

INTERNATIONAL ASPECTS OF QUEEN REARING AROUND THE WORLD

by J. WOYKE

Bee Division, Agricultural University, Warszawa, Poland

Apiaries exist all over the world where queen honeybees (*Apis mellifera*) are reared and bred on a large scale. The queens are exported to different countries and thereby influence the genetic constitution of the bees there, even in distant continents. In some countries the native bees have been almost totally replaced by foreign races or strains. This happened for instance in the German Federal Republic to *Apis mellifera mellifera*, which was replaced by *A. m. carnica*; in Israel where *A. m. syriaca* was replaced by *A. m. ligustica*, and in Japan where *A. cerana japonica* (another species) was also replaced by *A. m. ligustica*. There are no native honeybees in the New World—the Americas and Australasia—and all honeybees there have been imported from other continents.

During my travels and studies in different countries I have been able to observe interconnections of queen rearing around the world, and these form the subject of the present article.

The world's most important centres of queen rearing and bee breeding are in Austria, Italy, the Soviet Union, the United States and Australia, which are dealt with in the above order.

Austria

Austria is well known for its exports of Carniolan queens (*A. m. carnica*). The most important characteristic of Carniolan bees is their ability to develop strong colonies early in spring. In a number of countries the spring nectar flow from rape (*Brassica napus* v. *oleifera*) now gives one of the most important honey harvests (see article by I. H. Williams, pages 141-153), and the cultivation of rape has thus shifted the main flow from summer to the spring. Carniolan bees are very good for such conditions, although they have an undesirable character: a tendency to swarm. However, the Austrian beekeepers do not only rear queens, they carry out selective breeding, under a programme supervised by the Beekeeping Institute in Lunz am See, and especially by Professor F. Ruttner and the late Ing. H. Ruttner. Special apiaries are maintained in Austria at which different lines of Carniolan bee are compared and evaluated, and thanks to these efforts its swarming tendency has been reduced.

Due to active publicity in favour of Carniolan bees, queens have been exported in large numbers to other countries, and Carniolans are now driving out the native bees.

The Austrian bee breeder Mr. W. Singer exported Carniolan queens to Egypt, to replace the Egyptian bee *A. m. lamarckii*. The first reports were favourable, but the introduction of Carniolans in the oasis used for breeding them seems to have had one unfortunate side effect—predation by the wasp *Philanthus triangulum*. This was the subject of an article in the previous issue of *Bee World* (pages 97-107). Up to the present, most efforts to introduce European bees to the African continent have failed.

Italy

Italy is the home of the Italian bee *A. m. ligustica*, a bee adapted to warm and hot climates with abundant nectar sources. Under these conditions, the bee develops very strong colonies, with a brood nest occupying several hive boxes. Italian bees, or mixed descendants from them, now occupy much of the Americas and Australia. In those areas the bee does well, and the beekeepers are satisfied. But the bee is not adapted to cooler climates, or to the scarcer nectar sources of central and northern Europe. In these conditions it continues to produce much brood, irrespective of the lack of nectar flows, and the colony eats all the honey it collects. There are also difficulties in feeding some Italian strains for winter, since the bees rear brood all the time they are being fed, and also eat into their winter stores. The Italian bee is a poor survivor of the long winters of central and northern Europe.

In countries with warmer climates, queen rearers as well as other beekeepers import large numbers of Italian queens from Italy. The best known breeder in Italy was the late Mr. Giulio Piana, who died in 1978. All over the world beekeepers compare and evaluate different bee races in their apiaries, hoping to find 'the best bee', and I have been very surprised to see that the Italian queen rearers are doing the same. I noticed Caucasian and Carniolan colonies in apiaries used for rearing Italian queens, which were mated in the same apiaries. Many of those queens would not be pure-mated exclusively to Italian drones. But due to the fact that, in honeybees, yellow body colour is dominant over black, yellow Italian queens produced yellow offspring even when they mated with black drones: the importers are not able to tell whether the queens are mated purely or not. To overcome these difficulties, some Italian breeders keep reserves of Italian bees on small islands. For instance Mr. Piana had such a reserve on Elba; however, this island is not an official sanctuary for Italian bees, and anyone can keep any race of bees there. There are still regions of Italy with pure Italian bees, but nevertheless some people believe that the present Italian bee in Italy is not the same as it once was. It has been suggested that the Italian bees on Kangaroo Island off South Australia, to which their ancestors were taken in 1884 and which is now a honeybee sanctuary, are more typical of the classical type of Italian bee than are the present Italian bees of Italy.

The Soviet Union

The USSR is renowned for its exports of queens of the Caucasian bee *A. m. caucasica*. This bee has the longest proboscis of any race, and it can collect nectar from red clover (*Trifolium pratense*) when other honeybees cannot do so. It is therefore very valuable as a pollinator in regions where red clover is cultivated. This bee is unfortunately susceptible to nosema disease; also it stores honey in the brood chamber, thus restricting egg laying during a honey flow. As a result, the colonies are weak in autumn and do not overwinter well in regions with a long winter.

The Russian breeders conduct intensive selection of Caucasian bees in the Caucasus region, and have succeeded in improving its egg laying as well as its overwintering capability.

Caucasian bees give a very high heterosis effect in crosses with the black central European bee *A. m. mellifera*, and it is mainly for this reason that the queens have been imported to Poland.

Unfortunately, the prosperous queen export business from the USSR has had to be stopped, because of infestation with the mite *Varroa jacobsoni*. This mite originally parasitized the eastern species of honeybee *Apis cerana*, which occupies south-east Asia and also the Far East region of Soviet Union. *A. cerana* is more resistant to *Varroa* than *A. mellifera*, but it is less productive; according to V. V. Alpatov it was for this reason that *A. mellifera* was introduced into the Far East of the USSR (*Bee World* 59(4) 164-167 (1978)). Since *A. mellifera* bees extensively rob *A. cerana* colonies, the mite was able to transfer from *A. cerana* to *A. mellifera* colonies. The *A. mellifera* bee in the Far East was once used intensively for comparisons and for crosses with other honeybee races in different regions of the USSR, and the mite was probably introduced into different regions in this way.

A. mellifera lives close to *A. cerana* in some other countries, and *Varroa* is likely to have transferred from *A. cerana* to *A. mellifera* in almost all of them. Nevertheless the effect of the mite in closing down a growing export of queen honeybees was greatest in the Soviet Union.

United States of America

The USA is unquestionably the country with the largest industry of queen rearing and bee breeding, and the largest exporter of queens. These are reared in the southern states, especially Florida, Georgia, Louisiana, Texas and California. The breeders can start queen rearing early in spring, so they can supply young mated queens at the time when the bee season is starting in the northern states and in Canada and Europe. The queens are in demand for two purposes: to replace old queens, and to head packages of bees sent to the north. To produce many packages, each with a young queen and 1 kg bees, a type of bee is required which rears much brood and develops populous colonies. The Italian is such a bee, and the above abilities—which it already has—have been intensified further by selection. It seems that more attention has been paid to selecting a bee that rears much brood than one that produces much honey. A bee that rears much brood can be very successful in regions with many nectar flows, where colonies can be moved continuously from one flow to the next, but it fails in areas with only one flow or a few short ones.

Another striking character of many American strains of bee is the yellow body colour. Many breeders have selected just for this colour, and as a result the golden American bee has become popular—in spite of the fact that there is no correlation between body colour and honey production.

After the high productivity of the four-way hybrid corn (*Zea mays*) was recognized, bee breeders started to use the same method for breeding a four-way hybrid honeybee. The breeding programme was worked out by the USDA and conducted in its experimental stations at Madison in Wisconsin and Baton Rouge in Louisiana. The original breeder queens were inseminated instrumentally, and queens supplied to the beekeepers were mated naturally from a mating apiary. The first mating apiary was located on Kelleys Island in Lake Erie; then, through co-operation between USA and Canada, a second was established on Pelee Island, also in Lake Erie.

Until recently the breeding of four-way hybrid queens was conducted by the late Dr. G. H. Cale of the Dadant Company, which offered two types of hybrid queen: Starline and Midnite. The Starline hybrid is derived from Italian bees

and is yellow coloured; it is well adapted to commercial apiaries in the USA where it develops strong colonies that can give high honey yields. The Midnite bee is black, and very gentle, and it is recommended for the amateur beekeepers.

Advertisements appear in the USA announcing the rearing and sale of Caucasian queens. But the import of new queens to USA has been prohibited for many years, to prevent the import of the acarine mite *Acarapis woodi*, so the queen rearers must rely on progeny of queens imported many years ago. Most mating apiaries are not sufficiently isolated to prevent the entry of drones of other strains, and Caucasian bees I have seen in the USA did not have much in common with the original Caucasian bee except its black colour.

One might have thought that nothing could interfere with the growing export of queens from the USA, but two difficulties have now arisen. The first concerns the 'aggressive' Africanized bee in South America. I was working with this bee in Brazil for 7 months, and I know the problems personally. Many beekeepers stopped keeping bees, although on the other hand some learned how to manage the Africanized bees: hives should not be in groups on common stands, but placed apart; much smoke must be used, and so on. Africanized bees are spreading over the South American continent at a rate of 200-250 km per year. They have now reached Argentina in the south and Venezuela and Colombia in the north. The possibility exists that they will reach the United States and, if so, no one would want to import queens or packages from the States. The situation is problematical even now; for semen from African bees was sent to the USA some years ago, and some queens were inseminated with it. Also a swarm of Africanized bees has been found on a ship in port in California, and this could happen again.

In recent years a new disease—called disappearing disease—has appeared in the USA. Affected colonies dwindled in the spring, some losing most or all of their worker population. Some Americans believe that the trouble was caused by genes of African bees, already introduced in some way to the USA. African bees are not adapted to long winters, and consequently bees in the USA with some African genes would be likely to die early in the spring.

The possibility of losing the queen export trade is quite serious for the American beekeeping industry, and some countries—Australia for example—have already prohibited the import of queens from the USA. Recently Mr. R. Weaver, the well-known beekeeper from Texas, has established a queen-rearing enterprise (in co-operation with Mr. J. Powers) in Hawaii, which the African bee cannot reach by natural migration. So if African bees do enter the USA, Mr. Weaver will be able to rear queens in Hawaii and export them, although this will not be possible from mainland USA.

Australia

This country has a tremendous potential for further development of its beekeeping industry, and for increasing its honey production. Most of the trees native to Australia are eucalypts, and many of them are quite good nectar producers. Commercial beekeeping is increasing, and one result is a growing demand for queens, with a consequent increase of queen-rearing apiaries. Some breeders already rear many thousands of queens a year. The local conditions, as well as the international situation, favour this movement, and Australian queen rearers are preparing themselves to take over world queen production. They may be able to replace the Americans in the world market for queens.

During my first stay in Australia (1973-74), I conducted some genetical investigations in the bee sanctuary on Kangaroo Island, South Australia. The bees on that island have more original Italian bee character than the bees now kept in Italy: the Australians have a source of pure original Italian queens. I explained the importance of this bee sanctuary to the Minister of Agriculture for South Australia, with the result that a bee station has been created on Kangaroo Island, to maintain and investigate the bees there. Queens of other races are now being imported to Australia and kept in quarantine apiaries to prevent the introduction of new bee diseases. The breeders receive breeding material from these apiaries. So the Australians now have original pure material of different races, and their problems are concerned with breeding these bees properly, and ensuring pure matings.

Like most breeders in different parts of the world, Australians have excellent methods of queen rearing, but often lack sufficient genetic background to conduct real breeding work and to ensure pure matings. A bee breeding course was organized in 1976 in the Queensland Agricultural University. An international team lectured on bee genetics and bee breeding, and gave practical instruction in the instrumental insemination of queens, with the result that some of the participants gained a great deal of knowledge from the course.

It is now possible to find advertisements in the *Australasian Beekeeper* for naturally mated queens at \$3.5 to \$4.5, and for instrumentally inseminated queens at \$100; these latter queens can be guaranteed purely mated, and they may be used as a source for rearing queens of a pure race. However, a disease caused by the Kashmir bee virus was recently found in the eastern states of Australia (J. Rhodes (1978), *Australas. Beekpr* 80(2) : 30-32), and this disease may well interfere with the queen rearing and export industry.

Poland

In this country bee genetics is well developed, and much progress has been also achieved by using instrumental insemination of queens in practical beekeeping. Instrumental insemination of queens, developed in the USA, is now used in certain experimental stations in many countries, but Poland is perhaps the only country in which it is used extensively in practical beekeeping. This is probably due to the progress achieved here in investigating the conditions in which the queens should be kept during and immediately after insemination. As a result, the survival rate of inseminated queens has been increased, as well as the number of spermatozoa entering the queen's spermatheca. Some stations in Poland now specialize in inseminating queens for beekeepers, and others, as well as some individual specialists, also carry out instrumental insemination of queens for beekeepers. All breeder queens must be inseminated instrumentally, but additionally several thousands of queens used directly in honey production are inseminated each year. This trend will be continued in Poland, and will probably be followed in other countries.

Japan

Japan is not an important producer or exporter of queens, but events there have had an influence on the queen rearing industry on other continents. The native bee of Japan is *Apis cerana japonica*, but this is now almost completely replaced by the Italian bee. As early as 1973 I saw that Italian bees in Japan were heavily

infested by the mite *Varroa jacobsoni*, as in other countries where *A. mellifera* has come into contact with *A. cerana*.

Japan conducted an aid programme to develop beekeeping in Paraguay, and sent some honeybee colonies there. As a result the *Varroa* mite was introduced to South America, and will almost certainly spread over that continent. The Africanized bee, with its high swarming and migration abilities, will undoubtedly help in spreading the *Varroa jacobsoni* mite, and there is a real chance that the mite may thence reach the USA. So the American beekeepers and breeders may have not only the invasion by Africanized bees to fear, but also the mite *Varroa jacobsoni*.

This closes our circuit of interconnections of queen rearing around the world.

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