), and an estimated 5-8% of global crop

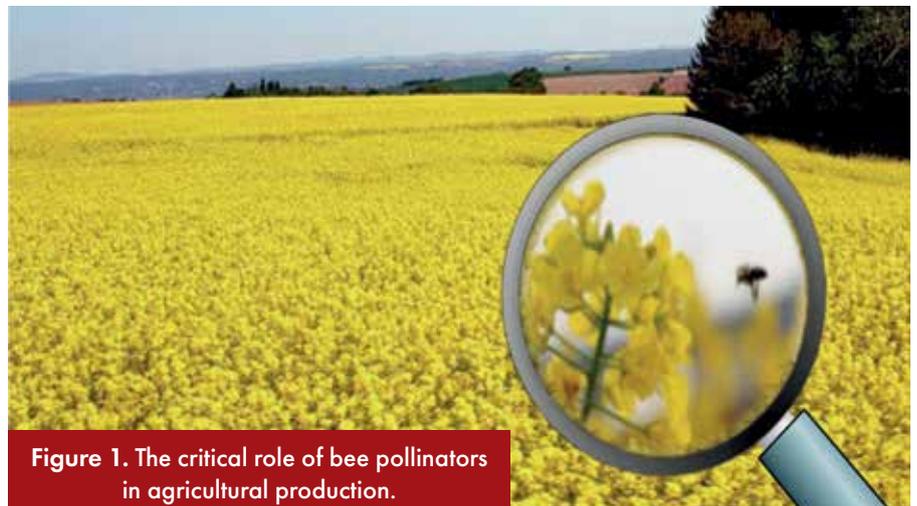


Figure 1. The critical role of bee pollinators in agricultural production.



Figure 2. Diversity of bees and associated functional traits improve crops pollination.

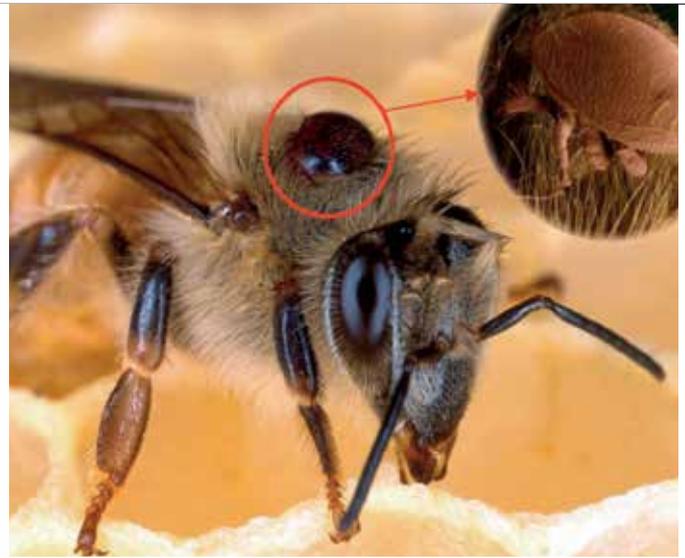


Figure 3. *Varroa destructor*, an ectoparasite of honey bee.

production would be lost without pollination services (Aizen *et al.* 2009), leading to changes in human diets and a disproportionate expansion of agricultural land to fill this shortfall in crop production by volume (Potts *et al.* 2016).

Due to differences between bee species morphology and functional traits (Figure 2), a higher diversity of pollinators provides complementary inputs or synergy, improving the quantity and quality of pollination. The role of wild bees diversity in crop pollination is therefore evident, for which recent global studies have showed positive effects on growth and stability of crop yields related to the presence of wild bees besides the supplement of managed pollinators.

However, this critical pollination service provided by bees is currently threatened due to their widespread decline. Loss of both wild and managed bees may negatively affect human food production as many crop types rely, at least to some extent, on animal pollination for the quantity and/or quality of their yield (Klein *et al.* 2007).

DECLINE OF BEE POLLINATORS, A MULTIPLE FACTOR HYPOTHESIS

Given the cryptic decline in bee populations, a vast research effort emerged since the 90s to understand the mechanisms underlying the population collapse of wild and managed bees. Large-scale monitoring of bee populations pinpointed the ongoing decline in European wild bee populations and in managed honey bee populations in the United States and across Europe (Biesmeijer *et al.* 2006, Potts *et al.* 2010).

Not only bee populations and pollination services decreased, but also beekeeping economy. Current global trends in honey production are collapsing, independently on the stagnation of beehive livestock (Potts *et al.* 2010). Many factors are involved in the cause of bee decline. Land-use change (i.e., habitat loss, fragmentation, habitat degradation and decrease of resource diversity and abundance) was pointed as a major cause of the decline of wild bees in agricultural, in particular

the loss of floral-food and nesting resources.

The agricultural disturbances in the availability of flower resources, such as the scarcity of flowers and/or the monotonous offer of crop flowers, affect the honey bee colony dynamics and survival (Requier *et al.* 2017). Pesticides, e.g. neonicotinoids with lethal or sub-lethal effects, as well as pyrethroids and fungicides, were also highlighted to deeply affect the behaviour and fitness of honey bees and wild bees (Goulson *et al.* 2015). Additional identified critical causes include diseases, pathogens, and parasites, such as the *Varroa destructor* ectoparasite (Figure 3). Despite highly intensive research efforts however, no single driver and/or mechanism could be identified (Goulson *et al.* 2015).

Bee decline is now better described as a multifactorial hypothesis (Potts *et al.* 2010, Goulson *et al.* 2015), where three main groups of stressors are said to be involved: “Limited and/or monotonous floral resources”, “Pesticides” and “Parasites

and Pathogens” occurring simultaneously or influencing each other through synergic effects (Figure 4).

TOWARDS GROWING INTERESTS IN BEE IMPORTANCE AND CONSERVATION

The current evidences of a decline of the populations of wild and managed bees worldwide, which may disrupt the reproduction of bee-pollinated wild plants, crop pollination service and honey production (Potts *et al.*, 2010), lead to concerns for negative social, economic and ecological effects (Potts *et al.*, 2016).

A collective awareness has emerged over the last years, where science, policymakers, and the public have increased their interests in bee decline issues. For instance, Agri-Environment Schemes was successfully applied in agricultural habitats to restore wild pollinator populations through an increase in floral and nesting resources (Scheper *et al.* 2013).

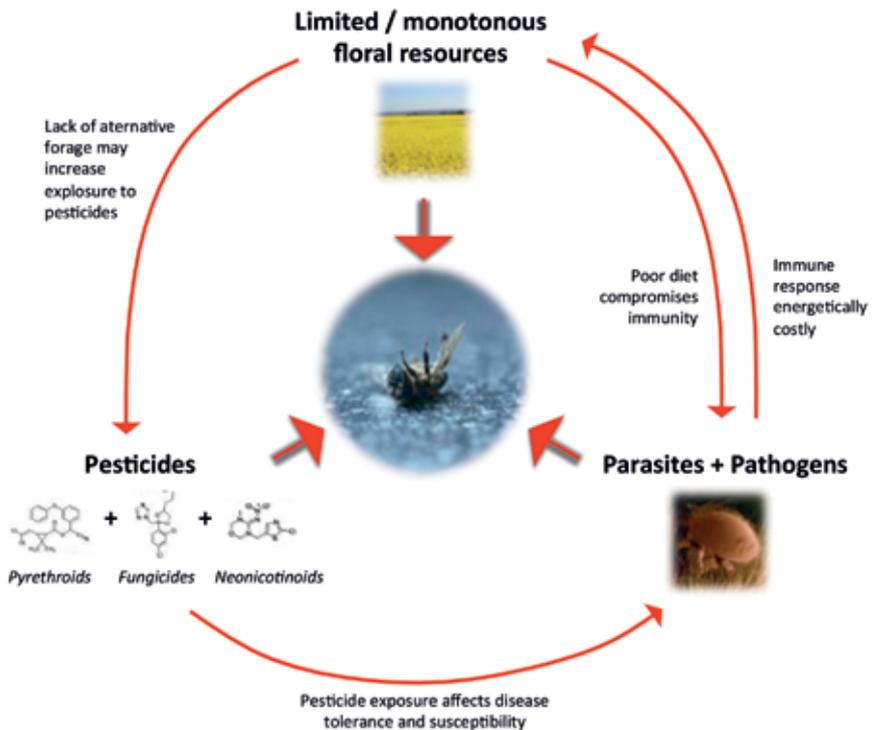


Figure 4. The multiple factor hypothesis of bee decline, based on Goulson *et al.* (2015).

Moreover, 77 international experts critically evaluated the available global evidence in pollinators' importance through the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 2016). In addition to these science and policymakers considerations, a recent study pinpoints a wide interest of the public in bee conservation issues (Wilson *et al.* 2017).

This study puts in light that conservation efforts require substantial public support, and that any programmes aimed at stopping or mitigating bee population declines will need to include outreach and education measures.

Fabrice Requier
Member
Scientific Commission
on Pollination and Bee Flora

REFERENCES

- Aizen M. A., Garibaldi L. A., Cunningham S. A., Klein A. M. (2009) How much does agriculture depend on pollinators? Lessons from long-term trends in crop production. *Annals of Botany* 103, 1579-1588 • Gallai N., Salles J. M., Settele J., Vaissière B. E. (2009) Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. *Ecological Economics* 68, 810-82 • IPBES (2016) The Assessment Report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on Pollinators, Pollination and Food Production. Available online at <http://www.ipbes.net/node/44781> • Klein A. M., Vaissière B. E., Cane J. H., Steffan-Dewenter I., Cunningham S. A., Kremen C., Tscharntke, T. (2007). Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society B: Biological Science* 274, 303-313 • Potts S. G., Biesmeijer J. C., Kremen C., Neumann P., Schweiger O., Kunin W. E. (2010) Global pollinator declines: trends, impacts and drivers. *Trends in Ecology and Evolution* 25, 345-53 • Potts S. G., Imperatriz-Fonseca V., Ngo H. T., Aizen M. A., Biesmeijer J. C., Breeze, Vanbergen A. J. (2016) Safeguarding pollinators and their values to human well-being. *Nature* 540(7632), 220-229 • Requier F., Odoux J. F., Henry M., Bretagnolle V. (2017) The carry-over effects of pollen shortage decrease the survival of honeybee colonies in farmlands. *Journal of Applied Ecology* 54, 1161-1170 • Scheper J., Holzschuh A., Kuussaari M., Potts S. G., Rundlöf M., Smith H. G., Kleijn D. (2013) Environmental factors driving the effectiveness of European agri-environmental measures in mitigating pollinator loss - a meta-analysis. *Ecology Letters* 16(7) • Wilson J.S., Forister M.L., Messinger Carril O. (2017) Interest exceeds understanding in public support of bee conservation. *Frontiers in Ecology and the Environment* 15, 460-466.

Parasitic mites such as the Varroa mite pictured on the thorax of a worker bee are causing beekeepers to use pesticides inside of bee colonies to control the mites.



CHALLENGES TO HONEY BEES FROM PEST AND DISEASES

Jeff Pettis



Honey bees are widespread globally and often serve as the major managed pollinator in agriculture. Thus, good bee health is vital to global food security.

THE CHALLENGE

The status of honey bee health must be viewed in the context of the larger issue of pollinator declines worldwide (*Potts et al. 2010; IPBES 2016*). Honey bees are widespread globally and often serve as the major managed pollinator in agriculture. Thus, good bee health is vital to global food security. The challenges faced by honey bees can indeed have impacts on the supply of fruit, nuts and vegetables vital for human health. Lastly, the threats to bee health are numerous and multifactorial and require sound science-based information to be available to the beekeeping community. This is the charge and challenge that faces the Bee Health commission of Apimondia.

CURRENT STATUS

Only 30-50 years ago beekeepers were faced with just a few pests and

diseases for example the widespread problems of American foulbrood and wax moths. In recent years we have seen the global spread of new pests such as Varroa and Small Hive Beetles and older diseases have in some cases seen a resurgence recently, e.g. European Foulbrood. In addition to the spread of new pests and diseases there is widespread belief that good bee forage is declining with increased intensive agriculture and pesticide exposures (*Potts et al. 2016*). Specific recent concerns center on agricultural chemicals such as systemics and fungicides but we must remember that beekeepers themselves are adding to the pesticide issues with miticide use for Varroa control. Beekeepers are faced with many challenges but often if bees have access to good pollen and nectar they can overcome or be less susceptible to the multitude of challenges that



Managed honey bee colonies pollinating almond trees in California USA: managed pollinators are vital to world food security.



Healthy beehives are vital to pollination and good brood patterns are an indicator of good bee health and disease-free bees.

bees currently face. Thus, land use changes and intensive agriculture all tend to reduce forage availability and impact bee health. We need to protect existing natural forage areas and find ways to diversify the agricultural landscape.

One issue that has come more to the forefront in recent years is the debate between treatment-free beekeeping and those beekeepers who treat with miticides to control mites and antibiotics for bacterial diseases and or Nosema control. A part of this debate even involves the feeding of sugar and or artificial protein to honey bee colonies; some are totally opposed to interventions in bee hives while others feel they cannot keep bees alive without these outside inputs. Bees can and do survive without human intervention, even in the face of Varroa mites, but on a commercial scale for pollination and large-scale honey production most beekeepers use various inputs into their hives throughout the year. A challenge in managing bee pests and diseases is in finding

sustainable and non-chemical means to manage honey bees.

FUTURE TRENDS AND CHALLENGE

The demand for pollination services is growing in the developing world greater than the projected availability of honey bees for pollination (Gallai *et al.* 2009). As such it is projected that more bees will be needed in the future and this comes at a time when the challenges to bee health are increasing. Additionally, there is the debate between treatment-free beekeeping and more

input intensive beekeeping. What is the solution? Surely, we need to protect and improve natural bee forage, develop sustainable and non-chemical control options for bee pests and diseases. Additionally, we need to continue to increase awareness of the value of pollinators to food security. Lastly, we need to continue to develop sustainable methods for honey bee management and practical means to support beekeeping and beekeepers worldwide.

Jeff Pettis

President

*Scientific Commission
on Bee Health*

REFERENCES

- Gallai N., Salles J. M., Settele J., Vaissière B. E. (2009) Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. *Ecological Economics* 68, 810-82.
- IPBES (2016) The Assessment Report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on Pollinators, Pollination and Food Production. Available online at <http://www.ipbes.net/node/44781>
- Klein A. M., Vaissière B. E., Cane J. H., Steffan-Dewenter I., Cunningham S. A., Kremen C., Tscharntke, T. (2007). Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society B: Biological Science* 274, 303-313.
- Potts S. G., Biesmeijer J. C., Kremen C., Neumann P., Schweiger O., Kunin W. E. (2010) Global pollinator declines: trends, impacts and drivers. *Trends in Ecology and Evolution* 25, 345-53.
- Potts S. G., Imperatriz-Fonseca V., Ngo H. T., Aizen M. A., Biesmeijer J. C., Breeze, Vanbergen A. J. (2016) Safeguarding pollinators and their values to human well-being. *Nature* 540(7632), 220-229.



GOOD BEEKEEPING PRACTICES (GBPs) AND DISEASE PREVENTION

Jorge Rivera-Gomis et al.



Improving beekeeping management, honeybee health and bee product quality will improve too, increasing the competitiveness and resilience of the apicultural sector at all levels.

INTRODUCTION

Nowadays, beekeeping faces numerous challenges, and numerous disorders that affect honey bee colonies (Vanengelsdorp & Meixner, 2010). An important menace to the development of the beekeeping sector, and thus bee product safety, is the potential introduction and spread of bee diseases, also affecting the trade of honeybee products and living honeybees. As an example, the presence of the honey bee pest *Aethina tumida* (small hive beetle, SHB) was recently detected in Southern Italy, leading to the subsequent reactions in Europe (European Commission, 2014). Other factors to consider are also pesticides, climatic changes and high heterogeneity of the beekeeping industry (Woodcock et al., 2017; Goulson et al., 2018; Chauzat et al., 2013).

In this context, the “BPRACTICES” project, funded from the European Union’s Horizon 2020 research and innovation program

me under Grant Agreement n° 696231, ERA-Net SusAn, aims to develop a system of sustainable apiculture by implementing innovative management practices (Good Beekeeping Practices - GBPs).

The project consortium, coordinated by the Istituto Zooprofilattico Sperimentale del Lazio e della Toscana “M. Aleandri” (Italy), includes: University of Namik Kemal (Turkey), Agricultural Institute of Slovenia (Slovenia), Centro de Investigación Apícola y Agroambiental de Marchamalo (Spain), Austrian Agency for Health and Food Safety (Austria), Mississippi State University (USA) and Istituto Zooprofilattico Sperimentale delle Venezie (Italy). Moreover, the project involves: the International Federation of Beekeepers’ Association (Apimondia), the European Professional Beekeepers’ Association (EPBA), the University of Genova (Italy), European Union Reference Laboratory for Bee Health (ANSES, France) and the Food and



Agriculture Organization of the United Nations (FAO).

DEFINITION OF GOOD BEEKEEPING PRACTICES

GOOD BEEKEEPING PRACTICES (GBPs) are defined as those integrated and sustainable activities which beekeepers apply for the hive management to obtain an optimal health for honeybees, positive socioeconomic impacts (e.g. beekeepers and consumers health protection) and to ensure environmental protection. The application of the GBPs results in a positive effect on the wellbeing of honeybee colonies, food safety and environmental protection, thus guaranteeing high

production standards at all levels. An essential part of the Good Beekeeping Practices are the pre-clinical indicators, which allow to diagnose an infection or infestation before symptoms appear, representing an essential tool for mitigation of the disease and prevention of the clinical symptoms.

Implementation of prevention practices leads to improvement of honeybee health and consequently increases the performance of honey bee colonies, the profitability of the beekeeping operation and the pollination service provided by honeybees and also reduces the amount of residues in honeybee products.

CLASSIFICATION OF GOOD BEEKEEPING PRACTICES

Starting from the OIE-FAO guidelines “Guide to Good Farming Practices for Animal Production Food Safety” (OIE & FAO, 2009), we classified GBPs according to the following main headings: “general apiary management”, “veterinary medicines”, “disease management in general”, “hygiene”, “animal feeding and watering” and “GBPs specific to main honeybee diseases. For each category we created a list of GBPs which were then evaluated and given a score by the scientists involved in the “BPRACTICES” project.

- (1) The **GENERAL APIARY MANAGEMENT** section proposes practices concerning movement of the colonies, positioning of the apiary, zootechnical measurements, winter preparations and general guidelines to maintain honeybee health.
- (2) The section concerning the **DISEASE MANAGEMENT IN GENERAL** includes the practices concerning inspections of colonies for clinical signs of diseases,
- (3) GBPs concerning the use of **VETERINARY MEDICINES** should be respected to ensure the efficacy of treatments, honeybee health and product safety.



prevention, sampling in case of sick or dead bees, measures which should be adopted in case of dead colonies.

- (4) The **HYGIENE** section is about different methods of disinfection and disease spread control.
- (5) **ANIMAL FEEDING AND WATERING** GBPs are related to guarantee safety and hygiene of feeding and watering. It is also very important to have sufficient feed supplies all year round.

CONCLUSIONS

Resilience of the beekeeping sector, sustainability and the income of beekeepers increase when sanitary problems are prevented and costs (e.g. for treatments, colony losses, or caused by production decrease) are reduced. The on-farm practices firstly defined and identified in the “BPRACTICES” project provide a direct benefit to beekeepers. Improving beekeeping management, honeybee health and bee product quality will improve too, increasing the competitiveness and resilience of the apicultural sector at all levels.

Jorge Rivera-Gomis¹,
Jernej Bubnic¹,
Antonella Cersini¹,
Magali Chabert²,
Marie-Pierre Chauzat²,
Roberto Eggenhoeffner³,
Serkan Erat⁴, **Ales Gregorc**⁵,
Walter Haefeker⁶,
Mariano Higes⁷,
Riccardo Jannoni-Sebastianini⁶,
Charlotte Lietaer⁸,

Philip McCabe⁶,
Rudolf Moosbeckhofer⁹,
Dilek Muz⁴,
Mustafa Necati Muz⁴,
Nurullah Ozdemir⁴,
Marco Pietropaoli¹,
Licia Ravarotto¹⁰,
Alexandra Ribarits⁹,
Marie-Pierre Riviere²,
Maja Ivana Smodis Skerl¹¹,
Asger Sogaard Jorgensen⁶,
Giovanni Formato¹

¹ *Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana, Via Appia Nuova 1411, 00178 Roma, Italy*

² *ANSES, Honeybee pathology unit, European Union Reference Laboratory for bee health, 105 route des Chappes, CS 20111, 06902 Sophia Antipolis, France*

³ *University of Genova, Biophysic Section of Department of Surgery Sciences and Integrated Diagnostics (DISC), Corso Europa 30, 16132 Genova, Italy*

⁴ *University of Namik Kemal, Kampus Street, 59030 Tekirdag, Turkey*

⁵ *Mississippi State University, Center for Costal Horticulture Research, PO box 193, 39470 Poplarville, MS, USA*

⁶ *International Federation of Beekeepers' Associations, Corso Vittorio Emanuele 101, I-00186 Roma, Italy*

⁷ *Centro de Investigacion Apicola y Agroambiental de Marchamalo, C/Camino San Matin s/n, 19180 Marchamalo, Spain*

⁸ *Tecnologies and practices for small agricultural producers (TECA) platform of the Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00153 Rome, Italy*

⁹ *Austrian Agency for Health and Food Safety, Spargelfeldstrasse 191, 1220 Vienna, Austria*

¹⁰ *Istituto Zooprofilattico Sperimentale delle Venezie, Viale dell'Università 10, 35020 Legnaro (Padova), Italy*

¹¹ *Agricultural Institute of Slovenia, Hacquetova ulica 17, 1000 Ljubljana, Slovenia*

REFERENCES

- Chauzat, M. P., Cauquil, L., Roy, L., Franco, S., Hendriks, P., & Ribière-Chabert, M. (2013). Demographics of the European apicultural industry. *PLoS one*, 8(11), e79018.
- Goulson, D., Nicholls, E., Botías, C., & Rotheray, E. L. (2015). Bee declines driven by combined stress from parasites, pesticides, and lack of flowers. *Science*, 347(6229), 1255957.
- FAO, OIE (2009) Guide to good farming practices for animal production food safety. ISBN 978-92-5-006145-0
- Van Engelsdorp D, Meixner MD (2010) A historical review of managed honey bee populations in Europe and the United States and the factors that may affect them. *J Invertebr Pathol* 103 Suppl 1S80–S95
- Woodcock, B. A., Bullock, J. M., Shore, R. F., Heard, M. S., Pereira, M. G., Redhead, J., ... & Peyton, J. (2017). Country-specific effects of neonicotinoid pesticides on honey bees and wild bees. *Science*, 356(6345), 1393-1395.

ACKNOWLEDGEMENTS

We would like to thank the entire Executive Council of Apimondia for pulling together the scientific contributions of this publication. Their time and effort spent in collaborating in building up the articulated content for the delivery of this product was much appreciated.

Asger Jørgensen, former President of Apimondia, assisted us in co-ordinating the submission and review of the articles received.

Credit also goes to Raffaele Cirone, President of the Italian Beekeepers' Federation and Filippo Jannoni-Sebastianini of Apimondia for collating and preparing the content of this publication for printing with a tight deadline.

Our gratitude goes to FILTEA for sharing the printing expenses of this publication.



Apimondia
Working for the benefit of bees and apiculture

Pubblicazione celebrativa della Giornata Mondiale dell'Ape 2018
Realizzata per conto di APIMONDIA
Federazione Internazionale delle Associazioni di Apicoltura
Autori Vari

Coordinamento editoriale: Raffaele Cirone
Progetto grafico e impaginazione: Alberto Nardi
Foto di copertina: Operaia di *Apis mellifera* L. su fiore di girasole

© FAI Apicoltura Srl Edizioni - Maggio 2018
Corso Vittorio Emanuele II, 101
IT - 00186 ROMA (Italy)
Tel.: +39 06 6852556 - Fax: +39 06 6852287
Posta elettronica: info@faiapicoltura.biz
Sito internet: www.fai.bio

Finito di stampare nel mese di Maggio 2018 presso:
Tipografia EuroInterstampa S.r.l. - Roma - Italy

L'Editore declina ogni responsabilità in ordine alle opinioni espresse e ai contenuti che restano a esclusivo carico dei singoli Autori. Il presente volume non è in vendita e viene distribuito gratuitamente dal Segretariato Generale di Apimondia e fino ad esaurimento della tiratura di n. 1000 copie.

ISBN: 978-88-941041-6-5