SICAMM 2018 conference

Mustiala, Finland

13.–15.7.2018

Organized by the Finnish Beekeepers' Association at HAMK, Häme University of Applied Sciences

SICAMM is the international association for the protection of the European dark bee

Welcome to the dark side! The SICAMM 2018 dark bee conference in Finland

This time we have the congress in the middle of the summer instead of autumn. We want to show You Finnish beekeeping, a dark bee mating yard in the archipelago, sauna by the lake and light Northern summer nights. In mid-July, between the hard work at the beginning of the season, honey harvesting and preparing the colonies for the winter, there is a while for the Finnish beekeeper to take a breath as well. We hope that You find interesting talks and enjoy your visit to Finland!

Lassi Kauko, President, Finnish Association of the Dark Bee Keepers

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ABSTRACTS:

SICAMM 2018 CONFERENCE PROGRAM:

Friday 13th July

9:00 Opening ceremony

10:00 Keynote speaker Bjørn Dahle, Norway: SMARTBEES – Sustainable management of resilient bee populations

10:45 Coffee break

11:05 Per Thunman: *SICAMM today and tomorrow*
11:25 Lassi Kauko: *Dark bees in Finland*
11:45 Lars Kirkerud: *Brown bees A. m. mellifera in Norway – present situtation*
12:05 Joseph Widdicombe: *Developing a 'strain' from a hybridised population*
12:25 Ralf Ulrich: *Current activities in the German association for breeding Apis mellifera mellifera*
12:45 Annika Michelson: *Dark bees in Estonia*

13:05 Lunch

14:00 Ingvar Arvidsson: *Dark bees in Sweden*
14:20 Beata Panasiuk: *Conservation programs of Apis mellifera mellifera bees in Poland*
14:40 Łucja Sconieczna: *Variability of morphological features of the native middle-European bee*
15:00 Dylan Elen: *The dark bee movement in North-Belgium - an update*

15:20 Coffee break

16:00 Melanie Parejo: *Honeybee conservation genomics in Switzerland and informative SNPs to estimating C-lineage introgression in A. m. mellifera*
16:20 Norman Carreck: *Where are we heading with local bees in Britain and Ireland?*

18:00 Smoke sauna and social event at Korteniemi traditional farm

Saturday 14th July

9:00 Keynote speaker Ralph Büchler, Germany: *Honey bee mating behavior drives selection on local adaptation and disease resistance*

9:45 Dorian Pritchard: *Geordie bees bite the mite*
10:00 Nils Jakob Drivdal: *Diversity – a challenge for dark bee projects*
10:20 Coffee break

10:40 Roger Patterson: *Sustainability - can we all work together?*
11:20 Małgorzata Bieńkowska: *Bee breeding activity in Poland*
11:40 Lauri Ruottinen: *Mustiala – history and education*
12:00 Risto Kuittinen: *How a measuring system can help the management of honey bee colonies*
12:20 Aimo Nurminen: *Branding the honey of dark bees*
12:40 Ole Hertz: *A report from the Greenland beekeeping project*

13:00 Lunch

14:00 Alice Pinto: *A novel SNP-based tool for estimating C-lineage introgression in the dark honey bee*

14:20 Maritta Martikkala: *Beekeeping in Finland*
14:40 Marleen Boerjan: *Natural selection of varroa tolerant Apis mellifera mellifera 'black bee' colonies in the Netherlands*
15:00 Dylan Elen: *Breeding for conservation - a new European initiative*

15:20 Coffee break

16:10 Jack Hassett: *Significant pure population of the dark European honey bee (Apis mellifera mellifera) remains in Ireland*
16:30 Keith Browne: *Investigations into wild black bees in Ireland*

18:00 Dinner with a historical theme

Sunday 15th July

9:00 Keynote speaker Per Kryger, Denmark: *Bee races in Europe, their genetic characteristics and relationships*

9:45 Padruot Fried: *The project to protect the dark bee in Switzerland, 2015-17*
10:05 Jonathan Ellis: *Introgression in native populations of Apis mellifera mellifera L in the UK: implications for conservation*

10:30 Coffee break

10:50 Jacques van Alphen: *Is natural selection alone enough for the evolution of resistance against varroa in the European honeybee?*
11:10 Anneli Salonen: *Are there* d*ifferences in honey collected by Italian and dark honey bees?*
11:30 Jussi Marin: *Goal, it´s honey!*
11:40 Helen Mooney: *SICAMM 2020 congress in Ireland*

12:00 SICAMM meeting

13:00 Lunch

Monday 16th July

Excursion: Dark bee breeding magic in the sunny archipelago

Pakinainen island has had a pure breeding operation of the dark bee since year 2000. In addition to the bees, we will take a look at the rich flora of the island.

Tuesday 17th July

Excursion: Presidential bees and flowers, Naantali old town and something sparkling

Our main attraction is the Kultaranta, which has been the summer residence of Finnish presidents since 1922. Dark bees have been kept here for 10+ years. Our second attraction is Naantali Old Town. We will also visit the Naantali Abbey and our last stop will be the Brinkhall Sparkling Factory & Shop.

Wednesday 18th July

Open house at Hunajayhtymä, the largest honey packer in Finland

SMARTBEES – Sustainable managament of resilient bee populations

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SmartBees is a collaborative research project between 16 partners from universities, research institutions and companies across Europe. With funding from the European Union seventh framework programme, we are working on solutions to prevent colony losses caused by the Varroa mite and viruses and to counteract the systematic replacement of many native European bees with only two specific races which is observed over the last years. The team encompasses geneticists, molecular biologists, parasitologists, virologists, immunologists, communication specialists, mathematicians, and bee specialists. Some main results from the project will be presented.

SICAMM today and tomorrow

Thunman, P.
Vice president of SICAMM and beekeeper, Sweden; e-mail: pgthunman@hotmail.com

SICAMM was founded in 1995 at Flekkefjord, Norway by beekeepers and scientists from Austria, Denmark, Germany, Norway, Poland, Sweden, Switzerland and the United Kingdom, as an international association devoted to the protection of the European dark honeybee, *Apis mellifera mellifera*. The first president was Josef Stark from Sweden. After his death in 2004 Dorian Pritchard became the president. One of the objectives is to promote national and international cooperation between beekeepers, scientists, associations and institutions concerned with conservation of the dark north European honeybee *Apis mellifera mellifera*, L. One way of reaching the objectives is to organize conferences every second year. It is today a very informal organisation, no member fee and it is not registered in any country. Members are from nearly the whole Europe. All members of the board work voluntary. After this conference in Finland there will be a suggestion of how to formalize the organisation.

Dark bees in Finland

Kauko, L.
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Finland is outside the natural range of the honey bees, the bees can not survive here without management. Beekeeping started in eighteenth century with introduction of dark bees from Sweden to south western Finland after several attempts.

Other bee races were imported in the beginning of twentieth century but dark bees were predominant until sixties, when especially ligustica but even some others like caucasian queens were brought in big amounts. The breeding of italian queens was becoming quite extensive and to the end of 20th century pure melllifera bees were vanished almost totally. The project in northern Finland succeeded to find one pure enough strain kept by beekeeper Väinö Mäki. In next years the Mäki strain was maintained by artificial insemination at breeding station of beekeepers' association. Next step was when swedish Nordbi people visited project run in south western islands and made people there interested in dark bees. One of members of the group, Aimo Nurminen, started breeding bees on an island mating yard. The size of Mäki population made necessary in order to avoid inbreeding to introduce material from Sweden.

Now there are 300–400 dark bee colonies kept by about 30 beekeepers and one queen breeder with mating yard on an island in south western Finland. Another breeder will start this summer, he will have his mating yard on another island in southern Finland

Brown bees A. m. mellifera in Norway – present situtation

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Like the rest of the world, our original stock of brown bees has been depressed by importation and hybridisation of bees from abroad. There are now only about 10 percent of Norwegian bees that are considered by their keepers to be brown bees. Of these, another 10 % may have the purity and properties worth breeding on.

Brown bees in Norway seem to belong to two different stocks. One probably connects to populations in Sweden, the Baltic countries and Russia. These "forest bees" are now kept mainly in the eastern part, especially Hedmark county. The other stems from early import from the heathen of western Germany. These "heather bees" are to be found in the southern and western part of the country. They have got their reservation area in four municipalities in the south, around Flekkefjord.
The forest bees cannot be distinguished morphologically from heather bees. Their moods and behaviour, however, may be somewhat different.

Norwegian brown bees have been subject to breeding by different actors during the last century. The Norwegian Beekeepers Association has played a major part. Nevertheless, the stock of brown bees in Norway has decreased markedly over the last decades. During the years 2014–2017, the newly created "Norsk Brunbielag" or "Norwegian Association for Conservation and Breeding of Apis mellifera mellifera", NOCAMM, got foundation from The Norwegian Agriculture Agency to map the populations around the country, investigate their purity and promote breeding and use. The results, so far, are presented.

Developing a 'strain' from a hybridised population

Widdicombe, J.
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I will talk about the bees I started with and how I have been able to develop a near-native strain from them. I run 100–150 colonies in the area.

Dark bees in Estonia

Michelson, A.
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In 1930-ies F. Linnus mapped old bee trees in Estonia. They had a concentration in south-eastern Estonia but they reached through Estonia up to Virumaa region. There has not been done any investigations on dark bees in Estonia during the Soviet Union period nor during the re-independent time from 1990 to 2018. During the last 20 years I have been involved in making inventories of native breeds in Estonia and kept an eye on dark bees as well. Bees manage to survive winter time by themselves in Estonia. It is not rare to see bark bees in the nature or living in abandoned buildings or old hollow trees.

Several old bee keepers knows dark bees and have experience about them. In 2006 I got a message that there are at least 20 dark bee families left in Estonia. They collect a lot of honey in the Estonian environment, and never leave you without a yield. It is nearly impossible to keep them in beehives as they fligh out and away as well as expand outside the beehives. If one manage to expand their hives so that they get the needed space they are not impossible to keep. There are many old bee keepers

that prefer dark bees as they go out and collect honey in remote places and can protect themselves agains bears. Those who are used to dark bees have no problems with keeping them. It uses all possibilities for collecting honey. They have good winter survivar skills and are very patient.

Conservation programs of *Apis mellifera melliefra* bees in Poland

Panasiuk, B., Bieńkowska, M., Naruszewicz, W., Gerula, D. & Węgrzynowicz, P.
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Central European honey bee, *Apis mellifera mellifera* is an indigenous species inhabiting Western, Central and Northern Europe, from the north-western Alps and the Sudety Mountains to the Ural Mountains. In Poland, this bee was originally found throughout the country except for the southern part of Karpaty. In recent decades, the introduction of other bee subspecies has significantly reduced both the number of colonies with *A. m. mellifera* bees and the area that they are kept. Despite many beneficial features, especially greater resistance to diseases, better overwintering and the ability to use weak forage, Central European bees have been replaced by other subspecies, which is associated with their lower productivity and greater defensive behavior.

Currently, there are four lines of *A. m. mellifera* bees located in the north-eastern and central part of Poland: M Augustowska, M Kampinoska, M Północna and M Asta. These bees are under national programs for the protection of genetic resources in order to preserve the genotype of native bees.

Conservation breeding programs for Central European bees started in Poland in the 70s of the last century. The aim of these programs is to preserve populations by increasing the number of colonies with phenotypic traits that are typical for the line, preserving typical biological and production features (early spring development, resistance to diseases, good wintering, ability to store big amounts of pollen/bee bread, higher defensive behavior, high wax production) and reintroduction of bee queens to the apiaries in the region with only little improvement.

Conservation breeding is based on a system of leading herds – there is a leading herd for each bee line; the main objectives of leading herd are rearing and insemination of bee queens, assessment of bees' value, selection, but also promotion. Apart from the leading herds, there are also cooperating apiaries where beekeepers keep colonies in the required number for each population, transfer bee queens to the herd, assess colonies and provide breeding material if required (larvae and drones).

The number of bee colonies under conservation programs for each line in leading herds and cooperating apiaries in 2017 was: M Augustowska- 246, M Kampinoska- 94, M Północna- 230 and M Asta- 180. However the most important is protection of natural population of native bees and the number of colonies in these apiaries is: M Augustowska 785, M Kampinoska- 300 and M Asta- 550.

Variability of morphplogical features of the native middle-European bee

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The aim of the study was to evaluate the variability of morphological features of three protected lines of native middle-European bee (*Apis mellifera mellifera)* in Poland over 10 consecutive years. The morphological features of native bees indicating on breed affiliation (tongue length, cubital index), determining the size of the bee body (width of the 4th tergite and the sum of the 3rd and 4th tergite) and wings (their length and width), and their correlations have been estimated. The

evaluation of the cubital index, the width of 4th tergite and the length of the bee's tongue were also carried out with valid standards of *Apis mellifera mellifera*. Affiliation for Augustowska, Kampinoska and Północna lines to the population of native middle-European bee has been confirmed.

Statistically significant influence of *Apis mellifera mellifera* bee lines on the morphological features were found. Protected lines have demonstrated compliance with the applicable standards for native middle-European bee, and the variability of features has not been narrowed. In addition, it was found that apiary significantly influenced the bee size measured by both width of the 4th tergite and the sum of the widths of the 3rd and 4th tergite and the wing parameters (length and width) in Augustowska, Kampinoska and Północna lines. On the other hand, the comparison of the size of bees measured by the width of the 4th tergite of abdomen in our own research and from those originating from the 1960s from Poland indicates the tendency to dwarf the *Apis mellifera mellifera*.

The dark bee movement in North-Belgium, an update

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In 2015 the association "Limburgse Zwarte Bij" was founded in the Northeast of Belgium. Some beekeepers over there just wanted to keep AMM again. In the meantime, the association changed its name to "ZwarteBij.org" and has members of the whole of Flanders and the Netherlands. They started breeding activities, they started a mating station, ... A lot of things happened in just 3 years, so time for an update.

Honeybee conservation genomics in Switzerland and informative SNPs to estimating C-lineage introgression in *A. m. mellifera*

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In Switzerland, the genetic identity of the native honey bee subspecies, *Apis mellifera mellifera*, is threatened by introgression from introduced conspecifics, mostly *A. m. carnica* and Buckfast bees. To limit hybridization, different conservation efforts have been initiated and protected areas have been established. In this study, we aim to characterize the current honey bee population structure in Switzerland (and the neighboring French Alps), assess genetic diversity and admixture between different populations and to test whether a limited number of informative single nucleotide polymorphisms (SNPs) is able to accurately estimate admixture between native and introduced honeybee subspecies.

For this purpose, we sequenced whole genomes of haploid drones sampled throughout Switzerland (N=120, including 39 from 4 conservation areas) and France (N=31 from a conservatory in Savoy). Thereafter, we used model-based and network-based clustering to estimate individual ancestries and to infer fine-scale population structures.

In total we identified more than 3.374 M high-quality SNPs in our whole-genome sequence data. Based on network topology and admixture results, *A. m. mellifera* samples were clearly separated from other subspecies and clustered according to their geographical origin (Switzerland or France). Furthermore, we detected some highly admixed individuals in the conservation areas suggesting that the conservation management is still not able to entirely purge all foreign alleles and calling for

improved efforts. Nonetheless, the major part of the native *A. m. mellifera* population in Switzerland was found to be genetically pure and diverse.

Finally, we validated the accuracy of a recently developed SNP panel (including 117 SNPs) to estimate C-lineage introgression in *A. m. mellifera* against whole-genome sequence information. The SNP assay provided highly accurate admixture estimates and was subsequently compared to ancestries inferred from microsatellites currently employed in Switzerland. Furthermore, we report discrepancies between microsatellite- and SNP-based admixture proportions, which require further investigation. In conclusion, the proposed SNP panel can be applied in Switzerland as a precise and cost-effective tool to effectively monitor and manage *A. m. mellifera* conservatories and for selective breeding strategies.

Where are we heading with local bees in Britain and Ireland?

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Britain and Ireland have never had a well-established queen rearing industry, so most honey bee colonies are headed by queens of unknown origin, but this has allowed near-native bees to remain in many areas of the country. Nevertheless, a number of firms sell imported queens and a number of beekeepers champion their use. The views of a number of professional conservationists and ecologists who claim that the honey bee is alien to Britain, that honey bees have only a minor role in pollination, and compete with “wild” bees, have also been very unhelpful. A number of recent papers have, however, drawn attention to the possible disease risks associated with imported bees. The governments’ National Pollinator Strategies cover all species of insect pollinator, but may provide opportunities for promoting the conservation of honey bees. The results of the COLOSS honey bee Genotype-Environmental Interactions experiment, which showed that locally adapted strains of bee consistently tend to perform better than imported strains, provide support for the use of local bees over imported strains, and will hopefully encourage the further development of breeding groups working with locally adapted bees. The B4 Group, based in Cornwall, south west England is promoting the conservation of the dark European honey bee in a number of innovative ways, including the establishment of the UK’s first “black bee reserve”.

Honey bee mating behavior drives selection on local adaptation and disease resistance

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Honey bees show a highly complex mating behavior. They produce a huge surplus of drones in relation to the number of queens to be mated, build drone congregation areas and mate over long distances with up to 20 drones per queen, thus involving many contributing colonies from the local surroundings. As drones are haploid, they may directly express any genetic weakness, for example with regard to disease susceptibility. In fact, an experiment with 26 untreated drone colonies on the island mating station Norderney showed a high variability in the individual mating success of drones from differently infested colonies. Less infested colonies with higher mite resistance have a higher probability to transmit their genes to the next generation. Under natural conditions, selection will favor locally adapted populations with high disease resistance.

To utilize such natural selection effects, the breeder association AGT (Arbeitsgemeinschaft Toleranzzucht, www.toleranzzucht.de) manages some mating stations with drone colonies under

high infestation pressure. Instead of a common chemical winter treatment, a biotechnical brood interruption treatment during summer is used to limit the mite infestation level below certain thresholds. Based on the positive experience from several seasons we suggest such a nature like control strategy for general beekeeping to support the development and spread of resistant stock.

Geordie bees bite the mite

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"Geordie bees" are *A. m. mellifera* adapted to the Newcastle area of North-East England and they seem to be almost completely resistant to varroa. I have not treated mine for 16 years, but of several hundred colonies, have lost only 3 or 4 to the mite. This report describes one colony with many hybrid workers that developed a heavy infestation, but overcame it within several weeks, with many mutilated mites falling to the floor as if they had been bitten. The proportion of damaged mites was highest during the post-swarming capping interval, but also increased steadily as the brood nest later expanded and by the end of summer total mite drop had decreased to a negligible level. Altogether up to 9 strategies or occasions are indicated when mite numbers may be reduced by the bees, notably in relation to brood breaks.

It is suggested that inter-bee grooming is typically expressed at unusually high levels in north-British *A. m. mellifera* and that this is the basis of their resistance to varroa. In this colony, with many hybrid workers, excessive allogrooming arose only after mite numbers had greatly exceeded supposedly lethal levels: in late May total mite fall was 23 per day. Literature reports ascribe grooming damage to what could be called "emergency bees" that specialise in defensive allogrooming, which may have appeared in this case as a consequence of the stress of massive mite assault. It is suggested that emergency bees may develop as a result of disruption in juvenile hormone production in early worker development.

Diversity – a challenge for dark bee projects

Drivdal, N.J.
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Strategies in breeding efforts are vital, for the expected breeding progress and future breeding programmes, but not at least for bees ability to adapt to changes in environment and climate. It is urgent to spread knowledge about the vital role of genetic diversity.

- diversity of genes
- diversity of project strategies
- diversity of beekeeping
- diversity of breeding methodes

Even though we have been discussing those issues from the first SICAMM conference on, I feel we are in need of continuing this. First of all, because there are still a lack of knowledge of the bees natural breeding dynamics and adaptation to environment, and also a lack of understanding the bees natural breeding dynamics and genetics. The field of biology genetics has still many challenges, as an example Dr. Christian Brochmann are organising projects to survey how inbreeding may influence the creation of new species. We need to find a way to express ourselves clearly, so that scientists and beekeepers may interact in a constructive manner. First of all we need to accept that we have different conditiones, traditions and challenges, and have choosen different methods and structures.

Sadly there has often been a lack of understanding in our discussions. Among the politicians and the public, we often get the inpression that their motivations are solely maximum profit as fast as possible. I am convinced that all in the SICAMM community share quite opposite values.

Sustainability: can we all work together?

Patterson, R.
Beekeeper and author, UK; e-mail: roger-patterson@btconnect.com

This presentation takes the main points from one I gave to a recent English conference "Sustainable Beekeeping: A future without Imports", but with a slightly different message. Although the U.K. is made up of islands, so a different situation than much of Europe, there are probably many other similarities that will allow us to promote dark bees together.

Standard beekeeping information is not often based on dark European bees, but those of Mediterranean origin, with teachers and writers simply "cutting and pasting" from elsewhere. Beekeepers believe what they are initially told, so are unlikely to change without persuasion. We must change culture if we want to succeed.

I will raise some issues that probably affect most of us, wherever we come from, with some suggested solutions. I believe that education is needed, but it needs organising throughout the dark bee range, not in isolation. In my view SICAMM is well placed to manage this so we are all working together, not duplicating or conflicting with what others are doing.

Bee breeding activity in Poland

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Honey bee breeding in Poland has been regulated by governmental law for four honey bee sub-species: *A. m. mellifera* (commonly called the “national”, “local” or “black” bee); *A. m. carnica*, *A. m. caucasica* and *A.m ligustica* over 40 years ago. The territory of Poland is a natural habitat for *A. m. mellifera* bees. Polish beekeepers started to import Caucasian queens from the former USSR countries and Carniolan queens, mainly from Danubian countries and Austria, during the last century. Uncontrolled importation caused hybridization of local bee stocks. The imported sub-species of bees, especially the Carniolan bees, began to dominate.

In Poland exist three types of breeding programs. One is for genetic improvement of the sub-species, cross-breeding programs where the breeders work mostly on breeding productive hybrids from two sub-species or from different breeding lines within a sub-species and the national Black Bee Genetic Resources Conservation Program for four lines of *Apis mellifera mellifera*: Asta, Pólnocna (North Bee), Kampinoska and Augustowska. The selection of breeding material is conducted in breeding apiaries, which realize breeding programs on double recording system: stationary recording in breeding apiaries and field recording of various cross breeds in selected commercial apiaries. Except of production traits like honey yield and spring development, there are also biological traits evaluated: swarming, wintering, gentleness, hygienic behavior, varroa infestation and in some apiaries SMR, that directly influence the production and make the apiary management easier.

Over 95 % of breeding apiaries in Poland use instrumental insemination to produce breeding queens and also queens for commercial colonies. Instrumental insemination with semen of selected breeds and isolated drones guarantees pure mating and selection. In Poland instrumental insemination of

bee queens is used not only for breeding purpose but also on large scale for common beekeepers, and scores about 30,000 bee queens yearly (from 20,000 to 80,000 depending the year).
Totally in Poland beekeepers produce 282 256 queens, but registered breeders produce only 68 % of queens (190 575). Unregistered producers sell 37 130 Buckfast and 54 551 *A.m carnica* queens, that is about 32 %.

Table. Production of honey bee queens in registered breeding apiaries in Poland.

	Total produced	Virgin queens	Naturally mated	Instrumentally inseminated
Apis mellifera carnica	180 363	122 272	37866	20 225
Apis mellifera caucasica	7 378	3946	1266	2 166
Apis mellifera mellifera	2 115	1031	318	766
Apis mellifera ligustica	719	462	238	19
Total	190 575	127 711	39 688	23 176

How a measuring system can help the management of honey bee colonies

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The life and welfare of honey bee colonies depends mainly on temperature and vegetation. Here in Finland honey bee colonies are in the northern boundary of European beekeeping and thus it is important to exploit as good as possible the short summer of Finland.

BeeBienen Oy has developed measuring systems for honey bee colonies since 2007 and in 2015–2016 one such a system was installed in a hive of Aimo Nurminen's beeyard in Masku in southwestern Finland. This colony was a black bee colony and the queen was born in 2014.

The system consists of a CPU, sensors, scale and modem. Data is transmitted several times a day to a server, where it is available for the web service users. The system measures weight of the hive, temperature in- and outside of the hive as well as air relative moisture and lightness. The frequency of the measurements ranges from 5 minutes during the day to 30 minutes during the night.

The most important information can be obtained from the hourly, daily, weekly and monthly changes of the hive weight. When this information is compared with the temperature, humidity and lightness measurements, a lot of useful information on the life of the colony as well as on the importance of the honey plants can be obtained. Below are listed some results of the measurements from 2015–2016.

- The honey yield season started on 15.5. and ended on 16.7., spring yield period was 15.5.–1.6., yieldless period 2.6.-15.6., main yield period 16.6-14.7.2016.
- Maximum daily yield of nectar was 5 kg, of which the net honey yield was 4 kg.
- Queen started egg-laying on 27.4., and the last bees were born on 14.9.2016.
- Honey yield was 65 kg, which was the net increase of the weight in summer.
- Average monthly food consumption from 1.10.–31.12.2015 was 0,75 kg.

The calendar of flowering periods of the important honey plants is the basic information for effective use of measuring system. In Finland these are willow, lingonberry, raspberry, clover, and some cultivated plants. In Masku the honey yield season is long due to the cultivated oilseeds, which flower usually late July. When flowering information is combined with the weight increase, it is possible to see how much nectar flowers of the area can produce. Daily air temperature and

humidity can be compared with daily nectar yield. This helps to understand the circumstances where flowers can produce nectar. Weather forecasts can effectively be used in planning the management of bee colonies, if the beekeeper knows the basic facts concerning honey plants.

Branding the honey of dak bees

Nurminen, A. & Haataja-Nurminen, R.
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Tammirauma´s Honey farm is situated in the town of Naantali, South-Western Finland, in the heart of the archipelago. Our main focus is on producing a high-class honey, as well as breeding and conserving the Nordic bee subspecies. We also offer our bees to local growers for pollination purposes. We have been keeping bees since 1985 and specialised in dark bees since 2000.

A big challenge for the protection of the Nordic bee in Finland is primarily a lack of awareness of the breed – and especially its endangered situation. Our older beekeepers remember well the mixed dark bees and their aggressive nature, but for continued conservation of the original Nordic bee it is essential to recruit new beekeepers and breeders to the fold – and equally important to find new cooperating partners who will carry our knowledge of the bees into the future.

For a great deal of time we were faced with a dilemma: what could we do personally to help generate increased interest in the protection of Nordic black bees. Finally, we decided upon making our own, private-label, dark bee honey. A small leaflet containing the background story of dark bees became an integral part of the product. We launched our dark bee honey at a major food fair in 2015 – one of the main attractions on our stand being an observation hive containing live, black bees.

We have since found many important cooperating partners, who are equally interested in working towards the protection of black bees. For instance, Naantali Tourism Office distributes our honey, with its leaflet containing the black bee story, and tells visitors about the important and special work being done in the Naantali Archipelago. Our black bee honey is a great gift for nature lovers and this small jar is particularly popular as e.g. a Christmas gift or a spring gift from pupil to teacher.

Our honey – and the story of Nordic black bees that make it – has helped generate increased interest in the conservation work. Many new beekeepers have become inspired to take up the breed and order black queens. Our dark bee honey is not just a honey brand, it spreads the word about this threatened bee subspecies and the work being undertaken to protect it. The honey has generated a very positive image for this work and become an excellent broadcaster of our message, as well. Many of our customers say: "Thank you, I will buy the honey of the Black Bee - I think it's the best."

A report from the Greenland beekeeping project

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In 1998 started a project to investigate if it was posssible to create a gene reserve for Danish Black honeybees. In that time the Black bees in Denmark were only left in the small island of Læsøe. There they were threatened by mixing with other races of honeybees.

In Greenland no other honeybees existed, and the project should investigate if it was possible to keep bees and to create an interest among the Greenlandic sheep farmers for beekeeping. 20 colonies of bees were moved from Læsø to South Greenland and training workshops were held. Bees and

equipment were given free to the local participants. The three years project was paid by The Velux foundation.

It has not yet succeeded in creating a sufficient population of bees in Greenland – the goal was 200 colonies. Last year the beekeepers wanted to create 50 new colonies, but because of a very bad summer, only 17 colonies were ready for the winter. A visit in South Greenland in July this summer will collect information about the present situation and describe it in the SICAMM Workshop.

A novel SNP-based tool for estimating C-lineage introgression in the dark honey bee (*Apis mellifera mellifera*)

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The natural distribution of the honeybee (*Apis mellifera* L.) has been changed by humans in recent decades to such an extent that the formerly widest-spread European subspecies, *Apis mellifera mellifera*, is threatened by extinction through introgression from highly divergent commercial strains in large tracts of its range. Conservation efforts for *A. m. mellifera* are underway in multiple European countries requiring reliable and cost-efficient molecular tools to identify purebred colonies.

Here, we developed four ancestry-informative SNP assays for high sample throughput genotyping using the iPLEX Mass Array system. Our customized assays were tested on DNA from individual and pooled, haploid and diploid honeybee samples extracted from different tissues using a diverse range of protocols.

The assays had a high genotyping success rate and yielded accurate genotypes. Performance assessed against whole-genome data showed that individual assays behaved well, although the most accurate introgression estimates were obtained for the four assays combined (117 SNPs). The best compromise between accuracy and genotyping costs was achieved when combining two assays (62 SNPs). We provide a ready-to-use cost-effective tool for accurate molecular identification and estimation of introgression levels to more effectively monitor and manage *A. m. mellifera* conservatories.

Natural selection of varroa tolerant *Apis mellifera mellifera* 'black bee' colonies in the Netherlands

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Since 2001 volunteer researchers participating in 'De Duurzame Bij' have been active in the selection program 'varroa tolerant *Apis mellifera* honey bee colonies' of De Duurzame Bij. Leading in our approach was and still is, the idea that we needed to find a balanced host-parasite relationship in our *Apis mellifera* colonies comparable to *Apis cerana* colonies.

In *Apis mellifera cerana* colonies an essential part of the varroa tolerance strategy is the fact that *varroa destructor* reproduction is suppressed in worker brood and mainly reproduce in drone brood. However in European *Apis mellifera* colonies varroa mites reproduce in worker as well as in drone brood cells although a reduced mite reproduction has been shown in non-treated adapted colonies resulting in a reduced growth of the mite population.

In 2007 Le Conte et al. published results from honey bee colonies surviving *Varroa destructor* (Varroa Surviving Bees (VSB)) for more than 11 years without treatment. It was shown that VSB colonies adapted and developed mechanism to suppress the growth of the *varroa destructor* population. In a review on natural *Varroa* mite-surviving *Apis mellifera* honeybee populations Locke (2016) summarized strategies that reduce the varroa mite population in natural surviving colonies. Among these strategies the opening and removal of in-mature pupae from infested worker brood cells (VSH) resulting in reduced mite reproduction seem to be the most effective.

Since 2010 the beekeepers of 'De Duurzame Bij' do not treat any of the about 70 colonies used in their research. In 2010 the genetic background of the colonies varied from *A.m.primorsky, A.m. carnica,* a few Buckfast hybrids to general hybrids from random non-selected home mated queens. In 2018 the DDB colonies consists for 50-60% of *A.m.mellifera colonies* headed by queens from the island of Texel and mated with "Texel' drone on mating station Neeltje Jans. All queens and drones selected for queen raising were tested for low growth of the mite population in spring and a few also in the autumn. In addition, wing measurements are done as a morphological marker for 'black bees'.

Keeping in mind the above mentioned results on suppressed growth of the mite population in natural surviving honey bee colonies the researchers of the 'De Duurzame Bij' developed a DDB-protocol to follow the growth of the mite population during the different seasons in a year.
In the DDB-protocol the growth of mite population is reflected in the cumulative number of varroa mites felt through the screen on the bottom board. In addition, when screening the bottom boards for fallen mites we observe parameters of colony behaviour like diversity of pollen collected but more important is the observation of white antennae on the boards. If we see antennae, we not only count the number of mites but also the number white antennae, which are a sign that the workers in the colonies open infested brood cells and remove the pupae. We conclude that this behaviour is part of the hygienic behaviour of the colony as an adaptation of the colony to fight the varroa mites.

From 2010 the daily mite drop of 20-40 colonies/ year was counted and data were plotted as cumulative growth curves. In spring the cumulative growth curves were either linear, exponential or intermediate. The cumulative curve from autumn counting showed an almost logistic pattern with a max number of mites in October-November. A model based on a differential equation, is numerically solved, and fitted on the measured cumulative mite drop values using Excel Solver. This approach results in a growth factor r and two factors a en b representing the form of the curve. For example, if a=0 the growth of mite-drop is linear and if a=1 the growth of the mite is exponential. If a=1 and b=1 the cumulative growth of mite drop is logistic.

Breeding for conservation, a new European initiative

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After the three year during pan-European Genotype x Environment Interaction experiment (2009 - 2012) which was set up by different European COLOSS member institutions, it became clear that there is no such thing as "the best bee race". Instead, the results showed that local bees always have the best chances to survive. In order to make local bees more popular among beekeepers, a bunch of bee research institutions gathered in the EU funded SMARTBEES project. One of the goals of this project was to establish breeding programs for every European subspecies so that, eventually, there would be no reason anymore for beekeepers to import non-native bees. The SMARTBEES project will end in October 2018 and first breeding results are achieved, but there is still a long way to go and it is important to join forces in this. Therefore, it is time for a European network for breeding and conservation.

Significant pure population of the dark European honey bee (*Apis mellifera mellifera*) remains in Ireland

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The natural range of the dark European honeybee, *Apis mellifera mellifera* has been significantly reduced in recent years as a result of importation and replacement of queens with those of other *Apis* subspecies. Previous studies have indicated that a substantial amount of *A. m. mellifera* populations throughout Europe are heavily hybridized but that pockets of pure populations do still exist and need to be protected as this subspecies is a highly valuable gene pool and is of considerable conservational interest. Small numbers of Irish bees have been included in previous studies but scientific information is limited and questions remain about the genetic diversity of bees in Ireland and the extent of introgression into apparent black bees from introduced races and hybrids.

The objective of this study was to investigate the genetic composition of the *A. m. mellifera* population on the island of Ireland with both nuclear (microsatellites) and mitochondrial markers. Molecular data was generated from 412 bees sampled from 24 counties across the island. Mitochondrial data identified 34 different haplotypes with 63% of bees having sequences identical to three European haplotypes but all other haplotypes being novel. Population structure analysis using microsatellite markers indicates that the Irish population is genetically diverse and that 97.8% of sampled bees were determined to be pure *A. m. mellifera*. Results from cluster analysis using a Bayesian model approach, and the presence of novel alleles, shows evidence of distinctiveness within the Irish population.

Investigations into wild black bees in Ireland

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Wild honey bee colonies of local ecotype surviving without human intervention are likely to form a valuable genetic resource for the sustainability of managed apiaries as well conservation of threatened subspecies. In Ireland, following the Isle of Wight disease (which devastated honey bee colonies at the beginning of the 20th century) and subsequent hybridisation with C lineage bees, there has been a general acceptance by government agencies, scientists, and many beekeepers that no *Apis mellifera mellifera* (Amm) colonies persisted in the wild.

However, sporadic reports were received in 2014/2015 of the existence of 'wild' honey bee colonies. Given that Ireland's human population is low in density with only 32 persons per square km in some rural areas and only approximately 3000 registered beekeepers, many of whom are reported to not favour purchasing imported bees, it is feasible that honeybees could have naturally adapted to introduced pathogens such as *Varroa destructor.* To investigate the presence of wild native honeybees we initiated an investigation into any unmanaged honey bee colonies and in 2016 we launched a nationwide request through press and social media seeking locations of unmanaged colonies which realised over 170 replies in a short time period.

We found that unmanaged colonies have utilised a wide variety of both natural and artificial cavities and survived unaided for periods reported to be from three to over 20 years. Given the difficulty in confirming the authenticity of these timings the survival of individual colonies has been monitored

since 2016. Sixty-two of the colonies were sampled and a combined approach using mitochondrial, microsatellite and single nucleotide polymorphism (SNP) genotyping has shown the majority to be pure *Apis mellifera mellifera* and forming an integral part of the previously described pure Amm population in Ireland. This data, along with survival records for >2 years, and details of surrounding habitat and health of the unmanaged colonies, will be presented.

Results and conclusions of the project to protect the Dark Bee in Switzerland, 2015-17

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The number of bee colonies in Switzerland is estimated to be around 170'000. A very large amount are hybrids between Apis mellifera mellifera (Amm) and Apis mellifera carnica (Amc). About 10% are estimated to be pure Amm. On the average, 5000 pure bread Amm queens are produced every year. The pressure of suppression of Amm is high. In order to support the efforts to maintain the local Amm for future generations, the Swiss Dark Bee Association together with apisuisse initiated a project in 2014 in four areas with mainly Amm dominance, namely Glarus, Val Müstair, Melchtal and Diemtigtal. The aim was to investigate the structure of the local bee population and to substitute identified hybrids by pure bread lines/queens, as a basis for the establishment of protection sites. The project was financially supported by the Swiss Federal Ministry of Agriculture with Euro 250'000.

From 2015-17, 447 visual controls were carried out, 364 DNA hybrid tests were executed, 293 hybrid queens were replaced by pure ones and locally 625 queens were produced. After 3 years, the introgression varied among the 4 locations between 0.3% in Glarus and 61.5% in Diemtigtal. Only in one location, Glarus, the envisaged goal of very low or no hybridization could be reached. In Val Müstair and Diemtigtal one and two beekeepers, respectively, refused to participate in the project. In Melchtal, the third location, a beekeeper introduced foreign bees in the area of the mating station of the project. In summary, without participation of absolutely all beekeepers in an area, protection sites are impossible to be established. Based on the experiences gathered in the three years of the project, recommendations for the establishment of protection areas for the Dark Bee were developed. They include legal, technical and human factors.

Introgression in native populations of Apis mellifera mellifera L in the UK: implications for conservation

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Hybridisation and introgression can have negative impacts on regional biodiversity through the potential erosion of locally adapted lineages. The honey bee (*Apis mellifera* L.) occurs in twenty-seven subspecies across Europe, is an extremely economically important insect, yet threatened by multifarious impacts. Transhumance of the most commercially appealing varieties threatens native honey bee diversity by introgression and subsequent loss of locally adapted traits, or even by complete removal of some subspecies from parts of the range. We examined levels of admixture and introgression in UK honey bees suspected to be from hives of the dark European honey bee (*Apis mellifera mellifera*). Microsatellite DNA and STRUCTURE analyses revealed that the studied populations are generally admixed, and discriminant analysis of principal components shows them to be intermediate between *A. m. mellifera* and *A. m. carnica* populations. However, examining mitochondrial haplotype data (COI-COII intergenic spacer region) and nuclear DNA reveal that some hives are relatively pure (from four to fifteen hives, depending on the Q-value threshold). Genetic

diversity is relatively high in comparison with other European populations. Implications for conservation and management will be discussed.

Is natural selection alone enough for the evolution of resistance against varroa in the European honeybee?

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The invasion of *Varroa* in Europe has been instrumental in the decline and local extinction of wild black honeybees. *Varroa* has been present for 35 years now, and the question is why natural selection in Europe has not resulted in *Varroa*-resistant honeybees, despite the presence of resistance genes at low frequency. A critical review of the evidence shows that the extremely panmictic mating structure of honeybee populations together with the lack of functional expression of the resistance genes at low frequency prevents the increase of these genes by natural selection.

In honeybee populations with an already a high frequency of resistance genes when *Varroa* invaded, rapid natural selection has resulted in Varroa resistance (*i.e.* in the African subspecies *scutellata* and *capensis* and in Africanized honeybees in South America). Hence, natural selection can be effective, but only when the frequency of resistance genes has passed a certain threshold. This can be achieved by artificial selection in small closed populations at the price of undesirable inbreeding, or by artificial selection using single drone insemination. With the latter method, we hope to increase the frequency of resistance in European honeybees above the selection threshold and to create the conditions for the return of wild black honeybees populations.

Are there differences in honey collected by Italian and dark honey bees?

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There is very little information about the composition and properties of honey collected by different honey bee races. In this study we looked properties of honey samples collected from hives of black and Italian honey bees. To minimize the influence of surrounding vegetation, samples were collected from apiaries where hives of both bee race were found. The water content, electrical conductivity, antioxidant activity and amount of proline were measured, and pollen samples were prepared. Results will be presented in The SICAMM 2018 dark bee conference.

Goal, it´s honey!

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In Finnish ice hockey, perhaps the most controversial song: Honey, Honey (Hunajata, Hunajata) is performed by Erkki Liikanen. It is the official goal song of the Hockey Club TPS Turku. "GOAL! GOAL! GOAL!, It’s Honey, honey…" For more than thirty years Erkki Liikanen's "Honey, honey" song has been played in TPS home games. The words for this honey masterpiece has been made by VeePee Lehto. It is indisputably the most loved and the most hated song in Finnish ice hockey.

It is therefore natural that TPS has used the honey word in various contexts over the years. For example, the mascot is a honey bear called Jore, and at the home arena of TPS, the children's play

area is called Honey World. The best player of the game is awarded by the honey prize, voted by the fans. Even the TPS business community has their own club, which is simply called the Honey Club.

The latest honey-related TPS product is Apis mellifera mellifera, the European Dark Bee. It all started in 2017, when TPS marketing department created an ad campaign around a honey jar. At first just a poster around the city, but eventually the idea crew into creating our own honey jar. After few coincidences we got in to talks with Aimo Nurminen from Tammirauma's Honey farm and the rest is history.

Currently TPS has four bee apiaries right outside the arena (Gatorade Center). There are about 100,000 bees in the winter and about 300,000 in the summer. When it comes to the TPS uniform colors, the colors are black and white. Black being the primary color, so this makes this honeyfied collaboration even more unique and felicitous. The European dark bees are very shabby, mobile and energetic. A suiting description for a hockey club as well.

The rare honey grown in TPS's apiaries is sold at Gatorade Center's TPS Shop for €19.22 (TPS was founded in 1922). It has been a huge hit around the club supporters. Hundreds of jars sold to this day. Latest harvest (2017), the TPS honey is characterized as aromatic and strong tasting. TPS is very proud that it can take part in conserving the European Dark Bee, so may the future be strong for both teams on the ice and on the meadows.

SPONSORS (in alphabetical order)

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- Lappi-Hunaja (lappi-hunaja.fi)
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