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Opportunities for collaborative research with honey bees in Turkey and China

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Abstract

The study of honey bees represents one of the outstanding examples of the benefits of collaboration in science. What is not generally known are the opportunities for collaborative research offered by laboratories in Turkey and China. We report the results of a short survey identifying laboratories in these two countries that wish to form collaborations and highlighting unique characteristics that these countries offer for honey bee research.

Key words: China, Turkey, collaboration, honey bee.

Introduction

Collaboration enables the scientific community to address projects that require large effort and to more effectively distribute human and biological resources (Loan-Clark and Preston, 2002). One of the best examples of scientific collaboration is found within the study of honey bees and include the honey bee genome sequencing project, international efforts directed toward colony collapse disorder, and the open access *COLOSS Beebook* that contains contributions from 243 authors representing 34 different countries (Robinson and Weaver, 2006; Whitfield *et al*., 2006; Navajas *et al.*, 2008; Dietmann *et al.*, 2013). Not generally known to honey bee researchers are the opportunities available for collaboration in Turkey and China. Here we present the results of a survey identifying honey bee laboratories in Turkey and China seeking collaborations. Our results provide contact information of the laboratory directors and more general information about housing, language, and research needs.

Partnerships among laboratories allow scientists to: 1) acquire new skills, 2) more effectively use expertise, 3) serve as a source of stimulation and creativity, 4) develop and extend networks, and 5) enhance dissemination of information (Loan-Clark and Preston, 2002). In addition, collaboration at the international level helps build relationships between countries and serve as a conduit to provide international experiences for undergraduate students. One popular program in the United States is the National Science Foundation Research Experiences for Undergraduates program (Page *et al.*, 2004) and in Europe the Erasmus program.

The purpose of this note is to encourage those interested in honey bee behavior to forge collaborations with fellow researchers in Turkey and China. The impetus for seeking such collaborations was stimulated by discussions with attendees of the first symposium-workshop designed to explore honey bee behavioral plasticity from nervous system to ecosystem. The symposium-workshop was held as part of the IV Biennial European Conference of Apidology (Eurbee) in Ankara, Turkey during September 7-9, 2010 (Abramson and Giray, 2011). One of the unique aspects of the symposium-workshop was a tour of several Turkish honey bee research centers. In conducting the tour it became obvious to us that many researchers were unaware of the opportunities offered by Turkey to study honey bees. These opportunities include the presence of at least five subspecies including *Apis mellifera syriaca*, *A. m. anatoliaca*, *A. m. meda*, *A. m. caucasica*, and an ecotype from the *carnica* subspecies group. There is also easy access to the Cyprus honey bee, *A. m. cyrica*. For the *A. m. caucasica* and *carnica* subspecies, there are government protected honey bee population sites, and research facilities that maintain pure lines. Further discussion led to the realization that China is another country with great potential for collaborative efforts. In fact, China and Turkey top the list of countries with the greatest number of domestic honey bee hives (FAO, 2013).

Like Turkey, China provides unique opportunities for honey bee researchers (Kuang and Kuang, 2009). China has a honey bee germplasm bank in Jilin that maintains 5 subspecies of *A. mellifera* and a local subspecies of *A. cerana*. Maintained *A. cerana* colonies amount to over 2 million and provides materials for comparative studies between it and *A. mellifera* (Quin *et al*., 2012). In addition, China has endemic *A. dorsata*, *A. laboriosa*, *A. florea* and *A. andreniformis* subspecies. With nearly the same land area as the U.S., China offers a high diversity of geographical areas and climate for studying adaptation of honey bee species (Lin *et al*., 2012).

In a website listing the number of honey bee laboratories around the world, no laboratories were mentioned from Turkey and only 4 from China (Cyberbee, 2013). In a Web of Science search starting from 1983, there were only 139 publications where at least one author affiliation was to a Turkish institution. The number of publications for Chinese institutions was 207. The low numbers of publications probably relates to publication language and practices of the country and not to the level and extent of honey bee research in either Turkey or China. Two journals in Turkey publish English transla-

tions of their articles (*Uludag Bee Journal* and *Mellifera*, respectively). No Chinese journals publish English translations, although two provide translations of abstracts (*Apiculture of China* and *Journal of the Honey Bees*, respectively).

Materials and methods

To assist honey bee researchers in forging collaborations with Turkish and Chinese colleagues, we conducted a brief survey. The survey was designed to develop a database of facilities in Turkey and China that can be used as the basis for contact information. The questions were divided into 6 sections related to: 1) general contact information, 2) type of honey bees, 3) support, 4) facilities, 5) housing, and 6) collaborations. Sample questions within each category were designed to provide: 1) contact information of the laboratory director, 2) type of subspecies, and number of colonies associated with each, 3) type of support including equipment, staff, and faculty, 4) range of facilities associated with the laboratory including shared facilities, library information available on honey bees, access to undergraduate and graduate research associates, and language issues, 5) type of housing, dining facilities, and approximate cost, and 6) interest in collaboration, existing collaborations, and type of collaborations the laboratory is interested in.

Results

Thirteen Turkish surveys were returned out of 30 (43%) and 25 Chinese surveys were returned out of 45 (56%). The completed Turkish surveys represent 5 geographic areas: 1) Northern Turkey (Düzce, Samsun, Trabzon), 2) Marmara Region (Bursa, Tekirdag), 3) Northeast Turkey (Trabzon), 4) Central Anatolia (Ankara) and 5) Southern Turkey (Antalya). Of the 13 completed surveys, seven were concentrated in Northern and Central Anatolia. Northern Turkey is famous for the large numbers of domestic honey bee colonies, and specialty honey types (such as the Anzer honey, chestnut honey, and the "mad" honey from *Rhododendron* nectar). There are several different institutions in Northern Turkey distributed over several provinces. The Central Anatolia surveys are all from institutions located in the capital city where some of the largest research universities in Turkey are located. In addition, Central Anatolia is the home of many of the commercial queen breeders. Living costs are extremely low, with about $20.00 (USD) a day including food and lodging. To obtain the most recent information on cost of living in various cities in Turkey and China we suggest that the reader access the website www.numbeo.com.

The Chinese surveys were concentrated in the Provinces near the Southeast (e.g. Fujian, Zhejiang, Jiangxi) and Northeast (Beijing and Jilin) areas of China. Fujian Province harbors perhaps the world's only college specializing on honey bees, with 485 undergraduate students and 50 graduate students. The college provides many types of scholarships for graduate students outside China. Beijing has the Institute of Apicultural Research which has more than 10 principle investigators specializing on honey bee biology and pollination biology. Jiangxi Province also has four scientists specializing on honey bees.

The Ministry of Agriculture of China has invested large amounts of money into honey bee research - over 20 individual honey bee researchers have each received 6 million yuan (¥) (~1 million $) for a 10 year period (year 6 now). In addition, another 30 scientists from "Experimental Stations" which focus on more applied research (breeding, maintaining bee stock etc.), each received 4 million ¥ total for a 10 year period (also year 6). One chief scientist focusing on pollination received 15 million ¥ (~2.5 million $) in the hopes of solving the problem of hand pollination for pear trees. Most Chinese respondents expressed difficulty in accessing primary literature in English and producing the right questions for cutting edge research. With regards to equipment related to honey bee research, China is making great strides due to the large investment by the central government to honey bee research. Living costs are relative low, with about $15.00 a day including food and lodging.

The surveys returned from both Turkey and China all expressed an interest in collaborative research, had appropriate housing, dining, and laboratory facilities for both students and faculty, and represent a wide variety of research topics from behavioral to taxonomic investigation. Most expressed a need for molecular studies. In Turkey, most researchers identified the chief limitation as having access to cutting edge molecular techniques such as expression profiling, next generation sequencing technologies, including high density genomic markers, and transcriptomic analyses for bee research. The key areas of research in China are honey bee behavior and molecular biology. Assuming that potential collaborators have some familiarity with English, language does not appear to be an issue since all of the laboratories have some access to English speakers.

Conclusions

To facilitate collaboration, we have identified laboratories in Turkey and China seeking new colleagues. We have listed the name of the laboratories along with the e-mail addresses of the laboratory directors. General information is also provided on the needs and interests of Turkish and Chinese bee laboratories and the advantages that these countries offer for research.

We made a decision not to provide specific information about individual laboratories and their interests. Our rationale for this decision is that each survey is several pages long and to report the results of individual questions would vastly increase the page length of this article without necessarily increasing the usefulness of our findings. For example, laboratory priorities change, cost of living fluctuates, facilities may improve or deteriorate, and the variety of subspecies may change. As a compromise, however unsatisfactory it may be, we summarized what we believed to be the most important data and provided contact information. Since our sample

is relatively small, those interested in seeking collaborations in Turkey and/or China can easily send out a general e-mail to the respondents identified in tables 1 and 2. Alternatively, an e-mail can be sent to a Turkish or Chinese laboratory in a specific geographical area. We anticipate that our survey will stimulate similar research to uncover other honey bee laboratories in non-western countries seeking collaborations.

Table 1. Contact information to initiate collaboration with Turkish bee researchers.

Institution	Location	Director	Contact Email
Ahi Evran University	Kirşehir Province	Rashan Tunca	rivgin@gmail.com
Akdeniz University	Antalya Province	Kemal Karabag	karabag_kemal_33@hotmail.com
Ankara University	Ankara Province	H. Vasfi Gençer	gencer@agri.ankara.edu.tr
Düzce Üniversitesi	Bolu Province	Meral Kekecoglu	meralkekecoglu@duzce.edu.tr
Hacettepe University	Ankara Province	Çiğdem Özenirler	cozener@hacettepe.edu.tr
Hacettepe University	Ankara Province	Kadriye Sorkun	kadriye@hacettepe.edu.tr
Hacettepe University	Ankara Province	Ömür Gençay	gencay@hacettepe.edu.tr
Karadeniz Technical University	Trabzon Province	Sevgi Kolayli	skolayli61@yahoo.com
Middle East Technical University	Ankara Province	Aykut Kence	aykut@metu.edu.tr
Mustafa Kemal University	Hatay Province	Mustafa Muz	mustafamuz@gmail.com
Namik Kemal University	Tekirdag Province	Devrim Oskay	doskay@nku.edu.tr
Ondokuz Mayis University	Samsun Province	Ahmet Güler	aguler@omu.edu.tr
Uludag University	Bursa Province	Levent Aydin	laydin@uludag.edu.tr

Table 2. Contact information to initiate collaboration with Chinese bee researchers.

Institution	Location	Director	Contact Email
Honey Bee Research Institute, Jiangxi Agricultural University	Nanchang, Jiangxi Province	Zhijiang Zeng	bees1965@sina.com
Laboratory Animal Research Center, Nanchang University	Nanchang, Jiangxi Province	Xianbing Xie	xbxbees@msu.edu
The Medical Experimental Animal Center, Jiangxi Institute of Occupational Disease Prevention	Nanchang, Jiangxi Province	Zhiyong Liu	Liuzhiyong0791@163.com
State Key Laboratory of Food Science and Technology, Nanchang University	Nanchang, Jiangxi Province	Liping Luo	lluo2@126.com
Key Laboratory for Honey Bee Genetics and Queen Breeding, Jilin Provincial Institute of Apicultural Science	Jilin, Jilin Province	Yunbo Xue	asijlxue@sina.com
College of Bee Science, Fujian Agriculture and Forestry University	Fuzhou, Fujiang Province	Xiaoqing Miao	mxqsf88@126.com
Honey Bee Ecology Laboratory, Fujian Agriculture and Forestry University	Fuzhou, Fujiang Province	Bingfeng Zhou	bingfengfz@126.com
Laboratory of Honeybee Physiology and Pathology, Fujian Agriculture and Forestry University	Fuzhou, Fujiang Province	Shaokang Huang	seanhuang304@gmail.com
The Higher Educational Key Laboratory for Molecular Biology and Pharmacology of Fujian Province, Quanzhou Normal University	Quanzhou, Fujian Province	Liangxian Sun	lxsunbee@163.com
Laboratory of Honey Bee Physiology and Behavior, Fujian Agriculture and Forestry University	Fuzhou, Fujiang Province	Songkun Su	susongkun@zju.edu.cn
Honey Bee Science Laboratory, College of Animal Sciences, Zhejiang University	Hangzhou, Zhejiang Province	Fuliang Hu	flhu@zju.edu.cn
Institute of Technical Biology and Agriculture Engineering	Hefei, Anhui Province	Fanglin Liu	flliu@ipp.ac.cn
Institute of Bee Research, Chongqing Academy of Animal Sciences	Chongqing, Sichuan Province	Jun Guo;	guojun0591@126.com
Honey Bee Section, Bureau of Parks and Woods	Miyun County, Beijing	Qihua Luo	luoqihua0825@163.com
Honey Bee Research Institute of Henan Institute of Science and Technology	Xinxiang, Henan Province	Zhongying Zhang	zzy206@126.com
Apiculture Research Institute of Anhui Agricultural University	Hefei, Anhui Province	Linsheng Yu	Yulinsheng@ahau.edu.cn
Bee Laboratory, Horticulture Research Institute, Academy of Agricultural Sciences of Shanxi Province	Taiyuan, Shanxi Province	Youquan Shao	shaoyouquan@163.com
National Key Laboratory of State Forestry Administration Resource Insect Cultivation and Utilization	Kunming, Yunnan Province	Ying Feng	yfeng@vip.km169.net
Institute of Apicultural Research, Chinese Academy of Agricultural Sciences	Haidian District, Beijing	Jie Wu	apis@vip.sina.com
The Ministry of Agriculture Key Laboratory of Pollinating Insect Biology	Beijing	Ting Zhou	ztapis@263.net
Department of Beekeeping and Biotechnology, Institute of Apicultural Research, Chinese Academy of Agricultural Science	Beijing	Jianke Li	apislijk@126.com
The Ministry of Agriculture Key Laboratory of Pollinating Insect Biology	Beijing	Shufa Xu	phagraham@sina.com
Guangdong Entomological Institute	Guangzhou, Guangdong Province	Yuexiong Luo	lyxbee@126.com
Shandong Provincial Key Laboratory of Animal Biotechnology and Disease Control and Prevention	Tai'an, Shandong Province	Baohua Xu	bhxu@sdau.edu.cn
Jinhua Institute of Apicultural Research	Jinhua, Zhejiang Province	Xujiang He	Hexujiang3@163.com

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