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Prevention of Honeybee Colony Losses (COLOSS)

2011 Year in Review

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Continued need for honey bee research coordination

Honey bees are vital for the pollination of many agricultural crops and for the production of quality bee products such as honey, pollen, royal jelly, wax, and propolis (Shimanuki *et al.*, 1996; vanEngelsdorp and Meixner, 2010; Aebi *et al.*, 2011). Although recent, significant, advances have been made towards the better understanding of honey bee health, high levels of western honey bee, *Apis mellifera*, colony mortality continue to occur at an alarming rate in many regions of the world (Neumann and Carreck, 2011). Recently, a standardized survey of western honey bee colony losses performed by COLOSS in Canada, China, Europe, Israel, and Turkey for winters 2008/09 and 2009/10 revealed higher losses in almost all surveyed countries during the latter observation period (van der Zee *et al.*, 2012). In addition, newly published data, as well as personal communications with European and North American colleagues, suggest that this trend of increased losses persisted during winter 2010/11, and will continue for winter 2011/12 (CAPA, 2012).

The parasitic mite *Varroa destructor* continues to be the single greatest parasitic threat to western honey bees (Dietemann *et al.*, 2012). However, other pathogens such as microsporidians parasites, viruses, and bacteria, in addition to climate, linked to poor food availability, beekeeping management issues, and socio-economic factors further burden the vitality of the beekeeping industry (vanEngelsdorp and Meixner, 2010; Williams *et al.*, 2010)

COLOSS's objectives

COLOSS is an international research network that is composed of an executive committee and four working groups (Fig. 1).

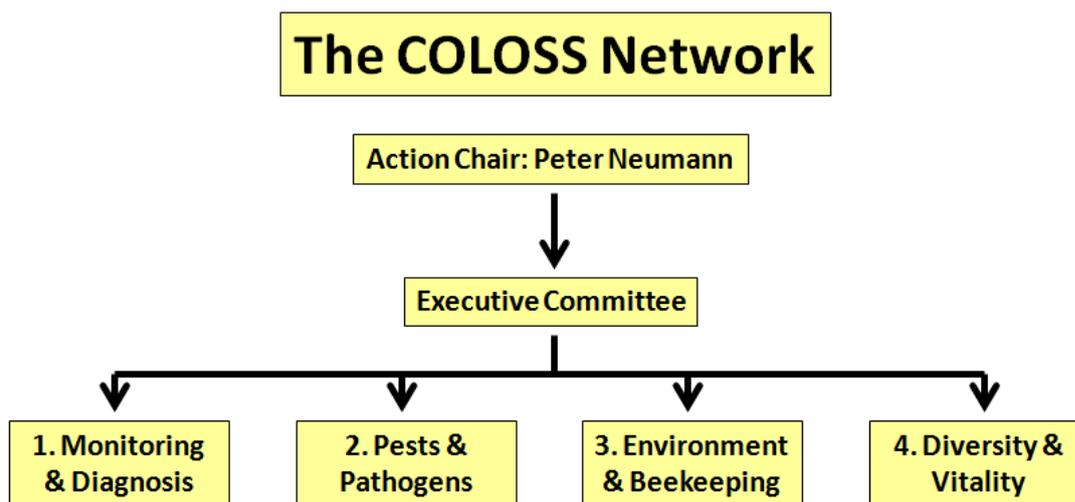


Fig. 1. Organizational structure of the COLOSS network, composing of a Chair, Executive Committee, and four working groups.

The network is tasked with improving honey bee health at a global level by organizing meetings and Short-term Scientific Missions that are aimed at meeting COLOSS's four primary objectives:

1. Develop and maintenance of standards for monitoring and experimental honeybee research.
2. Identify underlying factors & mechanisms responsible for colony losses
3. Explain & prevent large-scale losses of colonies
4. Develop emergency measures & sustainable management strategies

Increased membership

Despite a large existing membership of academic and government researchers, extension personal, veterinarians, and students after two years of financial support from the inter-governmental agency European Cooperation in Science and Technology (COST), more than 20 new members joined COLOSS in 2011, bringing total membership to 302 individuals from 59 countries worldwide (Fig. 2). COLOSS especially promotes networking among Early Stage Researchers (those with a Ph.D. for less than 10 years) to build a strong honey bee research foundation for the future; at the end of 2011, approximately 50 % of COLOSS members fell into this category, many of which were graduate students. However, there is one major problem currently associated with the COST funding scheme: with the exception of few invited speakers per meeting (usually plenary

lectures) support is restricted to COST members countries. This is a considerable constraint because honeybee health is obviously a global issue and therefore many key players in this field work in countries outside of the COST network (e.g. USA). Moreover, scientists from developing countries (e.g. Africa) are also disadvantaged.



Fig. 2. COLOSS members are located in 59 countries globally.

COLOSS at centre stage of honey bee health and pollinator issues

Two representatives of the network (the Action Chair and Prof. Paxton) were invited to address Members of the European Union Parliament in Brussels, Belgium, on three separate occasions in 2011. The first, featuring the network's Action Chair, occurred during a COST exhibition marking its 40th anniversary. The second and third were during plenary sessions at the European Parliament. The COLOSS Action Chair was also invited to give an update on network activities at Apimondia 2011 in Buenos Aires, Argentina. Apimondia is the premier beekeeping event, and hosted every second year at locations around the world. Over 10,000 beekeepers and scientists took part in Buenos Aires. Invitations to these events signify the importance of the COLOSS network to honey bee health and pollination issues.

A focus on standardization of methods

In 2011, COLOSS placed a strong emphasis on the standardization of honey bee research methods. First and foremost, the COLOSS *BEEBOOK*: standard methodologies for *Apis mellifera* research that will be produced in collaboration with the International Bee Research Association, began to take shape. This, undoubtedly future seminal work in the field of honey bee research, will be composed of over 25 chapters authored by leading honey bee experts (>130 authors), and is expected to be completed by late 2012. It will be published both as a hard copy book as well as open online access chapters of the Journal of Apicultural Research.

Second, the COLOSS Questionnaire, a standardized winter colony loss survey, continued to grow in participating beekeepers and countries, as well as complexity. For winters 2008/09, 2009/10, and 2010/11, 12, 24, and 24 countries participated, respectively (van der Zee *et al.*, 2012). Third, preliminary results of the pan-European COLOSS study on genotype-environment interactions in honey bee colonies observed significant interactions for most honey bee traits. Field experiments and preliminary data analyses were completed during 2011, and full results are slated for publication in the upcoming year. Fourth, the network made significant advances towards the standardization of honey bee larvae rearing in the laboratory, which is vital to understanding the effects of various negative factors, such as poor nutrition or agricultural chemicals, on this susceptible life stage. These four deliverables remain priority for COLOSS in 2012, and beyond.

Meeting organization

COLOSS organized one conference, one training school, and eight workshops in 2011 (Table 1). The themes of these events were primarily aimed at helping COLOSS meet its objectives, particularly the standardization of research methods.

Table 1. Events organized by COLOSS during 2011.

Meeting type	Month	Location	Title	Participant #
Conference	August	Belgrade, Serbia	7 th COLOSS Conference	56
Training school	November	Zagreb, Croatia	Future perspectives	12
Workshop	February	Avignon, France	COLOSS questionnaire: from question formulation to data analysis	26
	March	Plovdiv, Bulgaria	Honey bee vitality and diversity	31
	April	Copenhagen, Denmark	The future of brood disease	17
	June	Wageningen, Netherlands	Honey bee colony vitality – status of the genotype-environment interactions (GEI) experiment and the subspecies discrimination methods comparison	12
	July	Pulawy, Poland	Honey bee vitality and diversity: field observations of experimental GEI colonies	29
	August	Belgrade, Serbia	Results and finalizing Level 1 and 2 Questionnaires	18
	August	Belgrade, Serbia	Diagnostic surveys	33
	November	La Rochelle, France	In vitro larval rearing	13

Short-term Scientific Missions (STSMs) performed

Ten STSMs were performed by COLOSS members in 2011 (Table 2). Similar to COLOSS's organized meetings, these missions were aimed at helping COLOSS meet its goals and objectives; however, they focussed primarily on providing Early Stage Researchers with the opportunity to collaborate with leading honey bee laboratories in Europe.

Table 2. Short-term Scientific Missions organized by COLOSS during 2011.

Title	Institute	Participant	Home institute
Statistical modeling, spatial analyses, and calculation of relative risks maps for the COLOSS Questionnaire	Newcastle University, Newcastle, England	Lennard Pisa	Netherlands Centre for Bee Research, Tersoal, The Netherlands
		Robert Brodschneider Celine Holzmann	Karl-Franzens-University, Graz, Austria Institut de l'abeille, Paris, France
Genotyping the bacterium <i>Paenibacillus larvae</i> , the causative agent of American foulbrood	Ghent University, Ghent, Belgium	Aygun Yalcinkaya	Hacettepe University, Ankara, Turkey
Quantification of behaviour in honey bees	INRA, Avignon, France	Svjetlana Vojvodic	University of Copenhagen, Copenhagen, Denmark
Comparative study of the microsporidians <i>Nosema apis</i> and <i>Nosema ceranae</i>	INRA, Avignon, France	Christina Botías	Centro Apícola Regional, Marchamalo, Spain
Assessing the vitality of honey bees	Wageningen University and Research Centre	Anne-Claire MARTEL	ANSES, Sophia Antipolis Cedex, France
Artificial rearing of honey bee larvae	Karl-Franzens- University, Graz, Austria	Nurit Eliash	The Volcani Center, Bet Dagan, Israel
Techniques for artificial insemination of queens	Institute of Pomology and Floriculture, Pulawy, Poland	Leonidas Charistos	Hellenic Institute of Apiculture, Moudania, Greece
		Sladjan Rasic	Faculty of Agriculture, University of Belgrade, Belgrade, Serbia

Dissemination of information

As a research network, COLOSS values the importance of the dissemination of information related to bee health to relevant stakeholders, including member activities to the network as a whole, as well as to non-member honey bee and related researchers, government officials and veterinarians, beekeepers, farmers, policy makers, and the general public. In 2011, COLOSS publications, defined as those co-authored by at least two COLOSS members, totalled nine books or book chapters, 21 popular science articles, and 32 peer-reviewed publications in international scientific journals (Table 3). In addition to presentations given at COLOSS-organized workshops, network members also presented about COLOSS activities at a number of events, including at more than 30 scientific meetings (Table 4).

Table 3. Publications authored by COLOSS in 2011. Only those publications co-authored by two or more network members are included.

Publication type	#	Example book or journal titles
Books & book chapters	9	<ul style="list-style-type: none">● <i>Honey Bee Colony Health: Challenges and Sustainable Solutions</i> (Taylor & Francis)● <i>Varroa – Still a problem in the 21st century?</i> (IBRA)
International peer-reviewed articles	32	<ul style="list-style-type: none">● Trends in Ecology and Evolution● PLoS ONE● Applied and Environmental Microbiology● Ecology and Evolution● Journal of Invertebrate Pathology● Apidologie● Journal of Apicultural Research
Popular science articles	21	<ul style="list-style-type: none">● Revue Suisse d'Apiculture (Swiss Beekeeping Journal)● African Journal of Agricultural Research● Deutsches Bienenjournal (German Beekeeping Journal)● Entomologica Austriaca

Table 4. Presentations by COLOSS members that specifically mention the network that were given to relevant stakeholders at various events in 2011.

Event type	#	Example events
Scientific, beekeeper & general public meetings	32	<ul style="list-style-type: none"> ● 2011 Apimondia, Buenos Aires, Argentina ● 10th International Congress on Plant-Bee Relationships, Cholula, Mexico ● 10th OIE Symposium on Diagnosis and Control of Bee Diseases, Buenos Aires, Argentina ● Natur-Museum Luzern, Luzern, Switzerland
Training schools & non-COLOSS organized workshops	5	<ul style="list-style-type: none"> ● Association Nationale des Eleveurs de Reines et des Centre d'Elevages Apicoles, Roquebrune, France ● Swiss Bee Inspectors Training School, Morschach, Switzerland
Addresses to elected officials & policy makers	3	<ul style="list-style-type: none"> ● EU Parliament, Brussels, Belgium

Future directions

COLOSS will continue 2012 where it left off this past year. With financial support provided for the 4th and final year by COST, and the 2nd year by the Ricola Foundation, COLOSS is organizing its annual conference in conjunction with EurBee 2012, Europe's premiere biannual honey bee research event. It is also organizing 17 workshops or other meetings, 2 training schools, and 14 Short-term Scientific Meetings. These events will continue to focus on the standardization of honey bee research methods, including the completion of the COLOSS *BEEBOOK* and the pan-European genotype-environment experiment, as well the continuation and expansion of the COLOSS Questionnaire globally.

Over the past years, COLOSS has developed into an internationally recognized network for bee health (*e.g.* nominated as a key stakeholder at the EU level by the parliament). It will continue with its legacy, including monitoring colony losses globally, the *BEEBOOK*, as well as global networking to adequately address the complex issues of honey bee colony losses.

References

- Aebi, A., Vaissière, B.E., vanEngelsdorp, D., Delaplane, K.S., Roubik, D.W., Neumann, P., 2011. Back to the future: *Apis* versus non-*Apis* pollination. Trends in Ecology and Evolution 10.1016/j.tree.2011.11.017.
- CAPA, 2012. Canadian Association of Professional Apiculturists statement on honey bee losses in Canada (2011). <http://capabees.com/main/files/pdf/canwinloss.pdf>, accessed 12 January 2012.
- Dietemann, V., Pflugfelder, J., Anderson, D., Charrière, J.D., Chejanovsky, N., Dainat, B., de Miranda, J.R., Delaplane, K.S., Dillier, F.X., Fuchs, S., Gallmann, P., Gauthier, L., Imdorf, A., Koeniger, N., Kralj, J., Meikle, W., Pettis, J., Rosenkranz, P., Sammataro, D., Smith, D., Yañez O., Neumann, P. 2012. *Varroa destructor*: research avenues towards sustainable control. Journal of Apicultural Research DOI: 10.3896/IBRA.1.51.1.15, in press.
- Neumann, P., Carreck, N.L., 2010. Honey bee colony losses. Journal of Apicultural Research 49, 1-6.
- Shimanuki, H., Flottum, K., Harman, A. (Eds.) 2007. The ABC & XYZ of Bee Culture, 41st Ed. A.I. Root Company, 911 pp.
- van der Zee, R., Pisa, L., Andonov, S., Brodschneider, R., Charrière, J.-D., Chlebo, R., Coffey, M.F., Crailsheim, K., Dahle, B., Gajda, A., Gray, A., Drazic, M.M., Higes, M., Kauko, L., Kence, A., Kence, M., Kezic, N., Kiprijanovska, H., Kralj, J., Kristiansen, P., Martin-Hernandez, R., Mutinelli, F., Nguyen, B.K., Otten, C., Özkırım, A., Pernal, S.F., Peterson, M., Ramsay, G., Santrac, V., Soroker, V., Topolska, G., Uzunov, A., Vejsnæs, F., Wei, S., Wilkins, S. 2012. Managed honey bee colony losses in Canada, China, Europe, Israel and Turkey, for the winters of 2008–2009 and 2009–2010. Journal of Apicultural Research, in press.
- vanEngelsdorp, D., Meixner, M.D., 2010. A historical review of managed honey bee populations in Europe and the United States and the factors that may affect them. Journal of Invertebrate Pathology 103, S80-95.

Williams, G.R., Tarpy, D.R., vanEngelsdorp, D., Chauzat, M.-P., Cox-Foster, D.L., Delaplane, K.S., Neumann, P., Pettis, J.S., Rogers, R.E.L., Shutler, D., 2010. Colony Collapse Disorder in context. *BioEssays* 32, 845-846.