Importation and Preservation of Germplasm for U.S. Honey Bee Breeding and Stock Improvement

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Objectives

- Collection of germplasm from endemic populations of European honey bees
- Implement cryopreservation of all collected honey bee germplasm or both immediate and long term breeding use.
- Continue a selective breeding program to evaluate and improve introduced stocks and hybrids under US conditions, screening especially for resistance to pests and diseases
- Cooperate with ongoing honey bee stock improvement efforts) and the tech transfer program to improve honey bee genetics and stocks
- Collaborate with US queen producers to disseminate additional genetic variability to US



This report represents significant progress toward the improvement of US honey bee populations based on the importation of novel honey bee genetic diversity that can be accessed by the bee breeding industry. Funding by the Almond Board collection in the Caucasus region in 2014. In addition to cryopreservation technology, our laboratory developed above freezing long-term storage of semen and recently inseminated honey bee queens with semen that had been stored for over 430 days, the longest successful storage of any animal semen above freezing. The ability to cryopreserve semen,, coupled with the established USAD-APHIS/WSU permit protocol for honey bee germplasm importation, now provides the opportunity for the continued development and implementation of a honey bee genetic repository in the United States. Such a repository has practical permanent storage of genetic material for subsequent breeding use, much as has become routine in other animals of agricultural significance (dairy and meat cattle, sheep, swine, horses, etc.). In 2013, we cryopreserved representative stocks of the USDA-ARS developed Russian Honey Bee, representing the first large scale deposit of honey bee genetic material in the Honey Bee Genetic Repository.

beekeepers and to cryopreserve existing US

Background Recent declines in honey bee populations and the difficulties in reliably maintaining colony health are of concern to both beekeepers and growers of crops needing

pollination services. Amid widespread research directed to honey bee health issues, including Colony Collapse Disorder (CCD), there remains a notable lack of research directed toward genetic improvement of honey bees.

There is a strong queen production industry in the US, but producers continue to be limited by the lack of genetic diversity available. There has been little effort to introduce additional honey bee genetic material for over 90 years following the passage of the 1922 Honey Bee Act. In addition, the arrival of Varroa mites to the US caused major decline in feral European honey bee populations, formerly a source of potential breeding material.



Collecting site for A. m. caucasica in 2010 and 2011 in Mestia, Georgia

In 2013 we (WSS,BH,SC) traveled to Turkey and the Republic of Georgia and made significant collections of semen from *A. m. caucasica* semen from disparate areas of the Caucasus Mountains. In all cases semen was collected and returned to the US under a USDA-APHIS hand carry permit. Virgin queens were inseminated with the imported honey bee semen.. Aliquots of semen were concurrently supplied to Dr. Judy Chen of the USDA-ARS Bee Research Laboratory in Beltsville MD for virus determination. The collection and introduction into the US of genetic material derived from endemic honey bee populations of three subspecies is of high importance to the US beekeeping industry.



The most practical means of allowing germplasm entry to US is through collection of honey bee semen under permit and using instrumental insemination for subsequent propagation and screening of the genetic material



The Western honey bee is native to the Old World and three subspecies, Apis mellifera ligustica, A. m. carnica and A. m caucasica are being sampled for germplasm as part of this project.



Caucasian honey bee breeding apiary in Turkey

Specialized Beekeeping Short Courses We continue to conduct classes designed to provide beekeepers with the skills required to develop and maintain honey bee stocks. These are structured to provide "hands on" field and classroom training. The specialized short courses will continued to be offered at WSU Mt Vernon and Pullman campus locations. Classes are very popular and attract beekeepers from across the U.S. and abroad.



Process of cyropreservation of semen for long term storage.

Success of our laboratory in developing cryopreservation of bee semen along with the establishment of a USDA-APHIS approved quarantine apiary at Washington State University for germplasm introduction and collaboration with California cooperators provides new opportunities. With cryopreservation, honey bee semen can be preserved, stored and used in a matter of weeks, months or years via artificial insemination of queens. The new technology permits queen breeders to breed "across time and space" and opens the door to marker-assisted selection and progeny testing with bees as is done with other animals of agricultural significance.







Georgia – homeland of A. m caucasica

Research Effort Recent Publications:

No specific publications derived from the 2013-2014 Almond Board funding were forthcoming. However, a related paper in the area of cryopreservation was published in print in 2013 (Hopkins et al, 2012). A manuscript highlighting the collecting trips and the genetic material resource is being prepared for the American Bee Journal. In keeping with Almond Board policy, manuscript drafts will be submitted to the Almond Board **prior** to journal submission.

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