

# *A USDA-ARS Project to Evaluate Resistance to Varroa jacobsoni by Honey Bees of Far-Eastern Russia*

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*The concept of going to Russia to look for honey bees resistant to Varroa jacobsoni is rooted in history. It was in the far reaches of Primorsky Territory, on the Pacific coast of Russia, that the mite which now causes so many problems for U.S. apiculture began one of its longest associations with the western honey bee, Apis mellifera.*

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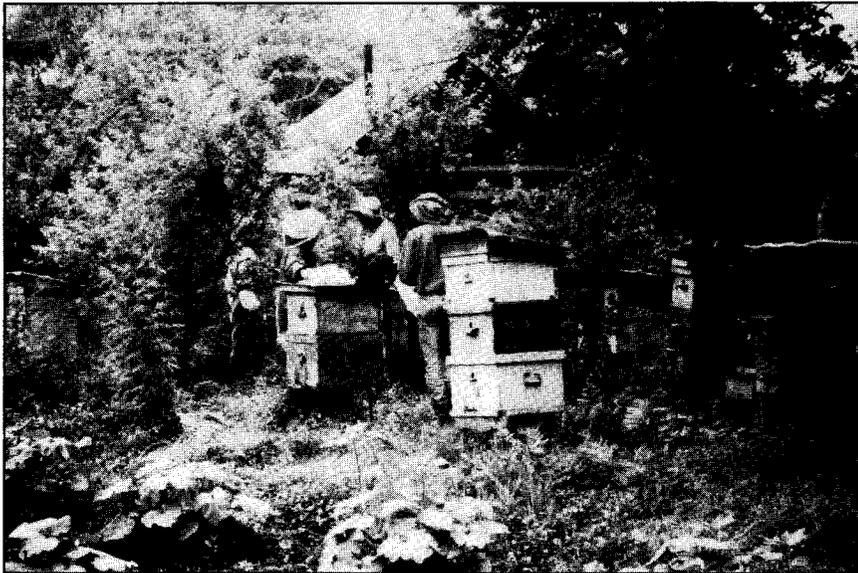
*Varroa jacobsoni* was recorded on its natural host, the eastern honey bee (*Apis cerana*), in eastern Russia by 1952. As Ukrainian settlers moved east from Europe to Primorsky beginning late last century, they eventually carried with them hives of western honey bees. Excellent honey yields in the Russian far east led to shipment of supposedly superior queens back to European USSR. With those queens went varroa mites. This movement of mites was the major route of introduction of varroa to European countries and, later, to much of the world. The story first was told well in 1978 by Eva Crane in *Bee World* (volume 59, pages 164-167). The precise timing of the start of varroa parasitism on the western honey bee seems not to be documented. However, the Russian far east is almost certainly where currently existing honey bee populations have been exposed to varroa for the longest time, at the earliest about 100 years ago and at the latest about 45 years ago. It can be hypothesized then that it is in Primorsky Territory of Russia that natural selection has had its best chance at molding bees able to withstand parasitism by *Varroa jacobsoni*.

We decided to pursue this logic and investigate the possible resistance of honey bees to varroa in the Russian far east. The Agricultural Research Service of the USDA (USDA-ARS) is committed to searching for genetic solutions to the difficult problems faced by U.S. beekeepers. The benefits of using resistant bee stocks rather than acaricides to battle varroa mites are clear: less chance of contaminating hive products with undesirable chemicals, lower costs of labor and materials, and less risk of the target pest developing resistance to pesticides. Resistance of *Varroa jacobsoni* to fluralinate is becoming more of a worry, as evidenced by recent reports from Italy about fluralinate losing effectiveness there (for example, the 1995 paper "Ineffectiveness of Apistan® treatment against the mite *Varroa jacobsoni* Oud. in several districts of Lombardy (Italy)" by M. Lodesani, M. Colombo and M. Spreafico in *Apidologie*, volume 26, pages 67-72).

A project was conceived with the following general agenda. First, a preliminary trip to Russia would be used to evaluate local bees for any biological promise of resistance, and also to judge if logistical, technical and administra-

tive support would be adequate to enable a scientific study to be completed successfully. If these factors warranted a decision to proceed, a second trip would be made to establish experimental colonies representing the honey bees of Primorsky, and to begin collecting data on the life history of varroa on untreated Primorsky bees. A third trip about a year later would involve a final assessment of resistance or tolerance of the bees to the mites; if trends were favorable, selected colonies would be propagated and the stock would be considered for importation into the United States for more rigorous testing and possible release to the beekeeping industry.

Contacts were made in summer 1994 with scientists of the Far East Branch of the Russian Academy of Sciences in Vladivostok. Drs. Victor Kuznetsov and Nicoli Kurzenko are entomologists but had little experience with honey bee research or with beekeeping. They were, however, eager to participate in the plan we outlined. Dr. Kuznetsov is the principal scientific cooperater in the field; he translates, arranges logistics, technical support and accommodations, and is responsible for much of the data



**Fig. 1.** Beehives are common in the garden plots behind houses in villages of Primorsky Territory, Russia.

collection. Dr. Kurzenko has handled the substantial administrative duties attendant to the bureaucracy of international collaboration.

A preliminary fact-finding trip was made in autumn 1994 by two of us from USDA-ARS (Rinderer and Delatte), joined by Dr. Kuznetsov in Primorsky. The trip was partially supported by the office of International Cooperation and Development of the USDA Foreign Agricultural Service (USDA-FAS, ICD). During this two-week trip, it was determined that the two major necessary elements — possible resistance in the bees, and availability of scientific support — were in place to warrant pursuing the project as broadly outlined. Dr. Kuznetsov arranged for visits to many beekeeping sites within several hours' drive of Vladivostok. Primorsky Territory is a sparsely populated, vast tract of forest. Bees make large amounts of honey from the famed nectar flows of *Tilia* (basswood) trees; these excellent honey crops are what spurred the shipment of queens from Primorsky to western Russia several decades ago. The region, between 43° and 48° north latitude, has predictably severe winters; normal lows of at least -40° C (also -40° F) were reported by beekeepers. Beekeeping is widespread, and most beekeepers are very skilled. In the rural villages, a remarkably large proportion of houses have a few hives of bees tucked away at the rear of the garden (Figure 1). The beekeepers we met were extremely cooperative and hospitable. The bees of Primorsky for the most part are dark, suggesting a Carniolan or Caucasian bee ancestry. They are remarkably gentle and used very little propolis. Bees are kept in jumbo Langstroth hives, many with elaborate

buckling systems between hive bodies to enable migratory beekeeping (Figure 2). The bees are wintered in buildings.

Because a chief goal of the trip was to assess possible resistance to varroa, a wide variety of colonies was sampled for mites by burning fluralinate smoke strips in the hive and measuring the resulting "mite fall" within the ensuing half hour. The bees were not immune to varroa; mites were present in all colonies tested. It was noted, however, that varroa populations seemed relatively small, even in colonies that had not been treated recently. Beekeepers seemed to have a casual attitude about varroa. Overall, the preliminary trip suggested that it would be worthwhile to monitor the life history traits of *Varroa jacobsoni* in Primorsky Territory.

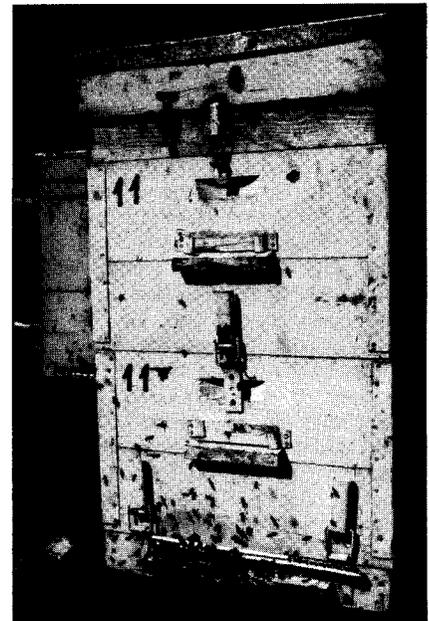
The decision to proceed with the project using base USDA-ARS funding was made in part on the wide support the plan received. U.S. beekeepers are strongly in favor of the research. Industry commitment was reflected by supplemental funding provided by the Honey Bee Stock Release Panel with monies generated from the release of honey bees previously imported from Yugoslavia. Other supplemental funds for the project were contributed by USDA-FAS, ICD. After establishing a formal cooperative agreement between USDA-ARS and the Russian Academy of Sciences, we were ready to begin the test.

Three of us (Danka, Kuznetsov and Delatte) spent nearly three weeks in June 1995 setting up the test. In advance of this effort, Dr. Kuznetsov purchased 50 strong colonies and hired a beekeeper (Figure 3) to conduct routine management of the experimental colonies.

Also, swarm traps were placed in two large forest preserves (where beekeeping is forbidden) with the hope of catching feral bees that might be living without treatment for varroa. The goal of the trip was to collect queens from a wide variety of sources in Primorsky Territory to ensure genetic diversity among the bees being studied. Eventually, the 50 test colonies were requeened with queens collected from 12 beekeepers in five districts (Ussuriysky, Khankaisky, Chernigovski, Spassky and Pozharsky) of Primorsky Territory. Almost all the queens were chosen from colonies showing low varroa populations based on mite fall following treatment with fluralinate smoke strips. Unfortunately, no swarms were caught to provide queens.

During this trip the colonies were beginning to build to honey production size. Beekeepers in Primorsky manage their bees intensively, using follower boards to limit nest size and often adding a comb at a time to the uppermost hive body. With the *Tilia* flow soon to begin, we saw one potential negative trait of the bees — a very strong swarming tendency. Almost all colonies we saw had swarm cells, with as many as 84 cells seen in a colony. Most of the colonies were far less populous than we would have expected for the degree of swarm preparation we saw.

We asked each beekeeper we contacted about their treatment for *Varroa jacobsoni* and about their experiences with the mite. Twelve reported using



**Fig. 2.** A hive typical of many of those used in Primorsky Territory. It is of jumbo dimensions and has buckles to fasten hive bodies together for transport.

oxalic acid (usually in solution; rarely vaporized in a smoker), four used amitrax, and one burned horseradish chips in his smoker. The beekeepers of Primorsky also very actively cut sealed drone brood from their colonies. Most combs have a space of at least 1 inch between the lower edge of the wax and the bottom bar of the frame; in this space, comb with drone brood is placed by bees and then removed by beekeepers. The beekeepers reported the onset of varroa problems occurred in the 1960s and 1970s in Primorsky, with the earlier reports coming from the southern part of the Territory.

We left with the test colonies established at the town of Chernigovka, about three hours' drive north from Vladivostok. Varroa populations were equalized among colonies by making fluvalinate treatments and by swapping combs of sealed brood between colonies with high and low infestations. No further acaricide treatments are planned. Mite infestations in worker brood were monitored monthly through September 1995 and will continue to be followed through the 1996 beekeeping season.

At this early point in the project, a few general observations are noteworthy. The bees of Primorsky Territory are not immune to infestation by *Varroa jacobsoni*. Beekeepers practice chemical and cultural mite control. Few feral colonies exist. However, mite populations within most colonies are relatively small. Mite fall following fluvalinate smoke treatments typically ranged only up into the hundreds of mites per colony, while similar surveys in U.S. colonies commonly yield thousands of mites. The most intriguing data we have seen so far are those of brood infestation levels in the 50 experimental colonies. In monthly samples taken early in the study, the percentage of worker pupae infested with varroa typically ranged from 0 to 5%, with only one colony having a higher infestation (12% in August). Mite fall in the colonies following an initial fluvalinate treatment before requeening in June ranged from 0 to 784 mites per colony; maximum worker brood infestation was 3% at that time. Thus, there seemed to be a very low level of worker brood that was infested, regardless of the number of adult mites present in the experimental colonies. Worker brood infestations and adult mite populations were measured similarly for colonies of U.S. bees in Baton Rouge in July. A comparison of the Russian and American bee data shows that for a given adult mite population, Russian colonies had lower varroa infestations in worker brood than American colonies had (Figure 4). Currently we can only speculate as to why this is so.

The type of study that we could do



Figure 3. Russian cooperators, among them Dr. Victor Kuznetsov (left) and Anatoly Reshetnikov (second from right), the beekeeper who manages the experimental colonies used in the project.

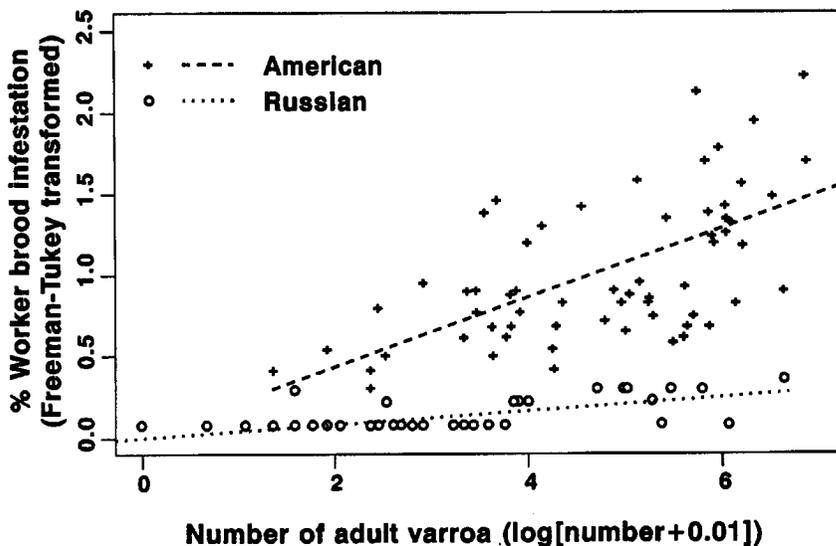


Fig. 4. A plot of *Varroa jacobsoni* infestations of adult bees and worker brood in each of the Russian colonies and in a group of U.S. colonies. Counts were transformed to meet requirements for a statistical regression analysis. The statistical results indicate that the relationship of varroa infestations of adult bees and brood differs for the two groups of colonies.

in Russia is necessarily limited by our inability to legally import bees or mites into that country. Thus, we cannot do comparative tests of Primorsky bees versus bees of standard U.S. stocks known to be susceptible to varroa, or of Russian varroa versus U.S. varroa that are known to be virulent. We must rely on observations of varroa population dynamics and life history traits, and judge whether they deviate markedly from what we have come to expect from varroa on other western honey bees in temperate zones. Even if results consistent with resistance are found, we still

will not be able determine if low varroa levels are based on traits of Primorsky bees, traits of Primorsky mites, or environmental factors peculiar to the region. If positive signs continue to be seen about resistance or tolerance to varroa in bees of the Russian far east, we would propose that the stock be imported for more critical comparative testing.



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