Genetic evaluation in the honey bee and its use in preserving indigenous races.

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The principle of breeding is very simple: one mates the best animals with one another to achieve good offspring. However, because the true quality of the animals is very difficult to determine, the realization is quite difficult. It is difficult because only the quality of genes is significant in breeding, and this quality is masked by the environmental conditions under which the potential parents live. The nectar flow and the evaluation standards for behavior such as gentleness vary so much from apiary to apiary that such results only permit limited information of the genetic value of colonies. Only the combination of performance testing and genetic evaluation provides insight into the breeding value of an animal. The breeding value states for a particular characteristic (i.e. for the honey bee, kg of honey, less varroa, etc.) how much an animal is genetically better or worse than the average of the population. In 1994 the most recent genetic evaluation system (BLUP Animal Model) was adjusted for the peculiarities of the honey bee at the Institute for Bee Research in Hohen Neuendorf, Germany (www.beebreed.eu). This approach uses genetic relationships between all colonies within the population. In addition, because traits of colonies is affected by the genetics of the queen and the worker bees, both generations were taken into account (Bienefeld et al. 2007, Apidologie 38: 77-85).

Before the genetic evaluation began, there was also an average genetic progress for honey production of 0.11% per year. Since the beginning of genetic evaluation this value has significantly increased to 0.59% per year and honey production rose 0.72 kg per colony and year.

Due to selective breeding A. m. carnica and A. m. ligustica are the most popular races for beekeeping purposes. These races are exported to many countries. Due to the mating strategy of this species, we found an uncontrolled introduction of genes from these races into the indigenous strains. The disappearance of several well-adapted honeybee subspecies and ecotypes is a fundamental loss. Genetic diversity is generally assumed to be an important barrier against new pathogens as well as the basis for efficient selection against current pathogens. In combination with climate change, the loss of genetic diversity may escalate into a major issue. In the decades to come, apiculture is expected to be significantly impacted by the concurrent processes of climate change. The honeybee will be doubly handicapped by global warming Weather variability, especially longer hot and dry conditions, increase the honeybee's vulnerability to several pathogens. Some honeybee races are facing extinction. Consequently, and in full accordance with the requirements of the Rio Convention on Biological Biodiversity, we need a concept for preserving honeybee subspecies and their ecotypes as genetic recourses for future demand. Considerable efforts must be made to preserve the honeybee ecotypes and to select within these ecotypes for adaptation to global warming. However, indigenous honeybee races are rarely used by beekeepers, because often lacking in honey production, gentleness and low swarming behaviour. Consequently, the only hope for preserving rare honeybee races is to select them to suit the demands of the beekeepers by a combination of performance testing and genetic evaluation. In addition to genetic progress in rare honeybee races, which improves their acceptance by beekeepers, genetic evaluation is recommended for endangered breeds by FAO and several national rare breeds organisations for the following reasons:

1) Genetic evaluation provides also information about inbreeding and genetic relationship.

2) Genetic evaluation encourages international cooperation and genetic exchange between small subpopulations.

3) Genetic evaluation provides breeding values for several traits, which offers a wider supply of suitable parents for different demands.