





GUEST EDITORIAL

The COLOSS BEEBOOK evolves: hive products, ‘omics research and Eastern honey bees, *Apis cerana*

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The COLOSS BEEBOOK was developed to provide honey bee scientists with a single reference where standard research methods related to various honey bee-related topics were available and promoted. This Special Issue of the *Journal of Apicultural Research (JAR)* includes the pollen chapter (Campos et al., 2021) and the venom chapter (de Graaf et al., 2021) of the COLOSS BEEBOOK Volume III “Standard methods for *Apis mellifera* hive product research”. This volume is a practical manual compiling standard methods for research on *Apis mellifera* hive products.

The pollen chapter considers research methods related to bee pollen, both as a source of nutrition for bees and as a human food. It covers the production and storage of bee pollen to ensure a high-quality product, methods for the identification of floral sources, and methods to determine quality criteria and pollen bioactivities. The venom chapter covers venom as a human allergen. Standard methods are presented for venom collection, characterization and storage, and for the determination of its biological activity and its use in biomedical research, principally venom allergy research.

The previous chapters on beeswax (Svečnjak et al., 2019); brood as human food (Jensen et al., 2019); propolis (Bankova et al., 2019) and royal jelly (Hu et al., 2019) were published in Special Issue 58(2), and the honey chapter (de Almeida-Muradian et al., 2020) was published in Special Issue 59(3). A general introduction to Volume III can be found in the editorial to issue 59(3) (Dietemann et al., 2019) and further information about the BEEBOOK project can be found in the editorial to issue 59(3) (Carreck et al., 2020).

The BEEBOOK project is a truly international collaboration; the papers that comprise Volume III represent the work of 133 authors from 26 countries spanning five continents. The work has been well received; together the Volume III papers have already been downloaded some 53,000 times from the Taylor &

Francis Online platform, and the papers have already received 119 CrossRef citations in refereed journals. With the two chapters on pollen and venom, publication of Volume III is now complete, and a hard copy version compiling all chapters of Volume III for use at the laboratory bench will shortly be published by IBRA and Northern Bee Books.

The first two volumes of the COLOSS BEEBOOK were published in 2013 and focused on general honey bee (Volume I) and honey bee pest and pathogen (Volume II) research methodologies. The .pdf papers can all be downloaded free to view directly from the Taylor & Francis Online platform and also through the COLOSS website: <https://coloss.org/>. They are also available as hard copy books (Dietemann et al., 2013a, 2013b), and can be purchased from the IBRA bookshop: <https://ibra.org.uk/shop> or from Amazon. These papers, collectively, have been cited in refereed journals over 3,000 times.

The previous editorial (Carreck et al., 2020) mentioned the need to update earlier BEEBOOK chapters where new methods have been developed. Following contact with the original author teams, we can report that interest has been expressed in updating the chapters on: estimating strength parameters (Delaplane et al., 2013b); physiology and biochemistry research (Hartfelder et al., 2013), pollination (Delaplane et al., 2013a), rearing and selection of queens (Büchler et al., 2013), epidemiological methods (van Engelsdorp et al., 2013), survey methods for estimating colony losses and explanatory risk factors (van der Zee et al., 2013), small hive beetle (Neumann et al., 2013), European foulbrood (Forsgren et al., 2013), viruses (de Miranda et al., 2013), and propolis (Bankova et al., 2019). In some cases, the original lead author will be coordinating the revision, but in many cases, new authors have joined the teams.

The field of molecular methods for honey bee research has experienced a rapid evolution since the

first publication of Evans et al. (2013), especially with the development of 'omics methods. Since it is the COLOSS BEEBOOK's purpose to compile the most up to date methods, we are currently including a chapter focused on "Standard methods for *Apis* 'omics research" in the new volume IV. This chapter will cover the immense changes in sequencing and analytics related to full-genome analyses of honey bees and functional insights into bee health, development, reproduction, and behavior. It will also cover new work comparing the genomes and biologies of multiple *Apis* species, and the emergent field of metabolomics, which uses protein and biochemical insights to describe the multitude of important chemical processes that go on inside bees. This chapter will provide recipes, resources, and a roadmap to online genomic and genetic databases that will be useful for researchers.

Because the field has much to gain from the development of Eastern honey bee, *Apis cerana*, research, and because much 'omics work has recently performed on this species, volume IV will also provide standard methods for *A. cerana* research, research on pests and pathogens and respective hive products. Bee experts in *A. cerana* research from the COLOSS network have therefore joined together to share technical experiences on specific techniques for *A. cerana* research for Vol IV - "Standard methods for *Apis cerana* research". We will aim to provide readers with updated and specific methods used to assist laboratory based work, based on the BEEBOOK volumes on Western honey bee research and also with additional new techniques for studying Eastern honey bees and their hive products. More information on the Eastern honey bees will provide greater insight into the evolution and host-parasite relationships of *Apis* species.

The BEEBOOK project has been fully embraced by the honey bee research community, and the numbers of citations that the papers receive are pleasing. We would like, however, to finish with a request that anyone writing papers using methods described in the BEEBOOK should not only cite the relevant chapters, but also ensure that they cite them correctly. In order to make this easy, the correct citation is given in the footnote on the first page of each paper and can be copied and pasted into the reference list.

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