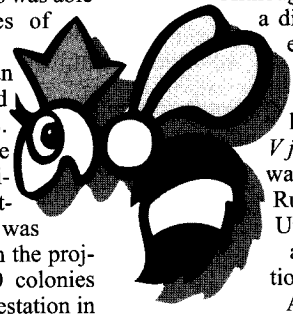
# The Release of ARS Russian Honey Bees

by THOMAS E. RINDERER[1], LILIA I. deGUZMAN[1], JEFFREY HARRIS[1], VICTOR KUZNETSOV[2], GARY T. DELATTE[1], J. ANTHONY STELZER[1], LORRAINE BEAMAN[1]

***For most of this decade, the Honey Bee Breeding, Genetics, and Physiology Laboratory of the USDA, Agricultural Research Service has been studying honey bees from Primorsky Territory, on the Pacific coast of Russia. We are interested in honey bees in that area since settlers from European Russia started bringing* Apis mellifera, *the western honey bee, to the area in the mid 1800's (E. Crane, Bee World, 59:164-167, 1978). The area is within the natural range of* Apis cerana, *the eastern hive bee and its external mite parasite,* Varroa jacobsoni. *Since this is one of the longest known associations of the western honey bee and* V jacobsoni, *we speculated that natural selection operating on the honey bee populations in the area had one of the best chances to produce resistance to* V jacobsoni.***

Staff of the USDA, ARS, Honey Bee Breeding, Genetics, and Physiology laboratory in Baton Rouge, pursued this logic with a two-week trip to Primorsky in 1994. We visited numerous beekeepers in the area and inspected many of their beehives. We left with: 1) an impression that the beekeepers treated colonies for varroa much less often than beekeepers in the United States, 2) an observation that the Russian honey bee colonies generally had fewer mites than did colonies of honey bees in the United States having similar histories, 3) an observation that a greater proportion of mites in Russian colonies were found on adult bees rather than in worker brood in comparison to the situation with colonies of honey bees in the United States, and 4) a realization that the scientific support available from the Russian Academy of Sciences was able to conduct cooperative studies of honey bees and their mites.

A joint project with the Russian Academy of Sciences was started in 1995 (*ABJ* 135:11,746-748. 1995) to assess whether or not the bees of the area showed any indications of having biological resistance to varroa. Dr. V. Kuznetsov was the principal Russian scientist on the project. He collected data from 50 colonies concerning the percentage of infestation in both worker and drone brood from untreated colonies for two years. Since we could not legally export United States honey bees to Primorsky for comparative tests, we conducted a similar study in the United States to provide a comparison. The colonies in Russia had far lower levels of infestation in both the worker and the drone brood (*ABJ* 137, 11,787-789, 1997).



Although a difference in mites or a difference in climate might explain the results, it was also possible that the honey bees in Primorsky had a genetic resistance to *V jacobsoni*. Consequently, it was necessary to test the Russian honey bees in the United States with the mites and beekeeping conditions of the United States Accordingly, in June 1997, we exported a collection of 100 Primorsky honey bee queens to the United States. The queens were brought to the USDA, ARS, Honey Bee Quarantine Station at Grand Terre Island, Louisiana. The quarantine

[1] USDA, ARS, Honey-Bee Breeding, Genetics & Physiology Laboratory, 1157 Ben Hur Road, Baton Rouge, Louisiana 70820-5502 USA.
[2] Institute of Biology and Pedology, Far East Branch of the Russian Academy of Sciences, Vladivostok 6990022, Russia.

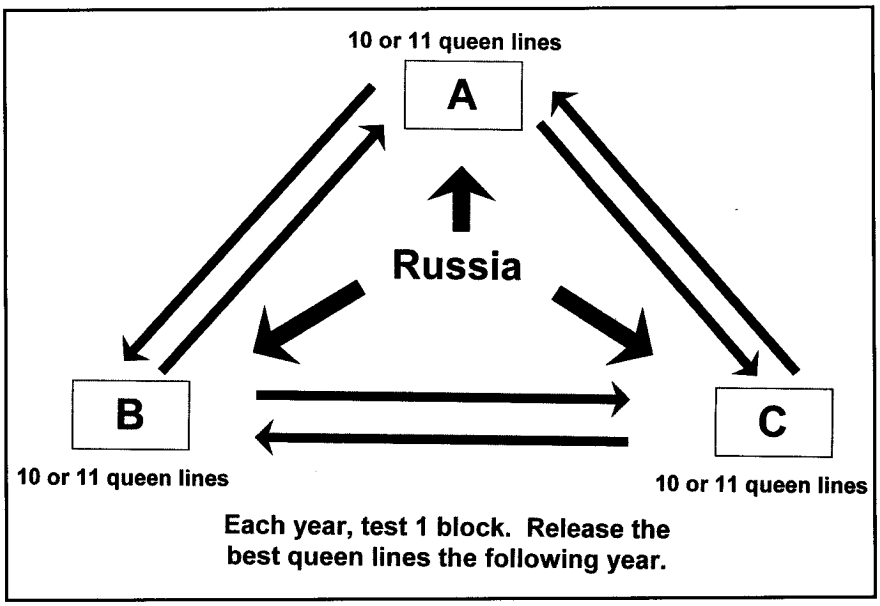
## Author's Note

**I have never sent a manuscript to two journals simultaneously before, but feel that this paper needs as wide a distribution as possible. I know that a lot of people are buying Russian queens this year, and think that many of them do not understand what they will be getting. It is important that they understand that the release program is held captive by the laws of honey bee genetics. These laws dictate that the release program will require two years to make full Russian *colonies* widely available. In the first year of the release, the Russian production queens that are being sold have all been mated to domestic drones that are produced by the various queen breeders. The colonies that will be produced by the Russian queens will be *hybrid colonies.* We cannot predict the varroa resistance or honey production of all the different hybrids that will be produced in the country. The second year, queen breeders will be able to produce Russian drones to mate with their Russian queens, so beekeepers then will be able to buy Russian queens that will produce "pure" Russian colonies.**

**The paper enclosed (The Release of ARS Russian Honey Bees) should help clarify this and other questions about what the Russian bees are and what they are not.**

period lasted 7 months and periodic inspections and examinations of the honey bees were conducted by laboratory staff, and staff of both the USDA Animal and Plant Health Inspection Service and the Louisiana Department of Agriculture and Forestry for regulation purposes. In February 1998, the honey bee colonies produced by the Primorsky queens were brought to the mainland near Baton Rouge and studies were begun to determine whether or not they were resistant to *V jacohsoni.* The first part of this determination was to measure and evaluate the growth of mite populations in the Russian honey bee colonies. Many of the colonies of Russian honey bees supported less mite population growth than the predicted rate, and a few of them supported only a very meager mite population growth (*ABJ* 139, 4, 287-290. 1999). Using an isolated island mating station, we produced daughter queens from the Russian queens that seemed to be the most resistant of the queens that were imported and began two extensive trials in which the resistance of the Russian honey bees to *V jacobsoni* was directly compared to that of domestic honey bees commonly used commercially in the United States. One trial began in mid-summer of 1998 and ended in early December 1999. The other trial was conducted in the spring and summer of 1999 in commercial apiaries in Iowa, Louisiana, and Mississippi in cooperation with Mr. Manley Bigalk, Mr. Steven Bernard and Mr. Hubert Tubbs, respectively. All of these gentlemen are commercial beekeepers who are primarily honey producers. Last August, when most of the year's data were collected, ARS held a teleconference with these beekeepers. These beekeepers had seen the bees in their own apiaries and could evaluate the quality of the stock for general beekeeping characteristics as well as help to evaluate the commercial implications of the data.

The beekeepers recommended that a procedure to release the Russian honey bees begin. Also, they and other beekeepers offered guidance about the procedure. Because of the past experiences with the release of honey bees from Yugoslavia, the beekeepers recommended that: 1) while industry should be involved in the production and distribution of breeder queens, ARS should remain involved with the stock in the areas of stock maintenance, stock selection and further research and 2) since the release procedure is going to be a continual process, and since it will take two years for beekeepers to be able to buy production queens that produced fully Russian colonies, the release procedures should be established and the process should begin in the Autumn of 1999. The ARS Office of Technology Transfer also provided their input to the development of the plan for release. They offered the counsel that a Cooperative Research and Development Agreement (CRADA) was the proper instrument to provide the mechanism for a honey bee stock release. Under such agreements, the "CRADA" partner is a member of industry that has the responsibility and right to produce and distribute a product at a reasonable profit. Further, the partner understands that it has the responsibility to share information with the government regarding product development and performance, and ultimately with the entire industry. All parties should benefit.




Following the advice of the cooperating beekeepers and the Office of Technology Transfer and attending to the constraints of having a limited number of highly desirable breeder queens and the need to have a CRADA partner in close proximity to Baton Rouge, Bernard's Apiaries in Beaux Bridge, LA was asked by ARS if they would be willing to serve the beekeeping industry and function as the CRADA partner. They would be responsible for producing and selling ARS Russian honey bee breeder queens to the industry and also be responsible for collecting information from the industry concerning the performance of the various queen lines distributed by the program. Bernard's Apiaries agreed to assume these responsibilities and has produced breeder queens for distribution in the late winter 1999 or early spring of 2000.

The release program is not a one-time event. Rather, it is a cycle of releases resulting from an underlying stock maintenance and selection program (Fig. 1). The queens that produced the colonies having the most resistance to *V jacobsoni*, and were otherwise acceptable for commercial beekeeping, were divided into three groups or "blocks". For the purposes of maintaining the stock, daughters of the queens of each of the three blocks are mated with drones produced by queens from the other two blocks. An isolated island mating station is used in order to have natural matings of the desired combinations of queens and drones. We chose natural matings in order to maintain the high genetic diversity afforded by queens mating with about 20 drones if allowed to naturally mate. For purposes of selection in 1999, the queens in block A were used to produce daughters for the large field trial with cooperating beekeepers. Each of 6 queen lines was represented by daughter queens in each state and each apiary. As a result of the trials, one queen line was dropped from the program, two queen lines were maintained in the program but not used to produce breeder queens for distribution, and the best queen in three of the lines was selected to produce breeder queens for distribution to the industry. Of the five queen lines retained by the program, the best daughter was used to propagate daughters for stock maintenance. In future years, queen-lines from the 1997 importation which have been assigned to the other two blocks will be evaluated in similar selection procedures to identify the program breeder queens. Thus, the program has provisions for selection between several queen-lines each year. Also, the program will select the best queens of the selected lines. These queens will be used to both propagate the queen-lines and propagate breeder queens for industry.

The laboratory has entered into another cooperative agreement with the Russian Academy of Sciences. Under this agreement, initial screening of queens in Russia will be done each year for four bee seasons. Each year, the best of the queens studied in Russia will be brought to the United States for further study and possible incorporation into one of the three queen-line blocks (Fig. 1). This program is underway. In June of 1999, an additional 100 queens were collected and brought to

the United States. As before, these queens went to the island quarantine facility. They will be screened for resistance to *V jacobsoni* during the 2000 bee season. Also, laboratory staff will be evaluating other queens from Russia in addition to those that are screened for the program by Russian scientists. By the end of this portion of the program, the colonies produced by between 500 and 700 queens have been studied and evaluated as potential sources of new queen lines for the breeding and selection program in the next 5 to 8 years.

Because of the continuing flow of new queens from Russia into the program and our selection within and between the existing queen-lines, we will be able to both apply strong selection for resistance to *V. jacobsoni* and still be able to maintain good genetic diversity within the overall stock. The main criterion for selection will be resistance to *V. jacobsoni*. However, resistance to *Acarapis woodi* (tracheal mites), honey production, and the presence of chalkbrood in colonies will also be considered when we make selections of the parents of future generations. Because of these aspects of the program, the ARS Russian honey bee stock will be different from year to year. We expect that the most noticeable difference will be a slow, steady increase in the expression of desirable traits.

In the first year of the release program, those who obtain production queens will be getting Russian queens that will produce hybrid colonies. Because of the genetic nature of honey bees, the Russian queens of the first year will produce hybrid worker bees, but also will produce Russian drones. These drones will be available for matings the second year. During this first year, it is recommended that beekeepers (both queen breeders and those that buy production queens) produce or obtain enough hybrid Russian colonies to produce the drones needed for the second year to produce "pure" Russian matings. Queen breeders will need the Russian drones to produce Russian queens that will foster "pure" Russian colonies. General beekeepers who have hybrid colonies the first year will have a supply of Russian drones that will mate with any Russian supersedure or other queens that may be produced in their apiaries. They will thereby assure that their apiaries with ARS Russian stock will remain Russian.

It is not possible for the laboratory to test all of the various hybrids that will be produced in the spring of 2000. We expect that at least some of these hybrids will be quite desirable. In such instances, queen breeders might consider organizing at least some of their program to continue to offer queens that will produce hybrid colonies. However, our best prediction is that there will probably be large variations between different types of hybrids, but generally, that they will be within the usual range for commercial honey bees in the United States, which also are highly varied. One hybrid we did test produced an average of about 2 pounds of honey more than the average of commercial controls. This difference is not statistically different, and suggests that hybrids will generally be commercially acceptable. However, the hybrid we tested did not display resistance to *V jacobsoni*. Perhaps others will show at least some resistance.

Each year, the program will release queens that are sufficiently unrelated to the prior year's queens that inbreeding will be avoided. Of course, people are welcome to organize their own breeding and selection programs that include Russian honey bees. Indeed, we encourage breeders to include some ARS Russian honey bee parentage into their own programs in order to enhance resistance to *V jacobsoni* in their own stocks of honey bees. However, attempting to produce ARS Russian honey bee stock by making crosses other than those recommended by the program may result in inbreeding problems. Also, such stock will not have the advantages to be derived from the ongoing selection program.

The current releases of Russian honey bee breeder queens are resistant to *V. jacobsoni*. This resistance is strong enough to have economic value. Beekeepers should be able to use half as many treatments for the control of *V. jacobsoni* as they are currently using. The ARS Russian honey bees are not immune to *V. jacobsoni*. Given enough time, many of them will succumb to the mites. However, ARS Russian honey bees are a good centerpiece for integrated pest management approaches to the control of *V. jacobsoni* that rely much less on miticides. As the selection program proceeds, the level of resistance to *V. jacobsoni* in the ARS Russian honey bees predictably will be further improved, and the need for miticides will be further reduced.

The ARS Russian honey bees also have shown good resistance to *Acarapis woodi* in preliminary tests. The Honey Bee Breeding, Genetics and Physiology Laboratory is currently conducting an overwintering test to more fully evaluate the economic value of this resistance. Results will be available in April, 2000.

On average, the honey production of the ARS Russian honey bee colonies tested in 1999 was about 14 pounds less than the honey production of commercial control stocks. The queens selected to produce breeder queens headed colonies that averaged 26 pounds more than the average commercial control colony. This selection differential will contribute to increasing the honey production of the selected Russian queen lines.

In other regards, the ARS Russian honey bees are, for the most part, dark bees that in some regards are similar to Carniolian honey bees. However, one queen-line has fairly yellow bees. This queen line is a bit more like Italian honey bees. None of the ARS Russian honey bees use propolis to the degree that typical Italians use it. For the most part, ARS Russian honey bees are not sting prone. However, early in the spring or in poor weather conditions, an occasional colony will be as sting prone as some of the more defensive commercial stocks that are currently used in the United States.

The ARS Russian honey bee stock is not "finished". Indeed, selection will be continuing for at least several years. Because of this, the ARS Russian honey bee stock will be continually changed and improved for the life of the selection program. This selection program is designed to produce Russian honey bees of the future that will contribute to the gene pool of the honey bees in the United States in two ways. First, it is and will be developed as a stock in its own right. Second, it will be bred in ways that it will be useful as a source of genetic material to enhance existing stocks of honey bees, especially in regard to resistance to both *V. jacobsoni* and *Acarapis woodi*. Hence, ARS Russian honey bees, and the breeding program to further improve them, are a resource for all of American beekeeping.