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BEE RACES AND PROTECTED AREAS IN SWITZERLAND

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ABSTRACT

With the growing realization that original, locally adapted bees compared to hybrids or introduced subspecies have an advantage, the desire for protected areas for those local breeds receives further support and encouragement. In this publication we report on the status of the Dark Bee *Apis mellifera mellifera*, (Amm), in Switzerland and about efforts which are being executed to maintain this local race (subspecies) and ecotype.

Key words: *Apis mellifera mellifera*, subspecies, races, Dark bee, protection areas, conservation

INTRODUCTION

Since industrialization, man has used the global resources intensively and in doing so stressed many of our ecosystems. Thus we endanger our own long-term bases of existence. The UN has addressed these problems and in December 1993, the Convention on Biological Diversity came into force [<http://de.wikipedia.org/wiki/Biodiversit%C3%A4ts->

Convention]. Switzerland has ratified this in 1994, which means that the cantons (provinces) have to act according to this agreement which means they are obliged to maintain biodiversity and ecosystems and use them in a sustainable way [<http://www.bafu.admin.ch/international/04692/04696/index.html?lang=de>]. This concerns countless creatures, even our native bee races (Figure. 1).



Figure 1. The Dark Bee with queen, drones and workers. Photographer: Balsler Fried.

THE DEVELOPMENT OF THE BEE RACES IN SWITZERLAND

In Switzerland two original, native honey bee races *Apis mellifera* are kept: *Apis mellifera mellifera* north of the Alps and *Apis mellifera ligustica* south of the Alps [Ordinance on Livestock: Art. 12]. In addition two foreign bee races are kept, namely the native bee of Carinthia and Slovenia, *Apis mellifera carnica* and the one brother Adam (1898-1996) bred in the Benedictine Monastery of Buckfast in Devon (England) called Buckfast race.

The search for «better» Bees (more honey and / or swarms) began already in the late 19th century. Experiments with foreign bee races followed in the late 1950s. After the suppression of the dark bee was already well advanced in Germany, the spread of the *Carnica* race in Switzerland gradually started. The main motives for this was probably the seemingly more quiet nature, the fertility and early honey foraging of these colonies. However, this action resulted in a fateful hybridization of the native population and in particularly aggressive colonies. What was again used in the episode as an argument against *mellifera*. Certainly, at that time such relationships and the importance and the value of locally adapted populations were little known. And so this ominous development for the Dark bee took its course until dedicated Swiss beekeepers founded towards the end of the last century the Swiss Association of *Mellifera* Bee Friends (VSMB) and engaged themselves for the promotion and preservation of the Dark Bee. In the meantime, the Dark Bee which was native in all of Switzerland virtually disappeared in the French-speaking area. In the Central Plateau of the Country there is actually no coherent population anymore. In the foothills and the Alps this bee could survive (with few exceptions) quite well. The pressure comes, however, from single colonies of other races causing the hybridization and with that disturbs breeding efforts. Of the approximately 100 000 colonies of today in German-speaking Switzerland about 10 000 are pure-bred *Apis mellifera mellifera* and perhaps 30 000 are *Mellifera* hybrids. Particularly in regions with predominantly *Mellifera* hybrids and few colonies of other races it would be useful to establish a unified *Mellifera* population. Everyone would win: the bees and the beekeepers.

THE THREAT TO LOOSE MANY BEE RACES IS RECOGNIZED

Other races of bees in Europe came under pressure, too, as for example the Sicula Bee of Sicily and the Dark Bee of La Palma [<http://www.beekeeping.com/artikel/canaries.htm>]. However, especially during the last 10 years, the importance of preserving all Honeybee breeds is now undisputed, this in order to conserve biodiversity. For years, this disastrous development has been noted in

scientific studies. A few years ago, even Prof. H. Pechhacker, Austrian *Carnica* Association (ACA), said at a breeder's meeting in Hungary: «Major parts of our native European bee races are threatened with extinction». Also in the final report of the project «Beekeeping and *Apis* Biodiversity in Europe (BABE)» there is a warning about an ominous proliferation of «seemingly superior races of bees» [Final Report of the EU project «Beekeeping and *Apis* Biodiversity in Europe» (<https://wiki.ceh.ac.uk/display/biota/BABE>)].

In connection with the high colony losses in recent years, the importance of origin and selection of the bees has been examined and significant interactions between location and bee origin were found. A locally adapted bee is often less successful in other regions [Büchler, 2011; Blumer-Meyre, 2014; Meixner, 2014; Büchler, 2012]. Alice Pinto points to the threat of destabilising a long-established successful genome in a given area. Quote: „Accordingly, native honey bee subspecies represent reservoirs of unique combinations of genes and adaptations to local conditions that must be preserved and passed on to future generations of beekeepers” [Pinto et al., 2014, in press]. In addition De la Rúa et al., 2013, make the point as follows: “Admixture may lead to increased genetic diversity, yet it may also compromise local adaptations by disrupting co-evolved gene complexes fine-tuned by natural selection over evolutionary time “.

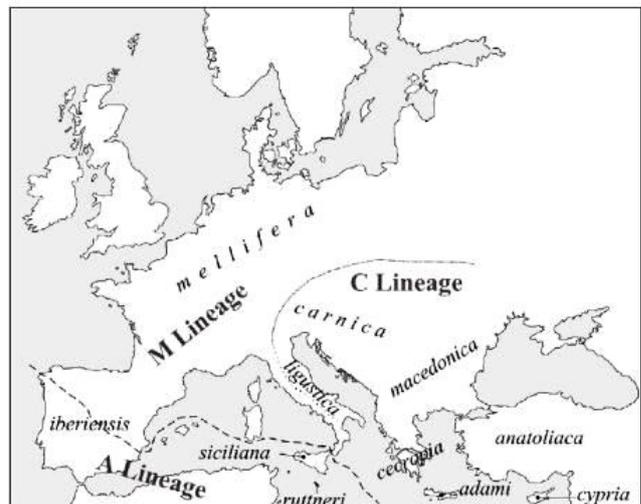


Figure 2. Distribution of bee races in Europe [De la Rúa et al., 2009].

SANCTUARIES FOR ENDANGERED TYPICAL, LOCALLY ADAPTED BEES

As stated, therefore, the importance of typical, locally adapted bees is very high. But we also know that their protection is in general very difficult, especially for our native dark bee. The understanding of the necessity of protection is not yet strong enough, and in other countries

a similar attitude is present. Thus, at the Apimondia 2013 in Kiev, for the first time a conference meeting (Figure 3) on endangered bee races took place [Bouga, 2013]. Interestingly, even the Slovenian representative complained about the impact of «yellow bees» from Austria. The whole country of Slovenia is a *Carnica*-sanctuary and the adjoining Austrian Länder of Kärnten and Steiermark are legally *Carnica* sanctuaries! A certain irony - from the point of view of *Mellifera* - is hard to hide

In order to avoid the disastrous crosses between bee races, protected areas (sanctuaries), are mandatory

where only a single bee population can be kept. For practical reasons, islands such as Ouessant, a Breton island in France, the Scottish island of Colonsay in the Atlantic or the Kangaroo Island in Australia are particularly well suited for that. In an interior land like Switzerland, very high mountains form valleys which offer excellent sheltered places. These have usually an open access, where natural migration by swarms and thus hybridization can occur. This must be countered by changing queens.



Figure 3. Roundtable at the Apimondia 2013 in Kiev on the topic «Conservation of endangered bee races». Chair: Maria Bouga, University of Athens, then from left: Per Kryger, University of Aarhus, Denmark and rightmost Ralph Büchler, Bieneninstitut Kirchhain. Photographer: Balsler Fried.

FOUR PROTECTED AREAS FOR THE DARK BEE IN SWITZERLAND

Today, the four existing sanctuaries - Canton of Glarus (about 1000 colonies), Biosfera Val Müstair (about 300 colonies), Diemtigtal Natural Park (about 300 colonies) and the Big Melchtal (about 50 colonies) - are maintained locally. The VSMB offers support and advice when needed. However, the necessary input exceeds the financial capacity of the local beekeeper's organizations. The Federal Ministry of Agriculture (BLW) evaluates the projects proposed jointly by apisuisse (the national beekeepers organisation) and VSMB to promote endangered Swiss bee subspecies [Maintenance and preservation of the endangered dark bee in Switzerland in four protected areas (www.mellifera.ch on «Publications»)]. This also proves the legitimacy of protected areas. The funds will be mainly used for finding racially pure colonies in partly hybridized populations and to assess drone colonies for local mating stations. With purchase of racially pure and ecotype queens, hybridized colonies are requeened. The hybrid test is performed with DNA analysis of the queens. Thus

it can be determined whether the queen emerged from a non-pure mating or a pure breed mating [Soland, 2012].

Beekeeping in VSMB is based on two pillars: on the one hand, pure breeding from typical colonies with a certified pedigree and mating only on a pure-line mating station. There, drone colonies are stationed, which consist of sister queens, bred from a colony according to the rules of “beebreed” [Sutter, 2014; <https://www2.huberlin.de/beebreed/ZWS/>]. The whole population consists of many lines and is managed in a well-balanced way. Special care is taken to avoid inbreeding. The second pillar comprises the protected areas in which local, mixed mating is not only possible but highly desirable, because the whole bee population in the area is free from other races or hybridized colonies. Due to the free mating, a great genetic diversity is maintained. That does, however, not mean that in a conservation area no quality promotion by selection in the population should be aimed at. In our case, race-specific mating stations (B stations) are present in some protected areas. The drone colonies there originate from different sources. For the care and management of colonies in a conservation area, the VSMB has established guidelines

[VSMB document: Strategy of protected areas VSMB, 2014]. Colonies and queens from protected areas are very important for the entire *mellifera* breeding program as a genetic reservoir for new blood.

In the following, we report on the status of these efforts and the necessary measures taken the various regions [Ritter, Fried, 2015].

KANTON GLARUS

In 1977, the political bodies of the Canton of Glarus decided that in their Canton only native bees may be held. This decision was anchored in the cantonal agricultural law. All other races are not admitted. In Article 1 of the corresponding law on beekeeping and bee breeding from May 1 1978 it is literally stated that «across the canton only bees of local landrace the Dark Alpine bee «*Apis mellifera mellifera* may be held and maintained » Other articles regulate the breeding issues, the notification requirement and the temporary colony migration. In the years 2006-2008 the Swiss Association of Bee Friends (VDRB) realized a project with the aim to promote pure bred type colonies. Wing measurements were used to differentiate hybrids from pure bred colonies. After the results were analyzed, a series of queens were replaced in the northern part of the canton because it was recognized that in this part of the canton a strong mixing had occurred [Rickenbach, 2011].

In 2012 the Society of Friends of Glarner Bees (VGB) launched together with the VSMB (financed by the company INNOCENT, fruit juice Manufacturer) a project to obtain a preliminary verification of racial purity in Sernftal (local valley) using the DNA hybrid test. The aim was to obtain a clue about the extent of mixture there. Samples were taken and analyzed. In 16 of 17 cases, racial purity was found.

In 2014, a new project started, again funded by the VSMB and INNOCENT; in one apiary in Sernftal hybrid colonies were replaced with purebred queens. A second

project is carried out by three family beekeepers. They produce queens from their 'old' Glarner colonies and sell them to interested beekeepers in the Canton or abroad. The VGB subsidizes the queens and covers the costs of the office which executes the wing measurements to determine the racial purity. The VSMB funded DNA analysis. The aim is to achieve that pure «Glarner blood» is propagated. For 2015-2017 it is planned to carry out similar work in the Canton, mainly in the northern part of it.

A problem to be solved in the Canton of Glarus remains to be solved: The mating station, which has existed for over 100 years in Klöntal, had to be closed in 2013 because of foreign influence through a newly established Buckfast mating station in the neighbouring Wägital [Knobel, 2012]. For this unsatisfactory situation one will continue to look for an acceptable solution.

VAL MÜSTAIR

The Val Müstair (Münstertal) is located in the south-eastern part of Switzerland and is surrounded on three sides by high mountains. To the southeast, the valley opens up to Italy. The local beekeepers association was founded in 1897, and as long as anyone can remember, Dark Bees were kept there [Hunkeler, 1947]. After the Second World War, individual beekeepers began to requeen on Carnica bees hoping to earn higher yields and gentler colonies. The concomitant hybridization with the negative by-product of increased defence readiness was followed at once and did not satisfy the majority of the local beekeepers. Therefore, in 2006 the local beekeepers association unanimously decided within the project Biosfera Val Müstair (Care and Development Zone of UNESCO), to initiate a project of propagating the pure Dark Bee. The request for the project came from local beekeepers association and the VSMB together with Pro Specie Rara. In the following second phase, apisuisse was included (Fig 4).



Figure 4. The Val Müstair is surrounded by high mountains. View from the Ofenpass to Lü at 1920 masl, the highest village in the valley. Photographer: Balsler Fried.

The aim was to build a sanctuary for the Dark Bee and thus contributing to the preservation of it. Funding was provided by the BLW and internal voluntary work. On the whole, about 300 colonies from about 20 beekeepers are held in the valley. In the six years of the project (2 phases, each of 3 years, 2006-2012) about 500 queens were produced and distributed. The main activity focused on the cultivation of local queens for requeening hybridized colonies and the

procurement of purebred drone colonies for the mating station. In the first phase of the project, the racial purity was determined by means of wing analysis, in the second phase the DNA hybrid test was used for it. Overall, the project can be assessed as very successful. But to secure what has been achieved, it is still necessary to continue with the DNA hybrid tests and especially towards the southeast, supersedure of queens is, if necessary, needed.



Figure 5. The mating station Las Clastras in Val Müstair is located at 2000 m and is open all year! The electric fence protects against bears and is reactivated here after work of Duri Prevost, Breeding Chief, and Renata Bott, President.
Photographer: Balsler Fried.

DIEMTIGTAL

Christoph Wissler, a dedicated local beekeeper, has taken the initiative in 2010, to start the project of a protected area for the Dark Bee in the Nature Park Diemtigtal [Wissler, 2011]. The goal was to locate and identify the existing population of purebred *mellifera* colonies, to breed queens of these colonies and requeen the hybrids. The Diemtigtal is geographically well suited to ensure secure local mating. A survey of the local beekeepers found 90% support for this idea. The project was also welcomed by the Diemtigtal Nature Park and financially supported. In the year 2011, 150 DNA samples were taken, 60 pure colonies were identified and 66 queens were substituted. In each year of 2012 and 2013, 82 queens were substituted. A project of this magnitude requires meticulous planning and coordination of all stakeholders. In addition, in the Diemtigtal Valley when at lower altitudes dandelions already bloom, at higher altitudes there is still snow on the ground. In the following years it is necessary to consolidate the work. For that, external visual

characteristics are considered, supported by DNA analyses, and where hybridization is there, queens are replaced. Additionally queens will be bred and hybridization monitored.

GROSSES MELCHTAL

In the canton of Obwalden various bee races are held: the Dark bee, the *Carnica* and the Buckfast. In order to avoid crosses between races, well-defined protection zones are necessary where only the Dark bee may be held. The Beekeepers Association Obwalden has set itself the task to contribute their part for the conservation and propagation of the dark bee by establishing a mating station in Melchtal (Stöckalp). Such a mating station is mentioned in documents as early as 1898. Today it is increasingly used by members of the association but also by external breeders. After the Beekeepers Association Obwalden had in principle decided for the protection of the dark bee, increasingly the desire was also expressed to establish a legally backed conservation zone in Melchtal. Contacts with interested parties and the various offices were

established. Based on these investigations, the government of the canton Obwalden approved the request for the conservation region «Grosses Melchtal» by adapting a supplement to the Regulations on protected animal and plant species. This supplement entered into force on April 1, 2013 [Huser, 2013] Thanks to financial support of the company Innocent, DNA analyses and changing of queens could be made in 2013. Similar work is planned for 2014 and 2015.

CANTON VALAIS

It remains to mention that two mating stations in the Valais have been declared protected areas. This is the B-mating station in Grund on the Simplon Pass and the A- mating station Gletsch on the Furka Pass. The corresponding order from the Valais State Council was issued on September 28th, 2008 based on the Law on Agriculture and Rural Development [Sanctuary agreement with the canton of Valais (www.mellifera.ch on «Publications»)].

FINAL CONSIDERATIONS

These protected areas are already more than a ray of hope for the conservation of biodiversity of honeybees in Switzerland. Their consolidation and security will remain an ongoing task. This requires funds (the Federal Government has promised this) and continue engagement of committed beekeepers who fulfil the task with a lot of passion. We recognise their work with thanks and appreciation. With the breeding work in the context of Beebreed [https://www2.huberlin.de/beebeed/ZWS/ (Breeding concept Beebreed *A.m.mellifera*, Genetic evaluation Swiss Association of *Mellifera* Bee Friends no.: 50)], our native bee developed into a quiet, powerful partner, and the hygiene aspect is given greatest attention. There is no objective reason not to keep the Dark Bee. The VSMB who is heavily involved in this activity is neither naïve nor fundamentalist. We do not want to turn back the wheel of time. But it is a fact: the Dark bee does not exist anymore in all parts of Switzerland. Although the conservation of biodiversity is recognized politically and socially at all levels, there are still areas with predominant *Mellifera* population where a certain resistance to protective measures is found, leading to unnecessary tensions. For a consensual, sustainable coexistence, the *Mellifera* beekeepers expect a more considerate behaviour in the following points:

- Individual beekeepers living in the middle of a traditionally proven area of a breed should not establish differently bred colonies and hybridize the whole environment. This applies analogously to migrant beekeepers.

- No queens of other races are to be sold in established protected areas. Free market economy in honour, but not at any price!

- Bee houses and bee sheds that have an

obvious impact on sanctuaries and mating stations are to be removed.

It would also be highly desirable if there were national legal bases for the implementation of such protected areas. The fundamental constitutional principle of proportionality should be respected: Must it really be accepted that in a larger area with dark bees, different bred colonies are kept, hybridizing the local indigenous population *Mellifera*?

A lot has already been achieved, but there are still challenges to work on the legitimate aim of sustainable preservation of our unique Swiss breed of bees. It's not only important to start something, it is crucial to lead it to an end.

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РАСЫ ПЧЕЛ И ОХРАНЯЕМЫЕ ТЕРРИТОРИИ В ШВЕЙЦАРИИ

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АННОТАЦИЯ

В связи с растущей важностью разведения оригинальных, адаптированных к местным условиям подвидов пчел по сравнению с гибридами или искусственно введенными подвидами, создание особо охраняемых территорий для тех местных пород пчел получает дополнительную поддержку и поощрение. В этой публикации мы сообщаем о статусе темной лесной пчелы *Apis mellifera mellifera* (АММ) в Швейцарии и усилиях, прилагаемых для поддержания этой локальной расы (подвида) и экотипа.

Ключевые слова: *Apis mellifera mellifera*, подвиды, расы, темная пчела, охраняемые территории, сохранение