

A Biodynamic Understanding of the Decline of the Honeybee based on Indications Given by Rudolf Steiner

By John Bach (updated December 2022)

The advent of colony collapse disorder (CCD) some fifteen years ago saw dramatic losses of colonies in North America and Europe, but this must be viewed as a new chapter in what has been a steady decline in the overall health of honeybees for at least the last forty years. This steady decline accelerated violently in the years 2006-7, when a steep rise in colony losses was reported by commercial beekeepers in Europe and North America. Losses had remained stable during the 1990s at a rate between 17-20%, but in 2006, these rates escalated dramatically, with losses in the U.S. averaging over 30%, and some large commercial operations losing almost all of their colonies. Even more worrisome for beekeepers was the way in which these losses were occurring. Traditionally, bee diseases were relatively simple to diagnose, and could be chiefly attributed to a small number of known diseases, or more recently, to mite infestations, but in 2006 a strange phenomenon appeared. Overwintered colonies, seemingly healthy in the fall, were found in the spring to be abandoned by worker bees. The queen, brood (bee larvae) and food supplies (capped honey and pollen), were left untouched, and the worker bees were nowhere to be found. These doomed hives, with no nurse bees to tend brood and the queen, quickly perished. Since then, a great deal of attention and research has been directed at solving the mystery of CCD and non-CCD increases in colony losses, with, as of 2022, no 'smoking gun' yet discovered to explain its mystery. Perhaps most disconcerting of all, is that losses have not diminished since 2006-7.

Losses from the mid-2000s to around 2015 held around 35%. This number has since continued to creep up, and over the winter of 2021-22, the Ontario Beekeepers Association reported losses of 45.2% across Canada, through a survey of beekeepers which represented almost 500,000 colonies¹. Many causal factors have been attributed to the dire plight that we now find ourselves in. The chief culprit scientists and beekeepers have blamed are disease and mite infestations, and the use of new pesticides on agricultural crops. Each of these factors has contributed to some losses some of the time, but none of them alone can explain these growing losses and the phenomenon of CCD. What many experienced beekeepers report is that, in general, bees do not seem to be as strong and vital as they once were, and that this weakness has made them more susceptible to adverse conditions, such as poor weather and disease. Penn State University has become one of the lead North American universities studying CCD and increased honeybee mortality. One of their lead researchers, Maryann Frazier, put it this way: "Something's causing the bees to be particularly weak and that then allows the mites and the viruses to do their job." Could it be that the root cause of decline in the honeybee has not yet come under the scrutiny of scientific investigation? Almost all scientific publications today attribute increased losses on the universal prevalence of varroa mite in colonies and the plethora of viruses that are carried into colonies by varroa.

In 1923, Rudolf Steiner gave a series of lectures on various aspects of the honeybee and of beekeeping (originally published under the title *Nine Lectures on Bees*²), and in those lectures, Steiner predicted that within a century, if current practices at that time did not change, the honeybee would be threatened with decimation. He was specifically referring to the method, which

¹ <https://www.ontariobee.com/inside-oba/news-and-updates/final-capa-statement-on-losses-for-2021-2022-winter#:~:text=Respondents%20collectively%20operated%20480%20983,from%2015.3%25%20to%2057.2%25.>

² https://rsarchive.org/Lectures/GA351/English/SGP1975/NinBee_index.html

had only been in widespread practice in Europe for about a decade, of artificially raising queen bees by grafting worker eggs. This essay will discuss in detail what Steiner spoke of in reference to the practice of queen grafting, and of the true nature of the honeybee, but before discussing this in detail, a brief history of bee diseases and the current scientific data on the various contributing factors to the decline of the honeybee will take place.

Perhaps the most famous of all books on beekeeping is *The ABC and XYZ of Beekeeping*, written by A.I. Root, first published in 1877³. The book was expanded extensively by his son, E.R. Root, and was revised up to the 1920s. This massive 600-page volume is still in use by beekeepers today, and covers a wide range of topics, in alphabetical order. Hundreds of different honey bee plants are discussed in the book; a full eighteen pages are taken up discussing different types of frames and frame spacing, a further seventeen pages are devoted to the evolution of the modern bee hive, while, amazingly, only about ten pages of this book discuss diseases of honeybee. Bee paralysis was, at the time, a mysterious disease, the cause of which was not clear. This disease was later found to be a viral infection (the first confirmed bee virus), and is now known as Chronic Paralysis Virus (CPV). Far and away the most serious disease that confronted the beekeeper at the beginning of the 20th century was European and American foul brood. This disease, which still occurs today, affects, as its name implies, the brood of a colony, the cappings of which have a sunken appearance. The larvae become discolored with brownish streaks, and eventually die, turning a dark brown or blackish colour. As decomposition of the larvae occurs, a distinct vinegar-sulphureous odor can be detected, hence the name 'foul-brood'. Foulbrood is a bacterial disease, with the American version (the more serious of the two) caused by a spore forming bacterium. The larvae eat the spores, thus contracting the disease.

Interestingly, the disease portion of *The ABC and XYZ of Bee Culture* was only added in the last editions (1910) of the book, with this noteworthy comment introducing the subject: "*A few years ago it was considered that bees were freer from disease than perhaps any other class of animated nature, for the reason that individual members of the colonies were so constantly giving way to the younger ones. But this has been shown to be, to a great extent, a mistake; for apparently there are at least three or four distinct diseases with which the bee-keeper has to contend.*" The process of queen grafting originated in America, and had been in widespread practice several decades before its adoption in Europe. The diseases that Root discusses were first found in America, running in parallel with the advent of artificial queen breeding. Looking back now, one hundred years since the publication of this book, it is easy to see that the honeybee is now under more stress and has to cope with far more disease than ever before. To the diseases discussed above, the honeybee of today also has to contend with a series of new diseases and, perhaps most destructive of all, the varroa mite. The diseases that infect bees today must be divided into two classes: viruses and carriers of viruses. The carriers of viruses are themselves destructive to colony health, but when they also carry viruses into bee populations, the combination can be deadly. There are two carriers of bee viruses: mites and fungi (microsporidia). Acarine (Tracheal) Mites were first discovered in the British Isles in the early 1900s, where the female mite lays eggs in the trachea of the honeybee and upon hatching, the mites feed on the hemolymph (blood) of the bee, and clog the trachea preventing the bee from breathing properly. Mature mites leave the trachea, attach themselves to one of the exterior hairs of the bee to mate and ultimately find a new host and repeat the cycle. Tracheal mite infestations, if severe, can destroy colonies.

Tracheal mites can pose a serious threat to honeybee colonies, but are not known to be carriers of viruses, as is the case with Varroa mites.

Another growing threat to honeybees today is the microsporidian known as Nosema. There are two known strains of Nosema- millefra (originally found in European honeybees,) and ceranae (originally found in Asian honeybees). Nosema lives in the intestinal tract of bees, and is believed to be an increasing danger to hive health in relation to the percentage of bees infected within a hive, although some hives with large infestations seem healthy. Nosema millefra and ceranae are related and both impair digestive processes within the intestinal tract of bees, but both also have idiosyncratic characteristics. Nosema millefra infections in bees tend to peak in spring, and then decline throughout the summer, as bees take regular cleansing flights. Nosema also causes diarrhea in bees, which can be seen as fecal staining both on the inside and outside of the hive. Over the last several years, the incidence of millefra has decreased, while ceranae has increased. Nosema ceranae was first found in the Asian honeybee (*Apis ceranae*) in 1998, and later the European honeybee (*Apis millefra*) in 2004. Nosema ceranae is now widespread throughout European honeybee populations around the world. Ceranae is more difficult to detect than millefra because fecal staining does not generally occur with a ceranae infestation. Also, while Nosema millefra infestations tend to decline during the spring, Nosema ceranae has been found to remain throughout summer, weakening bees during summer months, and into winter.

Far and away the greatest threat to honeybee populations today is the scourge of a mite known as Varroa destructor. In addition to puncturing the exoskeleton of the honeybee and feeding on its hemolymph (roughly the equivalent of blood to a bee), the Varroa mite carries within it potentially dozens of viruses that it then passes on to honeybees. The viruses themselves do not seem to have any negative effects on the mites. Varroa mite eggs are laid in brood chambers shortly before brood is capped. Typically, the mites lay several female and a single male egg in a cell. The mites reach maturity at about the same time as the bees do, but prefer drone (male) larvae, as drone eggs have a slightly longer incubation period, giving the mite more time to develop, and because drones visit other hives, mites have the opportunity to further colonize. The mites feed on the developing larvae, weakening them and infecting them with virus loads before they emerge as new bees. Upon emergence, mites accompany these newly hatched bees and soon search for hosts. Varroa mites reproduce exponentially in a hive, and lethal infestations can develop within only a month or two.

Varroa mites were first discovered in Southeast Asia in the early 1900s, where they parasitized the Asian honeybee (*Apis ceranae*). Wikipedia explains: "*The jump to A. millefra [the European honeybee of today] probably first took place in the Philippines in the early 1960s, where imported Apis millefra came into close contact with infected Apis ceranae*". The puncture wound in the bee remains open, further impairing the overall health of infected bees. One of the great endeavors of biologists today is to develop a strain of European honeybees that will be able to knock off varroa mites on other bees within the colony (known scientifically as varroa specific hygienic behaviour.) This is a characteristic that the Asian honeybee has developed over many centuries of living with the varroa mite. This effort has, unfortunately, failed for the most part. Varroa mites are now colonized in every continent in the world, and even though a great deal of research in the form of breeding has taken place over the last thirty years, efforts to eradicate varroa mite through breeding to develop varroa specific hygienic behaviour has failed. The deadly combination of the damage that the Varroa mite causes to honeybees through puncturing the exoskeleton and feeding on the honeybee, coupled with the growing number of viruses that the Varroa mite vectors into a bee colony has today reached the point where the future viability of the European honeybee is now seriously threatened. As was mentioned above, in the past there were only a few viruses

that were known to infect honeybees. There are now at least eighteen known viruses that infect honeybees, most of which are recent additions (within the last thirty years). Because many of them are new, how they affect bees and how they react with one another is still not completely understood, and is the subject of a great deal of research. The most serious of these viruses include: Acute bee paralysis virus and its cousin chronic bee paralysis virus, black wing queen virus, bee virus X, cloudy wing virus, deformed wing virus, Israeli acute paralysis virus, Kashmir bee virus, sac brood virus, and slow bee paralysis virus,

The following is a list of viruses that regularly threaten bees and are carried by the Varroa mite in British Columbia, where I live and keep bees:

- Kashmir Bee Virus (KBV) – KBV was first diagnosed in British Columbia in the early 1980s in imported honey bees from New Zealand. The diagnosis was not viewed with great concern as the pathogen didn't cause any symptoms in the honey bees. KBV was diagnosed again in 2004 following reports of unexplained losses in apparently healthy colonies. Follow-up surveys showed widespread distribution at low incidence levels.
- Israeli Acute Paralysis Virus (IAPV) – IAPV was first described by Israeli researchers in 2004. (Despite its name, IAPV is not unique to Israel). The virus is highly virulent and has commonly identified in colony losses in North America and Europe.
- Chronic Paralysis Virus (CPV) – This virus has been confirmed in British Columbia but with a very low incidence level.
- Acute Bee Paralysis Virus (ABPV)
- Deformed Wing Virus (DWV) – very wide spread
- Black Wing Queen Virus (BWQV)

The increase in colony losses in 2021-22 has been, in part, attributed to a new variant of deformed wing virus that is more virulent than its previous strain, killing bees at a much higher rate. This has brought about calls for increased vigilance in the detection and treatment varroa mite, but the treatment of varroa mite has also come under greater scrutiny. For example, the efficacy of the miticide Apivar has decreased over the last several years, as the varroa mite has developed resistance to this form of treatment. Naturally occurring treatment options using organic substances that are produced in nature are receiving increasing attention in the battle against the Varroa mite. Two of these substances, oxalic and formic acid are very effective in eradicating varroa mite, and, most interestingly, the nature of these substances was mentioned by Steiner in *Nine Lectures on Bees*. A more detailed discussion of these substances will occur later in this essay.

Apart from viruses and the Varroa mite, there are also two other areas of research that are viewed as potential culprits in the decline of the honeybee: the use of a new class of pesticides known as noenicitinoids, and electro-magnetic radiation. While pesticides and electromagnetic radiation are harmful to honeybees, they are not major contributing factors in the decline of honeybee health overall. If the main culprit in the honeybee losses was attributable to electromagnetic radiation, it would be simple to detect honey bee losses where higher levels of electromagnetic radiation was present. Urban areas and city centers have much higher levels of electromagnetic radiation due to a higher density of cellular towers, but no relationship to increased electromagnetic radiation

and honey bee losses has been demonstrated in urban and rural settings. Having said this, there is evidence that honey bees, insects in general, and birds are negatively affected by being in very close proximity to electromagnetic radiation near cell towers⁴, and electromagnetic radiation may be a contributing factor to honeybee losses in areas where radiation levels are higher. This does not, however, explain the higher losses found in all areas, regardless of electromagnetic radiation levels.

Another potential culprit in the decline of the honeybee has been the use of a new type of pesticides called neonicotinoids. These pesticides were adopted widely in agricultural settings in the 1990s, and today are the most widely applied of all pesticides. The timing of the widespread adoption of neonicotinoids and increasing colony losses run roughly parallel, and the advent of CCD has been thought by some researchers to be associated with the widespread use of neonicotinoids. The problem with this theory is that all insecticides have a negative effect on honeybees, as honeybees are, of course, insects. Neonicotinoids, as well as previous generations of widely applied pesticides, are not insect specific- they kill all insects that they come into contact with, regardless of whether the insect is considered agriculturally harmful or beneficial. Neonicotinoids damage the nervous system of insects and through this process can cause the insect affected to have impaired sensory functioning, which can cause disorientation in insects like bees that forage over wide areas and need to have the ability to navigate back to the hive. With CCD worker bees do not return to the hive, leaving only the queen and brood. It is thought that exposure to neonicotinoids impairs the honeybee's ability to navigate back to the colony after ingesting nectar infused with neonicotinoids. There are two problems with this hypothesis.

The first of these problems is that all previous generations of widely applied pesticides work on the basis of damaging an insect's nervous system. Organophosphates, the generation of pesticides used before neonicotinoids, was just as widely used in agriculture for decades, but did not cause the same symptoms of CCD over large areas and with large numbers of colonies. Organophosphates take a longer time to disperse from the soil, and have a higher toxicity than neonicotinoids. One of the main reasons for the adoption of neonicotinoids was that it was less toxic to birds, other wildlife and humans. Prior to the use of organophosphates, the main pesticide that was used around the world in agriculture was a class of pesticides known as organochlorides, which includes the infamous 'agent orange', also known as DDT which was used to deforest large areas in the Vietnam war. DDT killed all life, plants, animals and insects that it came into contact with if exposure was high enough. The organochlorides that were used by farmers in the 1960s and 70s were far more toxic than later generations of pesticides. Additionally, organochlorides are not water soluble and stay in soils for years, with the result that subsequent generations of crops grown in these soils also contained organophosphates. So, the question must be asked, 'why would a milder and less toxic pesticide from previous generations cause such widespread harm to bees?'. The European Union banned the use of most neonicotinoids in 2013, but there has not been a pronounced increase in colony survival rates because of the ban, with some countries reporting improved survival and other showing no improvement or a slight worsening of losses. If the increase in honeybee losses were mainly attributable to neonicotinoids, a pronounced positive change in honey bee losses in Europe would be expected since the ban took place. Most researchers have placed the increased losses in honeybees over the last thirty years on not one, but many variables including Varroa mite, pesticides, loss of native habitat and increased viruses carried by the Varroa mite. One area that has received almost no attention as

⁴ <https://www.beeeculture.com/electromagnetic-radiation-part-1/>

a potential contributing factor in the decline of the honeybee is the modern practice of queen breeding, which was implicated as a potential threat to honeybee health in 1923 by Rudolf Steiner.

What did Rudolf Steiner Say?

The intent of the first part of this essay was to give a brief picture of the research and discussion that has been taking place around the world in regards to the decline of the honeybee. This groundwork is important, as it sets the stage for a discussion to take place regarding what Rudolf Steiner said in his series of lectures given in 1923 on beekeeping titled *Nine Lectures on Bees*⁵.

Before getting into the details of these lectures, I would like to briefly speak about who Steiner was, not just for those who may be reading this essay who are unfamiliar with anthroposophy or the biodynamic movement, but also to correct anthroposophists who refer to Steiner as a philosopher or as a mystic. He was neither, and when we speak of Steiner in these terms, the false impression can be given to those not familiar with anthroposophy that his ideas may have been ‘thought up’ as some type of philosophical exercise, or that they were the result of some vaguely defined mystical experience. Rudolf Steiner was an Initiate. Initiates are leaders of humanity, and are given the task providing the impulses that will lead to the proper evolution of the human race. Rudolf Steiner incarnated at a particularly important time for humanity, when the new age of the archangel Michael had begun, signifying that the gates of the spiritual world, which had been closed for several thousand years, were slowly again reopening, and will continue to do so for the next millennium, retuning to humanity the vision that it had in ancient times. This will be a difficult idea for some to accept, especially for those who have had university training in the concepts of evolution and Darwinism. Academic institutions, especially those that are involved in scientific learning and research, often instill in students that any religious or spiritual beliefs are simply the fantasies of imaginations of the unenlightened who lack understanding of the ‘true’ nature of the world given by a Darwinistic approach to existence. It is not the intent of this paper to convert anyone’s belief regarding existential questions, but it is necessary to give an unvarnished account of Rudolf Steiner’s warnings of what would happen to the honeybees if they were not permitted to produce their own queens naturally, but instead had to rely on the process of queen grafting.

Steiner’s high level of clairvoyance allowed him to peer deeply into the spiritual world, where he witnessed the activity of many different types of spiritual beings. It was with this high level of clear vision and access to the spiritual world that Rudolf Steiner conveyed the true realities of the world of the honeybee. As anthroposophists know, each animal species has a group ego, where the traits of the species, which exist in the spiritual world, find their expression in each animal of that species. Every dog, for example, acts in similar ways because of the group ego of the species. Instinct is the expression of this group soul in animals, and it has its source from spiritual beings. The same can be said for elephants, sharks, spiders, etc. But when Steiner spoke of honeybees, he said the following: *‘In the initial stages of evolution, they [honeybees] were not connected with the same evolutionary chain of events that animals and humans have completed. The consciousness of a beehive is of a very high nature. Humankind will not attain the wisdom of such consciousness until the next major evolutionary stage- that of Venus which will come when the evolution of the Earth stage has finished*⁶ (p. 170). There is not a single group ego that governs the behaviour of the entire species of the honeybee, as is the case with other animal species.

⁵ https://rsarchive.org/Lectures/GA351/English/SGP1975/NinBee_index.html.

⁶ *Bees Lectures Given by Rudolf Steiner*. Anthroposophic Press 1998. This series of lectures is also available online at: https://rsarchive.org/Lectures/GA351/English/SGP1975/NinBee_index.html.

Instead, each hive has its own individual consciousness. Steiner spoke of this by saying *“The group soul of a beehive is a very high level being It is of such a high development that you might almost say it is cosmically precious.... We must view it as we would a precious child; it stands apart from lines of the normal evolutionary progress that most animals have followed (p. 176).”*

Here we are given a clear view of the true nature of the honeybee and of a honeybee colony. Each individual colony of honeybees acts with a high level of consciousness and intelligence, and behind each colony there is the working of a spiritual being that acts consciously to carry out the activities of the hive in the earthly realm. This is of immense importance, and sheds light on statements Steiner made regarding the practice of queen breeding. During these lectures, several discussions took place regarding the practice of queen breeding with a beekeeper named Muller, who was not an anthroposophist, but attended the lectures. Muller gave a lecture on beekeeping to an anthroposophical audience several weeks (10 Nov 1923) prior to the lectures given by Steiner, and in this lecture, he spoke of artificially breeding queens. Immediately following the lecture, with the audience still present, the following dialogue took place between Steiner and Muller:

Dr. Steiner: “I’ve just a few comments to make, namely in regard to the cause of continuous fertility in bees [a queen bee needs only to mate once, and then can lay fertile eggs, up to several thousand per day, for the rest of her life]. You may have already noticed from Mr. Muller’s comments that there is a problem connected to the artificial breeding of queen bees. It might be interesting to ask Mr. Muller if he thinks this method holds much promise for the future.”

Mr. Muller: “Yes, I hold this method in high regards for the most part. If you leave a colony up to its own devices, and you don’t tend it carefully, it might happen that the whole colony will deteriorate. The bad qualities will come through more and more, and whatever was good before is lost”.

Dr. Steiner: “Since when have bees been bred artificially?”

Mr. Muller: “For about twelve to fifteen years.”

Dr. Steiner: “Next time [the following lecture] we’ll investigate more thoroughly the matter of breeding of bees, and we’ll see that what proves to be an extraordinarily favourable measure upon which something is based today may appear to be good, but that a century from now all breeding of bees would cease if only artificially produced bees were used. We want to be able to see how that which is so wonderfully favourable can change in such a way that it can, in time gradually destroy whatever was positive in this procedure” (p. 177-8).

Further comments by Steiner, this time on 5 Dec 1923 further emphasizes and clarifies his meaning. Discussions had taken place between Muller and others between the lecture mentioned above and the next lecture given by Steiner. A moderator collected questions and comments for Steiner which were presented before this next lecture began. Part of that summary went as follows:

“Mr. Muller cannot comprehend that the bee colonies may die out in eighty or one hundred years. He simply cannot understand Dr. Steiner can say that, in fifty or one

hundred years, artificial breeding can cause serious problems for the bee colonies to which it has been applied” (pp 66-7).

Steiner answered as follows:

“This is what I mean when I say that from the conditions of beekeeping today, you cannot draw conclusions as to what artificial methods of beekeeping signify, or do not signify. One must think how it will be 50,60, or 100 years hence! It is quite comprehensible that someone should say today- I do not understand how this will be quite different in 50,60, or 100-years’ time- this is quite comprehensible. But it must be recognized that there is a great difference in whether one allows nature to take free course, or whether one brings artificial methods into the matter. I do not want to protest against what Herr Muller has said. It is quite correct. Today one cannot as yet confirm these things; one must wait for this. We will discuss it together in a 100 years’ time, Herr Muller, and see what your opinion is then. It is a question that cannot be decided at the moment” (p. 66-7).

The practice of artificially grafting queens was refined by Gilbert M. Doolittle in the mid-1800s, and came into widespread practice in America around the turn of the century with the publication of his book *Scientific Queen Rearing* in 1889. In this method, known as the Doolittle Method, four-day-old worker bee larvae, which were laid in horizontal hexagonal worker cells by the queen, are transferred (grafted) into vertical queen cups, which mimic the form and size of a naturally made queen cell. Sometimes a little royal jelly is placed in the cup with the larvae. These eggs are then placed in a small colony of bees in which the queen has been removed. The worker bees soon detect that the queen is not present (the queen emits a powerful pheromone) and begin at once to tend to the vertical larvae that are present in the hive and appear as queen cells. In this way, a beekeeper can produce dozens or even hundreds of queens within a short period of time, as the whole procedure, including the four-day development of the larvae is completed in the seventeen-day incubation period for a queen bee. This method has tremendous advantages for beekeepers, and is the foundation upon which modern beekeeping rests. Beekeepers don’t have to wait for the colony to make its own queens, which it does when it is preparing to divide through swarming, or when a queen is old and failing and needs to be replaced (known as supersedure). Newly grafted queens can be used to make many new colonies, by placing each of the new queens into a new hive with two or three pounds of worker bees.

Dramatic changes occurred with the advent of queen grafting. Beekeeping was historically a part of farming practice. In order to have crops pollinated, the farmer needed bees, and several colonies of bees were an intricate part of the farm. With the advent of grafting, the practice of migratory beekeeping developed. Beekeeping became a profession on its own, and operations developed in which hundreds of colonies were kept. These colonies could then be transported to farms, where they would pollinate crops and then be removed. The beekeeper charged a fee for the service, and also kept the honey. The farmer benefitted, because he could free up more land for expanding his crops, not having to worry about leaving wild spaces as nectar sources for bees when the narrow pollination window of most fruit and vegetable crops, which occurs in early spring, closes. This practice has now reached monstrous proportions, with perhaps the archetypal example of this being the 600,000-acre almond producing region of the central valley of California, where 80% of the world’s almonds are grown. Here, vast almond orchards stretch out as far as the eye can see, and very little vegetation other than almonds is permitted to grow. Honeybees are trucked in from as far away as New York State, some 4,000 kilometers away, to pollinate this massive, monocultured area. These truckloads of bees are driven all over the United States to pollinate crops- apples, cherries, sunflowers, cucumbers and citrus fruits to name but a few. Since

2006, when CCD first occurred, the per-hive pollination fee for honeybees in California has jumped from under 60 U.S. dollars per contract, to over 200 in the spring of 2013. Ironically, the greater the failure rates of overwintering colonies, the more grafting takes place. Grafting has also evolved, and queen's eggs are now 'harvested' in sterile laboratories, under microscopes. These queens are usually first artificially inseminated, again in laboratory conditions, in what is considered by many, myself included, to be a cruel practice. We have discussed diseases and parasites that have been strongly implicated in the growing levels of bee mortality, but how does this fit in with Steiner's predictions regarding the practice of breeding queens through grafting, and of the negative effects he predicted it would have on honeybees?

Of key importance in understanding the connection of grafting and the increase in bee mortality is that the hive itself, as quoted above, is connected with a conscious, spiritual being, of whom the honeybee colony is an earthly reflection. It is in this conscious activity that the laying of eggs by the queen, including eggs intended to be queens, must be understood. When a queen lays an egg as a queen, it is consciously meant to be a queen, and a worker egg is consciously laid as a worker by the being of the hive, through the activity of the queen. This is of the highest importance. When eggs laid as workers are then grafted into queen cells, these eggs

become queens, but were intentionally laid to be workers by the queen. They become inferior, weak queens that carry this weakness into their progeny- worker bees and drones. In nature, it sometimes happens that bees will turn worker eggs into queens, but Steiner speaks of this as an aberration and that it is a reflection of a weak and sick colony, or as an emergency measure if the queen dies or is lost unexpectedly. In lecture six of *Nine Lectures on Bees*, Steiner had the following conversation, again with Herr Muller:

Dr. Steiner: "You could say that the effect of what you feed them is truly very strong [queens being fed royal jelly], and you can't dispute the fact that in certain isolated cases, it is possible to turn a worker⁷ into a bee that could lay a few eggs, but a true queen it is not.

Mr. Muller: "That's what we call a pseudo queen, which is due to a diseased beehive".

Dr. Steiner: "...In the beehive there is this tendency for bees to be able to change a would-be worker into an egg laying queen by applying a special method of feeding it. This is a type of illness. The beehive is a single entity. In this case the beehive is sick....If you make a worker into a queen, then this queen is, in reality, an overly healthy worker, but the entire hive should be considered ill. This is what we would today call an emergency queen, and usually happens when the colony goes queenless unexpectedly" (pp. 114-5).

Based on Steiner's indications, this is the foundation upon which all of the problems facing beekeeping must be understood. Steiner gives the following analogy of taking all of the earth's coal and using it without any thought to future generations. *"You must then tell yourself, well, all right, we'll rob our descendants of coal. But they will be able to find another source of energy, so*

⁷ This is today called a laying worker, and occurs when a hive loses its queen and is not able to raise a new queen. Without queen pheromone in the hive, the ovaries of young worker bees become active, and these workers can then lay eggs. These worker bees have never mated, and an unmated egg always becomes a male bee (drone). A hive with a laying worker is a doomed hive and soon perishes.

they won't need the coal. In the same way, you could, of course, talk about the disadvantages in the artificial breeding of queens" (p. 21).

With the process of grafting queens, Steiner uses the analogy that the 'energy' that the bees will need in the future will be exhausted. What type of energy does Steiner here refer to? Those familiar with Steiner's work and with anthroposophical concepts will know that Steiner could only be referring what he called life or etheric forces. All life on earth must have an etheric sheath, or body which surrounds it and prevents it from its natural tendency to decomposition into organic matter, and eventually into minerals. When the life or etheric forces of any living thing leave, life ceases, and instead of the building and upholding etheric forces, which emanate from the sun and are life itself, the opposite forces, emanating from the earth, break down formerly living bodies back into mineral, lifeless matter. When the etheric body of the human being is weakened, for example, illness and disease inevitably set. This fact, even though not explained in these terms, is common knowledge in society today. When we are exhausted, or stressed, it is commonly known that we are much more susceptible to illness and disease, and this has been supported by a large body of scientific data. Additionally, human beings have karma, a destiny that predisposes us to illness and health. In particular, Steiner's comments on the nature of karma in human beings and infectious disease is worth visiting. In the fifth lecture of his lecture series *Manifestations of Karma*, Steiner discusses malaria and cholera in connection with the human ego. In this lecture he describes how a human being with, in the case of a weak ego constitution, may seek out the illness cholera in order to strengthen the ego, and in the case of an overly-strong ego may seek out malaria to effect balance in the ego. The chief point to be made here is that illness (in the case of malaria a parasite, and in the case of cholera a bacterium) is not blind and the result of chance, as those following evolutionally theory believe. Illness and disease also has, as does the honeybee colony, a form of consciousness that serves a purpose in the world. In the case of the animal, which cannot be said to have karma, at least on an individual level, illness acts to bring about death in the weak and unhealthy, but not as a random, unconscious action, as is thought of with the concepts of natural selection. Rather it is guided from the spiritual world with full consciousness, to keep the species strong and in a healthy balance.

With this in mind, the increase in illness and mortality in honeybees must be seen as a response to the weakened etheric forces of the species that have been brought about through human intervention in the form of the widespread practice of grafting queens. For example, someone who has contracted the AIDS virus has a compromised immune system and is open to a whole host of infectious diseases that attack the weakened patient. In the case of someone suffering from AIDS, we know that the underlying cause of the host of illnesses and infections are ultimately the result of the AIDS virus itself. If an AIDS patient dies of pneumonia, we can say that pneumonia was the ultimate cause of death in the patient, but that the root cause, the true cause of death, was the AIDS virus. In the same way, we must say of the honeybee that the root cause of illness and mortality in honeybees is not in the host of viral and other pathogens that are infecting bees, but that this root cause must be sought in the practice of grafting queens, and the dramatic increase of disease and mortality are but reflections of this root cause. The words of Steiner are clear, and as this essay has attempted to demonstrate that the dramatic increase in honeybee mortality must be considered, at root, as being caused by queen grafting.

Historical records of honeybee losses have not been accurately kept, but the general consensus, at least in the North America and Europe, is that average losses prior to 2006 were in the range of 10-15%, and that since 2006 those numbers have escalated. As has been shown above, accompanying these losses has been a large increase in the number of pathogens that are now infecting honeybees. The most serious of these are newcomers and should be viewed as

indicating a point of etheric exhaustion in the honeybee. Kashmir Bee Virus was first found in North America in the 1980s, Varroa first became a problem in the 1990s, in conjunction with the discovery of deformed wing virus (DWV). Nosema ceranae became widespread in 2004, and Israeli acute paralysis virus was first seen in that same year. We are now at a point where losses, if this trend continues, will reach truly catastrophic levels. Perhaps most disconcerting of all is that there is, as has been mentioned, little scientific work currently being conducted looking at the practice of queen breeding as being the root cause of honey bee weakness. With no real understanding of the problem, we must be prepared for much higher honeybee losses to occur in the western world in the very near future, I believe before the current decade has passed. Interestingly, there have been studies that show that some areas seem to be mysteriously less affected from high overwintering colony losses and CCD. One study in 2012 looked at beekeeping in Uruguay, where there are over 400,000 hives, and reported that significant losses beyond historical norms had not occurred, even though varroa mite, nosema ceranae, DWV, and other pathogens had been detected⁸. I suspect that in these areas, there are still vestiges where old ways of beekeeping exist, and where bees are allowed to produce their own queens through swarming and superseding.

As has been stated above, if Steiner's indications are correct, much larger and catastrophic losses of honeybee colonies are inevitable, and based on the acceleration of bee mortality, and also of new pathogens that are infecting honeybees, these crippling losses will be occurring in the near future. This will mean that the costs of many of the groceries pollinated by honeybees in commercial agriculture will become much more expensive in the western world. Fruit, melon, squash and cucurbit crops in particular, which cannot be produced at all without pollination, are most at risk. It is with this in mind that the anthroposophist, and in particular, the biodynamic beekeeper must understand their important role in this developing crisis. There are many other problems today in society that are a reflection of our collective lack of morality and understanding of the true spiritual nature of the world. Global warming, corporate greed, never ending conflict, poisoning of the oceans, loss of species, and world poverty and hunger are all signs of the turbulent times that we now live in. To this we must also add the plight of the honeybee as being a reflection of the poor state of affairs in which the human being now stands. In all of these events the beings of the spiritual world gaze sternly at the human race, waiting for us to correct the problems of the times in the way in which they must be addressed- with a true understanding of the world. The spiritual world, speaking through Rudolf Steiner, has given us the solution to the crisis of the honeybee almost a full century before it has reached its crisis point. In 1919, at the close of World War 1, Rudolf Steiner foresaw a real opportunity for true and spiritual social change to take place. In his book *The Social Future*⁹, Steiner gave the framework through which a new social order could be formed out of the ashes of a decimated Europe, which would have provided for the advancement and spiritualization of Western culture to take place. This opportunity was lost, and through it, an opportunity of bringing an anthroposophical understanding of the world, essential to the proper evolution of humanity, was also lost. Such an opportunity has now again been placed before the world, in which the solution to the problem of the honeybee can only be understood in its true light through an anthroposophical understanding of the nature of the honeybee and the world.

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https://www.researchgate.net/publication/286327976_Why_massive_honeybee_colony_losses_do_not_occur_in_Uruguay

⁹ https://rsarchive.org/Lectures/GA332a/English/AP1945/SocFut_index.html

Practical Solutions

The most important measure that must take place in order for honeybees to again become healthy is for bees to be allowed to create their own queens. Far and away the best way for this to happen is for bees to be given the opportunity to follow their natural inclination to create queen cells and to swarm. The beekeeper, must, above all, allow bees to produce queen cells, and if possible, to allow bees to swarm. A healthy queen in a healthy colony will often produce many queen cells, all of which can be used to create new colonies through making splits. In this type of propagation, which I would call natural division, one frame with queen cells is placed in a five- frame nucleus (nuc) hive, with at least one frame of capped honey, one frame of pollen, and one additional frame of brood (queen cells are laid in frames of brood). The rest of the nuc can then be filled with empty drawn frames and/or empty foundation frames, as needed. There is also the possibility of carefully cutting queen cells from frames where there is more than one queen cell, and then gently pressing them into existing frames of brood with no queen cells on them, and putting them in a nuc hive with at least one frame of brood, one of honey, and one frame of pollen. In this way, several new colonies can be made from one colony that is in swarm mode.

This is, of course, not the ideal. The ideal is to allow the bees to swarm at will and to unfold their natural impulse. This, however, creates a great deal more work for the beekeeper, and also decreases the number of new colonies the beekeeper can make, as some swarms will fly way before they can be retrieved. Where I live, in the mountains of British Columbia, most of the trees in the vicinity of my farm are over 30 meters in height, and catching swarms when they are high in trees is not feasible or safe, so I try to make natural splits before the colony swarms. Allowing bees to swarm is widely frowned upon in beekeeping, as it reduces honey harvests and it is widely believed that allowing the hive to create new queens may introduce undesirable traits into the colony, as was mentioned by Herr Muller in Steiner's discussions with him. This has brought about the wide spread practice of destroying queen cells in colonies as soon as they appear. Even in beginner books on beekeeping, this practice is promoted. For example, in the book *Beekeeping for Dummies*¹⁰, we read the following:

“If you spot three to four supersedure cells, you need to order a new queen, because giving the bees a new queen is far better than letting them create their own.... You don't want a swarm to happen. When a colony swarms, half the population leaves with the old queen looking for a new and more spacious home. Before that happens, the bees take steps- evidenced by the presence of swarm cells- to create a new queen. But with the girls gone, and several weeks lost while the new virgin queen gets up to speed, you're left with far fewer bees gathering nectar for you. Your harvest will only be a fraction of what it might otherwise have been” (pp. 138-141).

This attitude places the economic needs of the beekeeper ahead of the needs of the colony. We must, as beekeepers find a more natural balance between the needs of honeybees and what is best for them, and the economic needs of the beekeeper. Prior to the advent of grafting, bees were allowed to produce their own queens and to swarm. A beautiful example of allowing bees to produce their own queens and to swarm, while still maintaining an economically viable beekeeping operation can be viewed in a series of YouTube videos titled *Heathland Beekeeping* which chronicles a skep beekeeping operation in east Germany in the 1980s¹¹. This understanding of natural queen cells being of the best quality was still

¹⁰ Beekeeping for Dummies, 2nd Edition, Wiley Publishing, Inc.

¹¹ <https://youtu.be/hn5OxMXCSz8>

understood a century ago by some beekeepers and is briefly alluded to in *The ABC XYZ of Bee Culture* where A.I. Root states: “While these swarming cells will produce the very best of queens, it may not be convenient to requeen during the swarming season, and in some localities, it may be a very bad time of year for it owing to the interruption that it will make in the regular production of honey¹²” (p. 335). Here we can again witness the mistake of putting the economic needs of the beekeeper ahead of the needs of the honeybee. It is important to note that for thousands of years of human beings working with and depending on honeybees, the propagation of honeybees was based solely on allowing bees to create their own queens and to swarm. All throughout human history honeybees have flourished, until in the last one hundred years, problems have escalated dramatically. As the etheric or life forces of the bees slowly began to be degraded through the practice of grafting, more and more problems with bees have come about, with these problems accelerating greatly in the last three decades. With this in mind, it can clearly be seen that the decline of the honeybee has run in parallel with the practice of grafting queens. The goal of beekeeping in the future should not be the total eradication of the varroa mite, but should instead focus on creating strong and healthy queens that in turn produce strong and healthy worker bees that can withstand the viruses that are brought into colonies by the varroa mite.

This is not to say that control of varroa mite should not take place. Keeping varroa mite loads as low as possible through treating hives must remain a priority for beekeepers, to allow stronger and stronger queen lineages to be developed over time. If Steiner’s indications are correct, the weakened etheric forces of honey bees could be gradually built up with the introduction of strong colonies with natural queens replacing weaker, grafted queen colonies in as many areas around the world as possible. Additionally, the interest in these healthier bees would also lead to great opportunities to lay the ground work for a true, spiritual understanding of the honeybee and beekeeping. The following flow chart demonstrates the strengthening process of allowing bees to produce their own queens:



Over time, the goal would be to have long lineages, perhaps dozens of generations long, of ever stronger, natural colonies that would, in turn, have the strength to endure disease and parasites, and adverse weather in a much more robust way than the honeybees of today. The process of the weakening of the honeybee through grafting has been a relatively gradual one, taking a century to reach the point where we are today. The reverse process of building bees up again through allowing bees to create their own queens must also be viewed as a process that will take many years to accomplish. With this in mind, it is of the utmost importance that lineages of natural queens not to be broken. In order to create natural queens, the process of nature must be adhered to. Bees typically create queen cells in the spring during a heavy flow of nectar and pollen. During

¹² The ABC and XYZ of Bee Culture: A Cyclopedia of Everything Pertaining to the Care of the Honeybee. Amos Ives Root, Ernest Rob Root. Medina, Ohio, 1908

this time, the colony is bursting with worker bees creating the ideal conditions for the colony to produce queens and propagate. Creating these natural lineages of queens will be a slow process, with a realistic goal for beekeepers to produce one new generation of natural queens per year. For example, if a beekeeper is able to create a third or fourth generation natural queen, and this colony is then lost, the process must again be started from square one. This would mean a loss of three years of diligent beekeeping to create the third-generation natural queen, and another three years of natural breeding to get back to that third-generation queen- a loss of six years of work. Because of this, it is of the utmost importance for these natural queen lines to be protected from the ravages of the varroa mite and the diseases they carry. This means that varroa mite loads will have to be kept as low as possible to protect these natural lineages of queens.

There exists in some quarters of beekeeping today the notion that the best way to strengthen the honeybee today is to not give any varroa mite treatment at all to colonies, and that the colonies that survive carrying high varroa loads should then serve as breeding stock to create new queens that can withstand varroa mite loads and their accompanying virus loads. This method of beekeeping is widely known as treatment free beekeeping. This type of beekeeping has been adopted by many biodynamic beekeepers that I have spoken to, and it, in my opinion, is the greatest mistake that biodynamic beekeepers make. Many biodynamic beekeepers will argue that this type of beekeeping is totally natural and organic in nature- no chemicals are used and the honeybee colony is considered to be then allowed to follow its own natural inclination. The main problem with treatment free beekeeping is the lack of understanding that the honeybee is in a greatly weakened state, due to human interference, and does not have the ability in its weakened state to defend itself from the varroa mite and the viruses it carries. The concepts of treatment free beekeeping are borrowed from Darwin's idea of natural selection, where the fittest of the species survive and the weak are eliminated. This type of thinking is the polar opposite of a true biodynamic, spiritual understanding of the honeybee, where there is a spiritual wisdom and intent in the creation of queens by the colony and the queen herself. Steiner, I believe, had spiritual insight into the problems that would arise in the future from the varroa mite and its accompanying viruses, and he gave us an indication of how to deal with the varroa mite in his 1923 lectures, by speaking of the benefits and importance of the naturally occurring organic compounds formic and oxalic acid. These organic acids are essential to all life, and they form the building blocks upon which proteins are produced. Without these organic acids, life on earth would not exist.

Almost an entire lecture of the nine lectures in *Nine Lectures on Bees* is dedicated to the benefits and importance of oxalic and formic acid in the human body and in nature. Both honey and bee venom contain large amounts of formic acid, and ants produce enormous amounts of formic acid which is essential to their survival. Oxalic acid is produced in large quantities in thousands of plants including rhubarb, clover, spinach and many nuts. Steiner discusses the importance of both formic and oxalic acid for the human body. *"If a person produces an insufficient amount of formic acid, such an individual needs to be given a medicinal preparation, a remedy, by means of which you help to externally create enough formic acid in the body"* (p. 145). Problems that arise with memory loss are mentioned by Steiner as an indication of formic acid levels being too low. Interestingly, Steiner talks of the importance of honey consumption as we age, and with such high levels of Alzheimer's disease and other forms of dementia, conditions which have as a major component the degradation of memory, the high levels of formic acid in honey could be of great benefit for these conditions. He also speaks of the importance of oxalic acid as medicine to treat issues of the liver and intestines. In the question period following this lecture, Steiner stated the following: *"As children we promote the formative powers through drinking milk; if we need these same powers in adulthood, we must eat honey. You don't really need to eat it in large quantities, since the primary purpose is to derive these specific powers from it"* (p. 177). Not only is formic and oxalic acid important to human life, it also crucial to all life in nature as well. Venomous

insects, as is widely known, play a very important role in the life of plants, in particular plants that produce nectar and need pollination. We may think that the bee simply takes nectar from the plant and provides nothing in return, but this is not so. In lecture seven of *Nine Lectures on Bees* Steiner says the following:

“If you go out and see a bee sitting somewhere on a willow tree or on a flower, then you don’t say that the insect is simply robbing the flower. Instead, you say that while the little bee is sitting on it and obtaining nectar, the flower is having such a pleasant experience that it sends its own plant juice towards the place where the bee is sucking it out.... And in this same stream of flowing juice, while the bee is removing something from the flower, bee poison also flows in the opposite direction from the bee to the flower.... This is necessary. If this didn’t happen, and if there weren’t any bees, wasps, and ants, which continually come into contact with the world of flowers and nibble at them, then the necessary formic acid and the other necessary poisons wouldn’t flow toward these flowers, and the flowers would have to die out after a certain period of time” (p. 134).

The importance of formic and oxalic acid in both the human body and in the world of nature are mentioned here to dispel a common misconception of these substances. In addition to the false notion that treatment free beekeeping will help to create stronger honeybees through the process of natural selection, there is also the false notion with treatment free beekeepers that formic and oxalic acid are harmful to honeybees when applied as a treatment against varroa mite. The idea is that these substances upset the acidic balance in the hive, which then is harmful to the long-term viability of the colony. Additionally, it is felt that the continued use of these products will create resistance to them, and thus create stronger varroa mites. Here we must distinguish between chemical miticides created in labs, versus natural treatments like oxalic and formic acid, and thyme derived treatments, all of which occur naturally in nature. It is important to understand that nature is not blind, and that life and all processes in nature are not the result of accidental evolutionary processes, but are instead the reflection of a world of spiritual beings who guide all life on earth through a conscious wisdom which, in our current stage of evolution, has been hidden from human perception¹³. It is a fundamental pillar of biodynamic agriculture that all of the necessary treatments for disease or insect infestations (which must be viewed as deficiencies on the farm) can be found naturally within the kingdom of nature itself. The same can also be said for beekeeping. It is true that the artificial miticides are creating resistance in the varroa mite. These miticides (Checkmite and Apivar are the most widely used, and are both synthetic chemicals), must be considered as harmful to beekeeping, in that they will, over time, create resistant and stronger varroa strains. However, natural treatments, in particular oxalic and formic acid, have not lost any of their efficacy in use against the varroa mite. In *Nine Lectures on Bees*, Steiner spoke of how foulbrood, a bacterial disease of bees, was the result of too low levels of formic acid in honeybees. As has been mentioned above, the etheric or life forces of the human being are strengthened through the consumption of honey as we age, in large part due to the formic acid contained in honey. Through grafting, the etheric forces of honey bees have been weakened over time, and oxalic, and in particular, formic acid, will not hinder, but will instead help the honeybee to become stronger. Here we can make a very important connection- that a weakened etheric organism attracts disease and illness, as was mentioned above. Varroa mite

¹³ The vision into the spiritual world that the human being possessed as a natural faculty in ancient times, and of which ancient myths and religions are the reflection of, has been closed off to human perception for several thousand years in order to facilitate the true evolution of the human being. The spiritual history of humanity is discussed in great detail in many of Steiner’s books and lectures, including *Theosophy*, *Occult Science and Outline*, *Cosmic Memory*, and *Anthroposophical Leading Thoughts*, to name but a few. These titles are available on line at www.rsarchive.org.

and its accompanying viruses must be seen as a reflection of the weakened life forces of the honeybee brought about by the process of artificial queen rearing. Formic and oxalic acid are the most effective treatments used to combat varroa mite today. These treatments can be applied in a variety of ways- as pads infused with either of these acids, as vapor in the case of oxalic, or even in low doses in syrup feed to bees. The varroa mite is killed when it comes into contact with formic or oxalic acid- it can only live in an environment where the life forces of the bees are low. Formic acid is a key component that conveys etheric (life) forces into all life on earth. It is my belief that when we use these organic acids, we not only protect the honeybee from the varroa mite and its viruses, we also help in the process of restoring life forces to the colony itself.

Conclusion

Now that a clear outline of the biodynamic approach to beekeeping has been discussed, based on Rudolf Steiner's indications, a brief outline of the ideal beekeeping operation can be given. This ideal operation will above all, allow honeybees to create their own queens. This process will mean lower honey yields, but the resulting strengthening of the forces of the bees overtime will mean lower winter losses and more resilient bees. The main goal of the beekeeper should be the establishment of long lineages of natural queens, with the understanding that each generation of natural queens will be stronger than the last. These lineages, however, will still be weak when compared to the honeybees of one hundred years ago, and must be protected against the huge threat posed by the varroa mite and its viruses. This means regular treatment (three times per year, at a minimum), using applications of oxalic and formic acid. Thyme based products are also acceptable during times when none of the honey in the hive will be used for human consumption, usually early in the spring. Proper nutrition is also of paramount importance. To facilitate this, the beekeeper must first have a good regional knowledge of the nectar and pollen flows. When there are nectar or pollen dearths, the bees must be supplemented with sugar syrup¹⁴ and pollen substitute, particularly in the spring and fall. A single brood colony should weigh around 100 lbs. (33 kgs) going into the winter in the area where I have bees. Three years ago, I lost all of my colonies because a September pollen run did not occur. This run had been reliable in the previous years, but for some reason did not materialize that fall. By the time I realized there was a problem, in mid-October, it was too late. The queen was not able to raise enough healthy bees to over winter. This problem would have been alleviated if I had given the bees pollen substitute three weeks earlier. This is a good example of how missing signs of trouble within even a week or two of them occurring can have disastrous results. Diligence and regular checks of colony health are essential with the weakened honeybees that are now in need of very careful care and attention. Lastly, protection from harsh winter conditions seems to now be an essential element in areas where winters are hard. Where I live in Princeton, British Columbia, temperatures regularly drop below -20c. Three weeks ago (mid- December 2022), the temperature here reached a record low of -36c, and stayed below -25c for about a week. I have, over the last two years, experimented with indoor over wintering of colonies. This process is a work in progress, and most of my bees are still wintered outdoors, the fate of which I will not know for about another month, when the daytime highs will be above freezing at some point in February. This demonstrates the importance of the biodynamic approach to beekeeping being adopted around the world by many beekeepers. This is not a problem that will be solved by a handful of beekeepers in one or two areas in the world. If the honeybee is to have any realistic chance of avoiding truly catastrophic losses in the

¹⁴ Steiner gives a recipe for sugar syrup in *Bees*, where a small amount of chamomile and salt are added to the water and sugar syrup mixture, with the idea that the salt and chamomile make the syrup more easily digestible for bees, improving gut health over the winter when bees often cannot cleanse (defecate) for several months.

coming years, thousands of beekeepers will need to adopt biodynamic methods, with the ultimate goal of creating long lineages of natural queens.

Questions or comments are welcomed, and can be directed to my email at: jbach363@gmail.com.

Thank-you, John Bach