SICAMM

Societas Internationalis pro Conservatione Apis melliferae melliferae
International Association for the Protection of the European Dark Bee

Established in 1994, for the conservation, protection and promotion of the dark European honey bee (*Apis mellifera mellifera*) and other threatened local bees. A federation with more than 15 European countries. https://sicamm.org

Statement for the conservation and restoration of the Dark European honey bee, *Apis mellifera mellifera*

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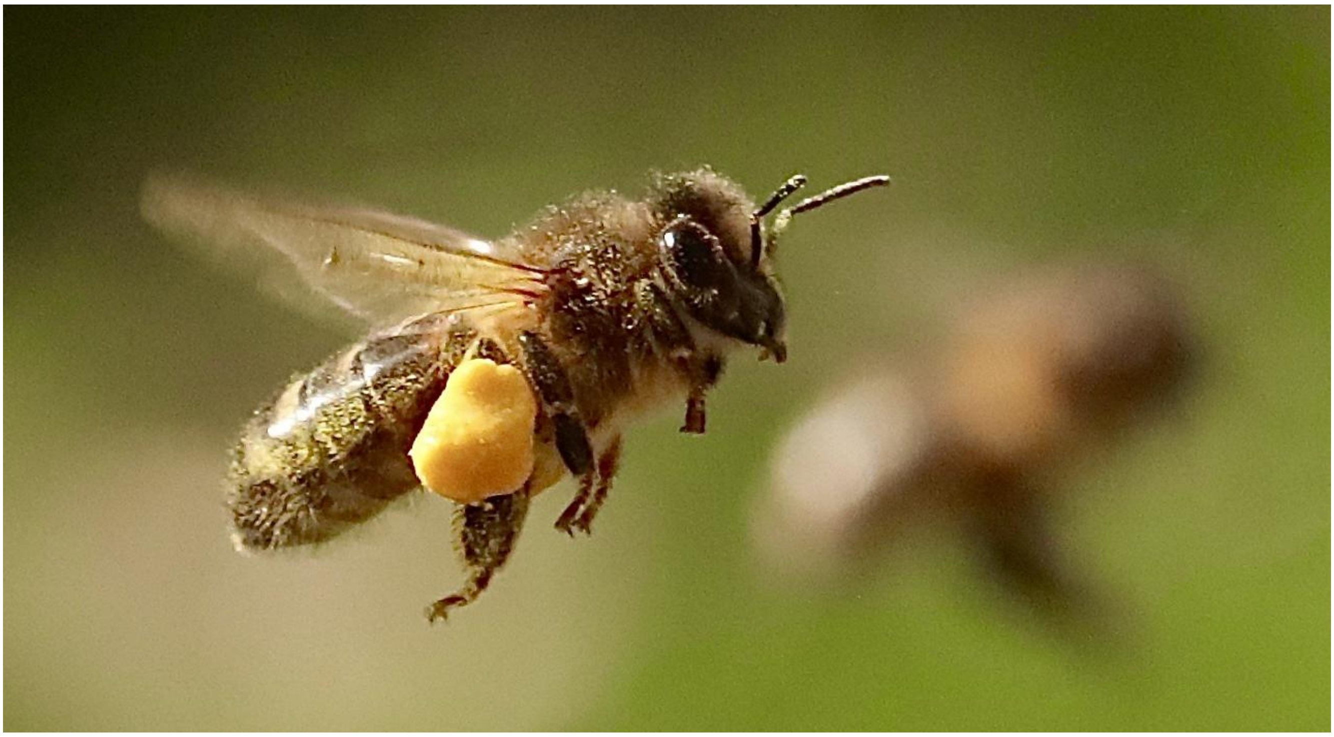

Image of the Dark European honey bee. Photo credit: Karen Kloppenborg Møller, Denmark

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1. Introduction

After the last ice age, the Dark European honey bee, *Apis mellifera mellifera,* (also known as the black or brown bee) one of the subspecies of the Western honey bee (*Apis mellifera*), extended naturally its range across Northern Europe. For the last one million years, it has evolved independently of other subspecies, except for *A.m.iberiensis*, which shared the same refuge during the last glaciation period.

Within this original distribution area, the Dark European honey bee has adapted to the climate, and the flora and pollinator community, and is therefore an irreplaceable subspecies for the maintenance of biodiversity and healthy ecosystems. From the mid-nineteenth century onwards, it was believed that honey bees imported from Southern Europe, and artificial hybrids resulting from the crossing of different subspecies, may be advantageous to beekeeping. However, there is no scientific data to support this view, although the belief persists amongst many beekeepers. This misconception, and the readily available supply from more favourable queen-rearing climates, mean that *A. m. mellifera* (*A.m.m.*) is now under threat throughout its original range. Hybridisation with non-native subspecies and artificial hybrids, such as the Buckfast bee, is a predominant phenomenon in almost all regions. Every effort now needs to be made to protect the Dark European honey bee and prevent its demise.

The severity of the situation varies from country to country. Whilst the Irish bee population has more than 90% of the genetic characteristics of *A.m.m.* (Hassett et al. 2018), the Dark European honey bee has nearly disappeared in many European countries, for example notably in, Germany and the Czech Republic. However, in nearly all Western European countries the number of beekeeping associations trying to save the Dark honey bee from extinction, or reintroducing the Dark honey bee, is steadily increasing.

Up to now, each country has worked to its own conservation protocols, using different strategies and standards. The aim of the SICAMM conservation team is to develop protocols for the conservation of the Dark European honey bee populations in the whole of its native range across Western, Northern and Central Europe. The difficulty lies in that situations and problems may vary from country to country, requiring different methods for different regions, as well as ones that respect local characteristics and adaptation to climate, flora, and pollinator communities. In addition to this, the procedures for controlling the import and export of queen bees, or of bee colonies, whether *A.m.m.* or other subspecies, differ significantly between countries. Unfortunately, imports often occur with little or no control, which increases the threat to local *A.m.m.* conservation efforts.

Fig.1 Distribution map of the dark European honey bee *Apis mellifera mellifera*
Green line: original distribution limits to the west, north and east - Vertically hatched line: transition zone to the honey bee subspecies of southern and eastern Europe (*A. m. ligustica, carnica, macedonica* and *caucasica*) - Red dashed line: northern limit of beekeeping - Adapted from T.D. Seeley by V.R. Douarre, 2025.

2. The Importance of Conserving the Dark European honey bee

Biodiversity. The different subspecies of honey bees have evolved over millennia as a result of natural selection and are the best survivors in their particular conditions. Preserving biodiversity in the natural world is essential for the maintenance of a robust biosphere, giving all the species that make up an ecosystem the best chance of survival.

Genetic variation. The natural mating system of honey bees, whereby queens mate with numerous drones, means that introducing other subspecies and artificial hybrids to a locally adapted population quickly results in a mixed population that is not well adapted to the local environment. Hybridising different subspecies also results in genetic instability, which makes selection and improvement slow and difficult due to the low rate of offspring that ‘breed true’, i.e. who acquire the traits of their parents. Therefore, selection of local dark honey bee populations should be favoured.

The Dark European honey bee has the largest distribution area of all European subspecies (figure 1). The fact that Dark European honey bees have not often been used in artificial selection programmes means that they still represent a trove of genetic variation. This makes them potentially better able to adapt to a changing world and suitable candidates for the artificial selection of the characteristics desired by some beekeepers.

Sustainability The importance of free-living honey bee populations cannot be overstated. These populations are completely subject to the pressures of natural selection, thus evolve freely. However, the role of beekeepers is also inextricably linked to the welfare of the honey bee. Beekeepers have a responsibility to develop a sustainable system of beekeeping that maintains a viable population of honey bees where quality can be maintained or improved indefinitely. This is only possible for bees in a large panmictic population, that is, in a sustainable, free breeding, population (van Alphen, 2025) and cannot be achieved by the random hybridization of honey bees or by restricting the mating of bees to isolated mating stations.

3. The Biological Constraints

To address the question of how to protect existing populations of Dark European honey bees from hybridisation with non-native honey bees, and how to successfully reintroduce or enforce these populations, insights from population genetics and other relevant biological disciplines can be used.

The first question to be addressed is what is the minimum population that can adapt to new environmental conditions. Population genetics uses the concept of 'effective population size' for this purpose. Effective population size is the size of an ideal panmictic population that would lose genetic variation from drift at the same rate as it occurs in a real population The minimum population size should be large enough to prevent the loss of alleles. In other words, it should be composed of a large number of individuals so that it loses genetic variation very slowly. In organisms, whose females mate with only one male, the minimum effective population size at which the loss by drift approaches zero is about 500 pairs. However, honey bee queens commonly mate with 10 to 20 drones. Because a much larger number of drones contribute to the next generation than the number of queens, this means that the effective population size (that is, the number of colonies) at which the population can persist is much smaller than 500. If one takes into account that honey bees are haplo-diploid it can be calculated that an effective population size of slightly more than 150 colonies would be sufficient (Moran, 1984).

The second question is how large the area needs to be to support a stable population. In other words, what is the environment's carrying capacity for honey bees and wild pollinators in terms of resources?

Natural densities of honey bees have not been assessed very often, but figures in the scientific literature suggest densities between 0.5 and 3 colonies per square kilometre. That means that a region of 50 to 300 square km would be needed to support a population of 150 colonies, that is a circular area with a diameter of 8 to 20 km. Besides the needed area size, it is also important that the area contains sufficient amounts of flowering species representing a broad plant diversity, so that potential competition to other wild pollinators can be minimized.

The third question is how to prevent the incursion of non-native drones. Annette Jensen and co-workers (Jensen et al. 2005) found that young queens mate with 90% of drones that originate within a distance of 7 km. That means that a buffer zone of 7 km wide would be needed around the area supporting the population. In the case of free-living honey bees, with colonies scattered over an area, this would require a protected zone of 380 to 908 km². Reserves of this size would be very difficult to realize in densely populated Western Europe.

A Dark European honey bee reserve does not necessarily have to only consist of free-living honey bees. An alternative would be to have conservation apiaries comprising a conservation stock of 150 colonies in a core (sanctuary) zone of 3 km radius, surrounded by a buffer with a radius of 7 km. The principle is (1) in the central zone, to maintain a low selection rate among the 150 colonies in the conservation apiaries, in order to maintain genetic diversity, and (2) in the buffer zone, to replace hybrid colonies with pure colonies produced from the central zone, in order to protect the mating of colonies of the conservation apiaries in the central zone from drones from outside the buffer zone, through a saturation effect. This scheme results in a reserve of slightly more than 300 km^2 (that is, a circle of 20 km diameter - radius 3 for core + 7 for buffer). This is exactly the principle that has been proposed by the European Federation of Conservatories for the Black Honey Bee in France (FedCAN: fedcan.org). The specifications set out by FedCAN define the functioning of the French Conservatories for the Native Black honey bee and could be used elsewhere in Europe or be adapted for specific local conditions and legislations.

4. Four Scenarios

We can distinguish four different scenarios for the conservation of Dark European honey bees, based on the biological constraints described above:

(i) **Sound populations endangered by imports.** Local Dark European honey bee populations are largely intact at the scale of the country but threatened by the importation of non-native honey bees and artificial hybrids (as in in Ireland).

(ii) **Viable populations in reserves.** Local Dark European honey bee populations remain viable in some reserves in the country but are threatened by the introduction and dissemination of non-native honey bees and artificial hybrids created with non-native honey bees (the situation in parts of France, southern Belgium and some of the countries in Northern Europe).

(iii) **Strongly hybridised populations.** Dark European honey bee populations have been replaced, or severely hybridized, by non-native subspecies and artificial hybrids (the situation in some parts of Switzerland, the UK, the Netherlands, Flanders and Germany). In this situation, efforts should be made to restore *A.m.m.* populations.

(iv) **Wild populations in forests.** Fortunately, some Dark European honey bee populations still exist, locally, as free-living colonies, in large forested areas with few economic interests for commercial beekeepers (such as the situation in Poland and Lithuania).

5. The Tools for Conservation

(i) Strategic ban on non-native imports

In all scenarios, a ban on the import of non-native subspecies would be a hugely beneficial step forward for the sustainable recovery of the Dark European honey bee. SICAMM should therefore work to convince policy makers in the EU and in other relevant European countries of the need for a ban. A ban is desirable for biosecurity reasons, to prevent the introduction of new honey bee parasites and pathogens into our honey bee populations. From a conservation point of view, a ban would encourage a move to a more sustainable beekeeping system
The importation of non-native bees is based on the misconception that these bees are better for beekeeping. There is no scientific basis for this, and there is evidence that local populations of indigenous dark honey bees are better adapted to the flora, the local climate and to co-existence with other pollinators. The large genetic variation still present in Dark European honey bee populations makes them potentially more able to adapt to a changing climate and to become resistant against new pathogens and parasites. SICAMM should therefore work to convince keepers of non-native bees of these scientific facts.

(ii) Creation of reserves, or conservation areas, for the Dark European honey bee.

In the early nineties, the Irish already had created an isolated mating area with buffer zones around it in the Galtee mountains (Mac Giolla Coda, 1995). FedCAN has published the specifications for how to set up and how to manage a Dark European honey bee reserve or conservation area. When all the beekeepers on a homogeneous territory cooperate, a reserve or conservation area can be created, using the specifications of FedCAN. This conservation programme can be implemented at a site where the Dark European honey bee is still present. A central area where only pure *A. m. m.* colonies are kept, is surrounded by a buffer zone, where non-native bees can be replaced by Dark European honey bees produced locally. In this way a population of around 150 colonies can be maintained, whose diversity can be preserved under natural selection, in the sanctuary at the centre.

Note on intrumental insemination
While instrumental insemination of honey bee queens is used in some breeding programs, the SICAMM conservation team does not consider it a suitable tool for the conservation of *A.m.mellifera* as it hampers natural and sexual selection and results in the loss of rare alleles (van Alphen, 2025). Therefore, we recommend free mating within an effective population size of at least 150 colonies.

(iii) Restoration programme to increase the percentage of Dark European honey bee alleles outside of reserves or conservation areas.

This could be a process of distributing young Dark queens to interested beekeepers, thus promoting drone producing colonies in an area. This should be accompanied by the spreading of scientific information on why Dark European honey bee populations should be restored. The role of education and supervision and the involvement of young beekeepers should play an important part in this program, backed up by experienced mentors or an *A.m.m.* beekeeping organization. Dark European honey bees used in restoration programmes should originate from areas with comparable climate and flora.

(iv) Promotion of free-living European Dark honey bee populations in the wild.

Existing free-living Dark honey bee populations must be preserved in European forests. Free-living populations of Dark honey bees are important because their natural selection can operate freely. This is important for the evolution of resistance to new diseases, parasites and other environmental issues. It is difficult to find the nests of free-living honey bees (Seeley, 2016) and so colonies of Dark honey bees may well have been overlooked until now. The recent discovery of 70 colonies of free-living honey bees on the Blenheim Estate in Oxfordshire, UK, suggests that more similar discoveries could be made if more effort is made to survey Europe's forests.

(v) Free distribution of genetically verified Dark European honey bee colonies in and around buffer zones

A practical and cost-effective tool to support effect of buffer zones is the free distribution of sufficient numbers of genetically verified *A. mellifera mellifera* colonies or queens to beekeepers. This approach supports the expansion of alleles of the native subspecies, encourages local beekeeper engagement, and creates a living protective ring around core conservation areas.
Distribution programs should be accompanied by training, basic record-keeping, and periodic monitoring of genetic integrity.

For scenario (1) the most important step would be a ban on the importation of non-native bees. A second step would be to create free-living honey bee populations in forests. These are important for natural selection and producing bees best adapted for survival. In addition, honey bee breeders should select for pure Dark European honey bee and purge alleles of non-native subspecies. Natural selection will help this process.

For scenario (2), the current solution of having local reserves or conservation areas to prevent further erosion of Dark European honey bee populations is an important step. For the management of such areas, reference to the description provided by FedCAN can be made. A ban on the importation of non-native honey bees and the regulation on the use of artificial hybrids created with non-native honey bees will be needed in the long term on these reserves. These reserves or conservation areas can be used to breed large numbers of Dark European honey bee queens and drone producing colonies to increase the frequencies of Dark European honey bee alleles in free mating honey bee populations in an enlarged buffer aera outside of the reserve and further away.

For scenario (3), it is important to create reserves or conservation areas with Dark European honey bees imported from zones that have similar climate and flora. It is important to convince beekeepers and policy-makers that it is possible to reintroduce Dark European honey bees successfully. A common argument against the reintroduction of Dark European honey bees is that the extensive hybridization, and the high proportion of non-native alleles in the population, make this an impossible task, but this is not true, although it will take time to restore the situation. Here are the steps that need to be taken. (i) A ban on the import of non-native honey bees and of artificial hybrids created with non-native honey bees. This would undoubtedly be a beneficial step as it would give honey bees in a country or a region, a chance to develop local adaptation. (ii) A gradual increase in the proportion of Dark European honey bee alleles in the population through the intensive breeding of Dark European honey bee colonies and the build-up of more Dark European honey bee drone colonies. A method used in Ireland of giving young black queens to neighbouring beekeepers would play an important role in this. (iii) A population of free-living bees which are subject to natural selection will help to increase the number of Dark European honey bee alleles. (iv) As the proportion of Dark European honey bee alleles in the population increases, it becomes easier to keep Dark European honey bee pure within the reserves.

For scenario (4), It is of great importance that forests that have a wild and free-living population of Dark European honey bees are recognized as protected areas, and the Dark European honey bees are recognized as protected, endangered species. It seems wise to surround such protected natural reserves with enlarged buffer zones, where non-native bees are gradually and centrifugally replaced with Dark European honey bee as done in scenario (2).

Disclaimer: *This statement is intended to promote the conservation and restoration of the Dark European honey bee (Apis mellifera mellifera) throughout its natural range in northern Europe. It could also be used for conservation efforts of other honey bee subspecies within their natural evolutionary ranges.*

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7. Acknowledgements

Michael MacGiolla Coda for providing valuable information on early buffer zone use in Ireland. Arjen Gerritsen and Jakob Bouw for illuminating discussion.

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