Varroatreatment in Denmark

Varroa destructor

The varroa-mite is now found in allmost all danish beecolonies. Varroa-destructor is a parasite - living in beecolonies - killing the colony in few years. On the next pages you will find the danish strategy fighting the varroa. This is the third in a series of pamphlets on varroa, revised according to latest findings.

The Danish Beekeepers Association and Project Group Beekeeping carry out research independently and jointly and the results of this research, together with international findings form the background for this pamphlet. The english part is translated from Danish by James Claxton.

Varroa in Denmark

VARROA IN DENMARK
Read here on the background for the Danish varroa treatment directive. By the Consultants in Denmark's Beekeeping Association

THE EXPERIENCE SO FAR
Since the varroa mite was first found on Als in 1984, great development in biological means of fighting the mite have taken place. Through the years expertise has been collected amongst researchers, consultants and beekeepers. We are the only branch of agriculture which now can say that the entire business can manage without the use of pesticides. This is in keeping with the development that society wishes for the production of foodstuffs.

THE DANISH STRATEGY
Beekeepers in Denmark have decided that honey and wax shall be produced without traces of medicine and pesticides. This is one of the most important aims behind the chosen strategy in combating the varroa mite. It is part of tradition which has characterised Danish beekeeping through generations. We have never used medicine and pesticides in treating bee disease, even though these are used extensively in other countries. It is slightly more troublesome to convert against attacks of foul brood, or to replace frames in order to contain nosema. But it works and we create pure products. Likewise it is said that it is more troublesome to combat the varroa mite through the removal of drone brood, and the use of lactic and formic acid etc. but it works, and we can continue to be proud of our products.

PESTICIDE-FREE HONEY AND WAX COMMAND HIGHER PRICES
It is important to maintain Danish honey as a pure product. It is important to keep the price of our own honey higher than the price of imported honey. There is also a large marked for pure beeswax. The cosmetics industry will not tolerate traces of pesticide in the wax they use. Danish beekeepers produce a surplus of beeswax. Good prices for wax provides for a better economy in beekeeping.

OXALIC ACID
Oxalic acid has been used by Danish beekeepers over the last few years in varroa treatment. Unfortunately, it now appears that this product does not figure in the so-called EU positive list of products that may be used in the treatment of bee disease. Therefore the product is not recognised in varroa treatment at the moment, but lactic and formic acids are. It is to be expected that oxalic acid will be put on the positive list in the near future.

REVISED PAMPHLET
This is the third in a series of pamphlets on varroa, revised according to latest findings. The Danish Beekeepers Association and Project Group Beekeeping carry out research independently and jointly and the results of this research, together with international findings form the background for this pamphlet. Development in the treatment continues strongly. It is to be expected that this edition shall be revised within the next three years (2001).

SUPPORT FOR THE STRATEGY

The Ministry for Food has passed the "Strategy for Varroa Treatment 1995 - 1999" which was produced by The Danish Beekeepers Association and The National Research Body. The strategy incorporates research, trials and advisory services to beekeepers on the necessary treatment. The research is carried out by Denmarks Agricultural Research Body and Project Group Beekeeping. They take part in diagnostic and information services. The Ministry for Food has provided financial support to the Association in order to employ consultants to carry out research and to advise on varroa treatment.

FIND OUT MORE ABOUT VARROA

Varroa - instructors: Throughout the country there are over 100 Varroa instructors. These are beekeepers who have promised to help colleagues with advise on varroa treatment. They have gained practical knowledge on varroa mites and their treatment on courses. You can meet the Varroa instructors in your local associations. A list of instructors has been sent to all associations and is to be found on the internet on udv9.osg.dk/html/vs4

CONSULTANTS

Consultants will give advise to all beekeepers on varroa treatment whether or not they are members of Denmarks Beekeeping Association.

PROJECT GROUP BEEKEEPING

Researchers from Project Group Beekeeping hold bee disease courses as well as taking part in courses and meetings in the associations. You can meet them there.

ADVISORY SERVICES TO ALL BEEKEEPERS

This pamphlet is in the Danish version sent out to all association members. It is also sent to all outlets for beekeeping equipment and to the varroa instructors. It is our hope that it reaches all beekeepers. Should you know beekeepers who have not received this pamphlet, call The Danish Beekeepers Association at (0045) 57865470, and we will be pleased to send out extra copies.

Varroa destuctor

THE VARROA MITE

The varroa mite is an organism which is optimally adapted to the honeybee

By Flemming Vejsnæs

HISTORY

The varroa mite (*Varroa jacobsoni*) comes originally from Asia. It has lived here for thousands of years as a parasite on the Asian honey bee (*Apis cerana*). Here there is a harmony between host and parasite, which results in no harm to the bee colony. These colonies live with the varroa mite.

DEFENCE MECHANISMS

The varroa mite bites into the adult bees and pupae, and proceeds to suck their blood. The varroa mite can only propagate itself on the sealed brood. The Asian bee has developed some defence mechanisms towards the varroa mite. The varroa mite only propagates itself on the drone brood, which is only produced in a limited amount and period. It has been observed that the Asian bee is capable of removing the varroa mite from itself or from brood. These and other mechanisms are not present in the European honey bee species. Here bee colonies will collapse in the space of a few years. The numbers of mite present goes out of control.

FOUND IN EUROPE

The varroa mite was first found in Europe in Bulgaria in 1971. Varroa is now found in all European countries, with the exception of Ireland (as published 1998). Varroa was first discovered in Denmark in 1984, and has today spread to all Danish bee colonies, with the single exception of Læsø. As a result of the spread of varroa great losses in bee colonies have been recorded in all areas irrespective of methods of control.

APPEARANCE

Varroa belongs to the arachnids. They have four pair of legs, as against insects three pair. They have no normal eyes. These are not necessary as they live in the darkness of a beehive. On the other hand they have so-called point eyes, which can distinguish between light and dark. They have many fine touch and smell senses on their front legs. The mite has an oval form and can at first glance resemble linseed. They are light brown at an early stage, and dark brown when mature. A mature female measures 1.5 - 1.7 mm. The males are smaller in size and lighter in colour, and are only to be found in sealed cells. They die when the bee crawls out of the sealed cell.

LIFE

The varroa mite can only propagate on brood, sealed in their cells. A female varroa mite stays on the house bees for 5 - 6 days. Thereafter she moves into the worker cells, which are about to be sealed. She moves into these cells from about 15 hours before they are to be sealed, and into the drone cells about 50 hours before sealing. Here she enters and lays up to seven eggs within the space of 36 hours. The first egg develop into a male mite, while the remainder develop into females. Mating goes on in the sealed cell and is a race against the period of sealing: only mated females survive. Males and unmated females die when the bees crawl out of the sealed cells. Therefore only an average of 1.6 mated females emerge from a worker cell (the period of sealing being ca. 12 days) while about 3 mated females come from a drone cell (the period of sealing here being 14 days). A varroa female lives normally for only one generation (on average 1.6) but in laboratory conditions they have lived for up to 7 generations.

THE SPEED OF DEVELOPMENT

Attempts to set up rules for calculating the rate of development of the varroa mite have been tried. We know today that these rules vary a great deal in practice.

Mite development

- Numbers double per month in the egg laying period
- A hundred fold increase per season
- A ten fold increase from year to year
- 50 - 90% die in winterThis means that if a bee colony started with a single mite in year 1, the colony would collapse within the next three years, with a mite population of between 5000 and 10,000 mites.

REINVASION

The greatest problem in combating the varroa mite is that our bees fly freely about with a large action radius. This means that healthy bee colonies can rob and destroy families that have been hard hit by mite attack in a very short time. What happens here is that the mites simply jump onto the invading robber - and healthy bees - or that the bees being robbed fly back with their mites to the new bee hives. Badly damaged bees also lose their ability to orientate. This situation can result in the reinvasion of a colony in the summer period, with up to several thousand mites. Reinvasion is a problem especially in areas where treatment has not been extensive enough. This is the main reason why varroa treatment must be supplemented by a late treatment as this reinvasion can continue all the way into the month of October.

COLLAPSE

Earlier it was reckoned that a damage threshold of 12,000 - 20,000 mites were needed before the collapse of a colony. However, over the latter years it has been shown that the damage threshold lies significantly lower, closer to 5,000 mites. This is due to the presence of opportunistic diseases which follow in the wake of varroa damage, in the form of virus (See below).

TOLERANT BEE STRAINS

The Asian Bee is varroa tolerant. It has developed several defence mechanisms towards the varroa mite. Much research has been carried out in an attempt to develop a resistant European Bee. As yet unsuccessfully. One can observe that in the various breeding programmes carried out over the world, some bee strains tackle varroa better than others. However, a tolerance equal to the Asian Bee is yet wishful thinking, and lies far into the future.

Varroa treatment in Denmark

VARROA TREATMENT IN DENMARK

- an outline of the National Startegy

By Henrik Hansen & Camilla J. Brødsgaard Danmarks Jordbrugs-Forskning, Projektgruppe Biavl

The varroa mite, together with attacks of virus are the cause of varroa disease. The Danish strategy for combating the virus is built on a need based strategy without the use of pesticides. Treatment is based on a combination of technical beekeeping and physical methods .Furthermore, organic acids which occur naturally in honey are used and do not give problems of residues. Experience has shown that an effective treatment can be carried out using this strategy, and it can be combined with an economically viable honey production. At the same time beekeeping products can be kept free from problematic traces of pesticides. If an effective treatment against the varroa mite is not carried out the colonies will die due to virus attacks.

VIRUS

In recent years in Denmark, and throughout the rest of Europe, there have been great problems with secondary virus infections in connection with Varroa attack. These attacks have led to the deaths of many bee colonies. At the present moment we have diagnosed the following conditions in Denmark : Acute Paralysis Virus (APV) , Deformed Wing Virus (DWV) and Sack Brood Virus (SBV). In Sweden Unclear Wing Virus (CWV) (Nordström, 1997) and in England Slow Paralysis Virus (SPV) (Ball, 1997) have been found in connection with varroa attacks.

In Denmark problems with DWV and APV have been registered . These virus attacks cannot be treated. However outbreaks can be prevented by treating for varroa in good time.

The varroa mite can spread APV to brood and adult bees. The sting of the adult bee can be the cause of the virus outbreak. An outbreak will result in brood being badly cared for, and for the adult bees the loss of their orientation abilities. Thus spreading of the virus to other bee colonies occurs, when infected bees beg their way into new hives. Outbreaks of APV can be expected in Denmark at the moment with the presence of 2,000 - 5,000 mites in a colony and will result in the death of the colony.

Outbreaks of DWV can be expected far earlier than that of APV. When the symptoms of DWV are recognised , treatment for the varroa mite should be carried out at once.

NEED BASED TREATMENT

In order to treat the varroa mite effectively it is necessary to carry out a monitoring of the mite population in the colony. Monitoring is carried our by laying an insert at the bottom of the hive, and counting the numbers that fall down. Of course hive types which have a specially designed bottom for mite counting can also be used.

It has been shown under Danish conditions that there is a linear connection between the natural mite death as counted on a plastic insert and the amount of varroa mite in the colony and brood. Recent studies have shown the following connection between the number of mites in a colony with a minimum of a half frame of sealed brood and
the average number of mites which fall down on the plastic insert per day, in the course of a week.

Total number of mites in a colony = 120 X average number of mites per day.

One can calculate at the same time that the amount of mites in a colony with brood will double monthly, and that between 50 and 90% of them will die in winter.

In areas with inadequate treatment of varroa mite a huge invasion can take place from colonies on the verge of collapse. It is, therefore, necessary to monitor several times through a season. The times are dependent on how effectively ones neighbouring apiaries have treated their colonies. The first monitoring should take place at the end of May, and should also take place at the end of June, July and August. If it is not possible to carry out these four monitorings then, as a minimum, monitoring should be carried out at the end of June and the end of August. As far as possible monitoring should be carried out on all colonies in the apiary.

An average colony with an outbreak of APV will probably die when there are about 5,000 mites present. In order to save the colony treatment ought to be carried out much earlier, when there is a maximum of 1,000 mites present. If, on average, 2 mites per day fall onto the insert in the course of a week's count at the end of May, then treatment should be carried out at the latest at the end of July. It is necessary to treat all the colonies in an apiary. If a lactic acid treatment is carried out in the end of October, then the numbers of fallen mites can be counted afterwards. Seen out from the expected 90% effect of treatment , the amount of surviving mites in the colony can be estimated. Colonies should be wintered with a maximum of 50 - 70 mites.

TECHNICAL BEEKEEPING AND PHYSICAL METHODS

Technical beekeeping and physical methods have the great advantage that one avoids traces of chemicals in honey or wax.

Removal of Drone Brood

The varroa mite prefers to propagate in cells with drone brood. With the removal and destruction of sealed drone brood one has a good supplement to other methods. This method ought, therefore, to be part of treatment in general.

Creation of Nuclei

It is very important that one continues to maintain the desired number of productive colonies. This can partly be secured by creating nuclei each year. These should be established in July. Since honey is not to be harvested from them in the first year,

they can be treated with lactic acid.

Heat Treatment
Heat treating of sealed brood provides an effective treatment against the varroa mite. This treatment can be carried out in a thermostatically controlled box. In Germany a number of products have been developed specifically for this treatment, e.g. "Apitherm" . In order to obtain the best results (close to 100% morality of mites) and to create the least damage to brood, frames should be treated for three to four hours at 44°C, depending on the apparatus in use.
Treatment should be carried out two or more times over the period in which brood are present. If one chooses to treat twice, then the first at the end of May and the second at the end of July would be appropriate.

Queen Caging
Queen caging is an effective technical beekeeping operation. The effectiveness of this can be enhanced if a pair of sealed brood frames are removed simultaneously at the beginning of summer. Queen caging can be used in colonies not intended for setting out on heather.
The Queen can be caged in a cassette on a frame for less than four weeks from the middle of June. The frame is then used as a bait for varroa mites and should be changed every eight to nine days. The removed frames should be destroyed. If one wishes to save the brood in the frames, then they can be treated with lactic acid or using heat treatment.

CHEMICAL PRODUCTS USED IN TREATMENT
Pharmacological products used in treating varroa mite are classified as veterinary medicines. At present there are no recognised veterinary medicines for the treatment of Varroa in Denmark.
There is a so-called "positive list" of products on the EU Commission for use in the treatment of animals (honey bees included) destined for human consumption. Lactic and formic acids are on this positive list. It is therefore legal to use these acids in the treatment of varroa mites. Oxalic acids, on the other hand, is not on this list , and cannot be legally used in this treatment.

FORMIC ACID
Formic acid is used in the autumn after the last honey is harvested. It is most effective when used while there is brood in the colony shortly after the honey is harvested. This means that treatment is often carried out at the end of July or at the beginning of August. If the bees are to be moved to heather, then treatment should be carried out shortly after the end of this honey flow.
Formic acid treatment can be carried out using a dishcloth, or a thin fibre board, to which is added 60% lactic acid. Krâmer boards, which are thick wood fibre boards, can also be used, to which formic acid in an 85% solution is added. The fibre boards are placed in perforated plastic bags. There are several formic acid evaporators available, all of which are used beside the hive wall.
Honey has a natural formic acid content. After formic acid treatment there will be a slightly higher content of formic acid in the remaining honey . However, the content still lies within the acceptable natural occurrence. Very little formic acid has been found in wax after treatment.

LACTIC ACID
The varroa mite is very sensitive towards lactic acid treatment. In order to avoid traces of lactic acid in the honey, a dead-line of eight weeks prior to the honey harvest should be observed for treatment. The lactic acid does not penetrate the sealed cell. In order to achieve the best results from this treatment, it should be carried out when there is no brood present in the colony, i.e. early spring or late autumn. The early treatment is carried out if one has a feeling that after the autumn treatment, there are too many mites present in the colony. A water spray is used in carrying out this treatment, spraying each side of every frame in the colony. The effectiveness of the treatment is very high.
Keeping within the dead-line then the lactic acid content is within the natural boundaries.

1 Brødsgaard, C.J. & Brødsgaard, H. F.1998. Monitoring Method as a Basis for Need-based Control of Varroa Mites (Varroa destructor - former Varroa jacobsoni) Infesting Honey Bee (Apis mellifera) Colonies. ATLA 26, 413-419
2 Fries, I., Aarhus, A., Hansen, H. & Korpela, S. 1991. Development of early infestations by the mite Varroa destructor (former Varroa jacobsoni) in honey-bee (Apis mellifera) colonies in cold climate. Experimental & Applied Acarology 11, 215-214.

Dronebrood removal

DRONE BROOD REMOVAL

THE REMOVAL OF DRONE BROOD KEEPS THE MITE NUMBERS DOWN THROUGHOUT THE SEASON

Af Asger Søgaard Jørgensen

In colonies where drone brood removal is practised in the course of the season, there will be three to four times fewer mites than in colonies where this is not practised.

DRONE BROOD REMOVAL

Removal of drone brood is an effective method to limit the propagation of the varroa mite. At the same time it prevents swarming, and it does not effect the honey production.

The varroa mite prefers to breed on drone brood. There are studies which show that between 8 and 10 mites go into drone cells each time 1 goes into a worker cell.

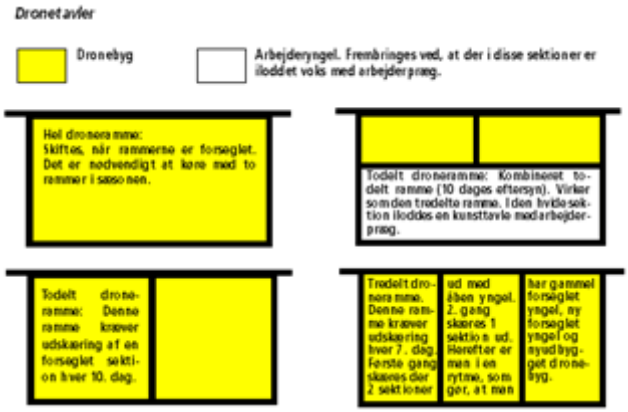
In the drone cell they have more time to get their prodigy developed. While the mite only can get one sexually developed daughter from a worker cell, they can get up to three in a drone cell.

THE DRONE FRAME IS USED THUS

Choose between using two whole frames, frames divided in two or three parts. (See figure)

* The weekend beekeeper, who sees to the bees once a week, should use a three part frame.
*Beekeepers who see to the bees every 10 days should use two part frames, or two whole frames.
* The frames should be empty when they are set into the hive.
*The frames should be set into the hive in Spring, when the queen has begun to lay, around April.
*The frames should be set up to or even inside the brood cluster.
* The frames should be seen to every week (three part frames),and every ten days (two part frames and whole frames).
* With the three part frames two parts should be cut out on the first inspection
*With two part frames one part should be cut out on the first inspection

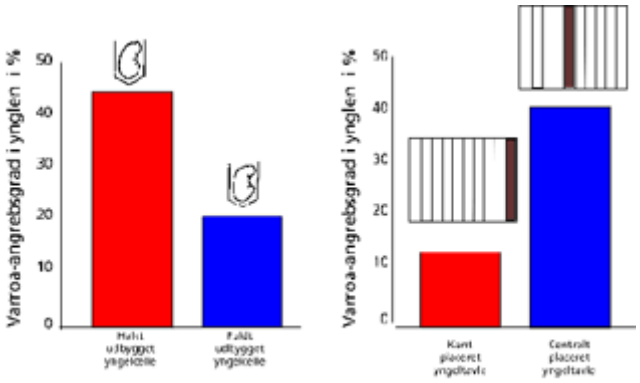
*The removed drone frames can either be melted immediately or burned
*Drones must not be allowed to get out of the frames, as this would result in a huge increase in the mite population.



THE FRAMES WORK BEST THUS
The bees themselves should be allowed to draw the frames themselves from the beginning. German research has shown that more mites come into cells that the bees have to complete than if they were given fully built frames. One of the reasons that more mites come into drone brood is perhaps that worker bees pay more attention to drone brood than to worker brood. There is more building work to be done around the larger drone cells than around the worker brood, and the drone larvae need more food. The mites are transported about in the hive by the worker bees. Since they spend more time around drone brood, this increases the chances of the mites finding the drone cells.

THE DRONE BROOD FRAMES SHOULD BE PLACED INSIDE THE BROOD CLUSTER
German studies have also shown that there were far more varroa mites in frames placed inside the brood cluster than those on the edge of the brood.
In April - May, when drone production is at its highest, there should be so much activity in the colony that the drone frames one sets on the edge of the brood should soon become part of the cluster, as the colony expands.

THE REMOVAL OF DRONE BROOD WORKS
Danish beekeepers have learned that drone removal works. Try opening a frame of drone brood., and see the many mites present. Now from the same colony try opening a frame of worker brood, and here there will be more often than not no mites.
German research has shown that for every mite in a colony in Spring, there can be 50 - 100 mites in Autumn. This means that for every mite removed in Spring there will be proportionally fewer in Autumn.
All in all practical studies have shown that there were 3 - 4 times as many mites in untreated colonies (where drone removal was not carried out) as in treated ones.
Drone removal thus keeps down the mite numbers in periods of honey flow, and postpones that critical point at which the varroa mite possess a real threat to the colony's existence.



Formic acid 1. Freely appied

FORMIC ACID 1 : FREELY APPLIED

FORMIC ACID TREATMENT JUST AFTER THE HONEY HARVEST MAKES FOR HEALTHY WINTER BEES.

Af Flemming Vejsnæs

WHAT IS FORMIC ACID?

Formic acid is an organic acid, which occurs naturally in honey. The correct use of formic acid in the treatment of varroa mite does not provide for significant traces of the acid in the resulting honey.

THE EFFECT OF FORMIC ACID

The vapour from formic acid kills the varroa mite both on the bees and behind the sealed cells. Formic acid is today the only product that kills the mite within the sealed cell.

Formic acid is heavier than air. The bees own ventilation distributes the vapour round the hive.

Formic acid can penetrate the shell of the mite (which is many times thinner than the bees) and it destroys the skeleton, the cells and the respiratory system. The outer shell of the bees is much more resistant towards formic acid.

The oldest brood in a colony can be damaged by formic acid treatment, but normally the losses are not significant.

In rare cases formic acid treatment can result in the loss of queens. Therefore it is a good idea that replacement of queens is carried out after the completion of treatment. Normally it is the older queens (over 2 years old) that succumb.

Up until now resistance towards formic acid has not been registered, despite the fact that the product has been used for over 15 years. Since the acid attacks the mites in a number of ways, it is not to be expected that a resistance towards formic acid amongst the varroa mite will be recorded.

The effectiveness of formic acid can reach up to 95% mortality, but this varies.

SAFETY

In varroa treatment a formic acid solution of either 60 or 85% is used. These are strongly corrosive. Therefore it must be handled with care. Use rubber gloves and protective glasses. Masks are also recommended.

All activity with formic acid should be carried out outdoors, or in well ventilated rooms.

Should acid come into contact with the skin, it should be rinsed immediately with abundant water. Likewise, should it come into contact with the eye, again rinse with lots of water for at least 15 minutes, and thereafter seek medical help. Make sure always to have abundant water at the apiary.

WHERE TO BUY FORMIC ACID

At beekeepers suppliers one can purchase formic acid in a 60% solution, while an 85% soln. can be purchased at agricultural suppliers in 25 Kg. containers. Formic acid treatment is a very cheap form of treatment.

HOW AND WHEN TO USE FORMIC ACID

Formic acid treatment should take place as soon as the last honey is harvested, and the colony has got its first portion of winter feed, e.g. 7 Kg. of sugar. Formic acid treatment can either take place over four consecutive days or through the use of various vaporizers.

FOUR TIME TREATMENT

Having begun winter feeding, the acid is administered on four consecutive days using a 60% soln. on an absorbent material. It is important that the material chosen can absorb all the acid. 2 - 3 ml. of acid per frame should be used. The absorbent material can either be placed in a tray or on a plastic insert at the bottom of the hive. It is important that the acid is not more than 2 cm. from the bottom of the frames. One can also place the absorbent material on top of the frames, resting on laths. In this case it should cover the whole area, so that the bees cannot fly up.

Some beekeepers use an 85% instead of a 60% solution, which gives a stronger shock effect, but also brings a greater risk of damaging stocks. In this case smaller amounts of acid should be used. 1.5 ml. 85% formic acid soln. is equivalent to 2 ml 60% soln.

TEMPERATURE

The outdoor temperature for using formic acid should be between 12 and 25°C. If the temperature is too low an insufficient vaporization will take place and have a limited effect. Too high a temperature will result in too explosive a vaporisation and could result in damage to bees and brood.

VENTILATION

One should make sure that the only ventilation is through the entrance block. Open wire bottoms on hives should be covered.

CONTROL

If one seeks a precise mite count under formic acid treatment , the mites should be counted at the beginning and up to 12 days afterwards. This is due to the presence of dead mites behind sealed brood cells.

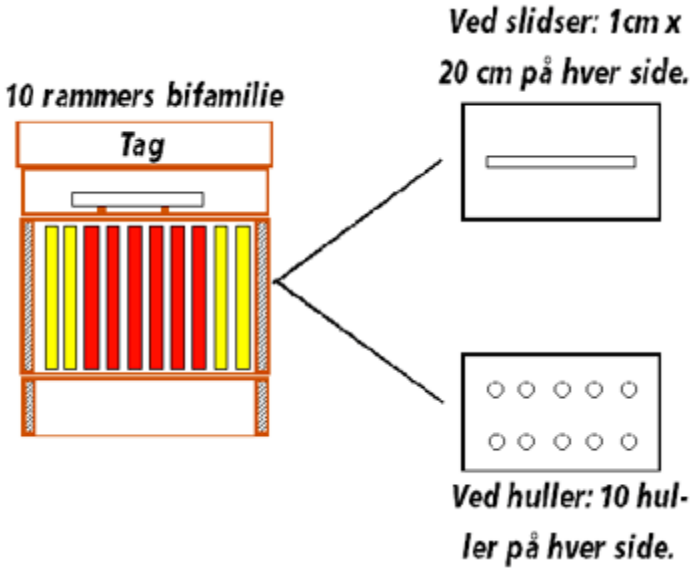
TREATMENT OF SEALED BROOD

Sealed brood frames from frames used for queen breeding can be treated using formic acid. The sealed brood frames without bees are placed inside a polyurethane hive for one hour with 25ml. of 85% formic acid on an absorbent material under and over the frames. Up to 7 frames can be treated in a ten frame box. The frames should be distributed evenly throughout the box. The effectiveness of this treatment is very high (close to 100%). With this form of treatment a loss of 10%of the brood can happen. especially amongst the oldest and most vulnerable .

It is important that only frames of sealed brood from colonies which are not badly damaged are used, as there otherwise could be virus present in the brood.

Formic acid 2: Krämerboards

FORMIC ACID 2 : KRÄMER BOARDS
KRÅMER (WOOD-FIBRE) BOARDS ARE VERY EFFECTIVE AND EASY TO USE.
By Flemming Vejsnæs



The most commonly used varroa treatment method in Denmark is that using Kramer boards (these are soft , absorbent wood fibre boards).

MAKING THE BOARDS
One can either make these boards oneself or do so together with other members of the association.
Soft wood fibre boards are used., cut to sizes of 17 X 24.5 X 1 cm, and inserted into acid resistant plastic bags. 250 ml. 85% formic acid soln. is then poured into the bag, which is then sealed with tape or ideally with a double welding using a welding apparatus for freezer bags.

SAFETY
Formic acid is corrosive and protective wear is advised (see previous article)

THE PLACEMENT OF BOARDS
These boards should be placed so that they cover the whole frame area. A vaporizing area can be created by placing an empty super over the boards. The boards themselves should be placed on 2 cm. high laths placed on top of the frames. The

vaporizing space provides for a more even distribution of the formic acid down through the frames.A crown board can be placed on the super.

USING THE BOARDS

For beekeepers who do not bring their bees to the heather, the boards should be used immediately after the first portion of winter fodder has been given, after the honey harvest. This is normally at the beginning of August. The boards should remain in place for 7 - 10 days and they can be used again if they have not released more than 100 grms of formic acid. Otherwise they can be refilled. The colony should be given the remainder of its winter fodder. The boards should be kept in a closed plastic bucket and thereafter placed on the hive again for 14 - 21 days, around the middle of September.

SLITS OR HOLES

One can either cut slits or make holes in the covering plastic of the boards in order to facilitate vaporization. Holes should be made in the ratio of 4 cm2 per frame. This means that for 10 frames an opening of 40 cm 2 should be used, to be cut out on both sides of the board, and which is the equivalent of a slit of 1 X 20 cm. In high outdoor temperatures the size of the opening can be reduced by 25%.

Our experience points towards using holes which gives the most even distribution, while with slits the danger is that the plastic can be pressed out to the sides and the opening thus becomes larger, and will give a greater vaporisation than desired.

A 16 mm hollow punch (can be bought at a hardware) can be used to make holes with, and this gives an opening of 2 cm2 . One hole of this size is needed per frame. Therefore, for ten frames ten holes in all are needed, to be made on either side of the board. With very high outdoor temperatures in the course of an early treatment, the area of opening, whether it be slits or holes, can be reduced by 25%.

TOO EXPLOSIVE A VAPORIZATION

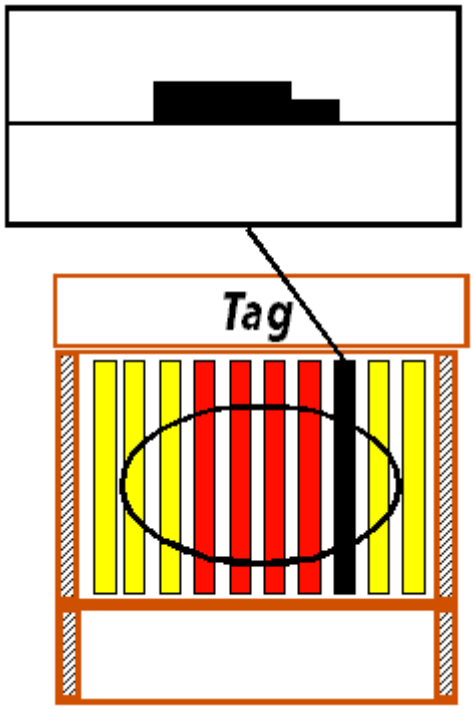
Always use a cool board under treatment, as this provides for a slower vaporization. On warm days it is recommended to wait until evening before inserting the boards.

Checking the vaporization

It is a good idea to carry out a check on the extent of vaporization by weighing the board before and after use. A reliable indication that the board is working satisfactorily is when 10 grm. of formic acid has evaporated daily. Besides, one can also check whether the board can be reused or not, by calculating if it has lost more than 100 grm. formic acid.

New formic acid vaporizers

NEW FORMIC ACID VAPORIZERS
MANY NEW VAPORIZERS HAVE BEEN DEVELOPED, AND WORK WELL.
Af Flemming Vejsnæs



In recent years a great development in the production of formic acid vaporizers has taken place. We have tested several and found them good or acceptable.

THE NASSENHEIDER VAPORIZER
The Nassenheider vaporizer has been on the marked in Denmark for a number of years and is in common use here with good results. The vaporizer comprises two compartments. One for storage and the other for evaporation. In the evaporation compartment one can put a piece of cardboard of two different sizes. The vaporizer can be placed on a lath on an empty frame, so that the apparatus is set half way up the frame. This is so in order for the vaporizer to come into contact with the warmth of the colony.
60 OR 85% SOLUTION
In the vaporisers manual it recommends that a 60% formic acid solution be used. Many of those using the apparatus in Denmark use an 85% solution together with the smaller wick supplied - with good results.

PLACEMENT
It is important that the vaporizer is placed so close to the brood that is is inside the area covered by bees. If necessary the vaporizer can be set up against the most outward brood frame. Should the vaporizer be placed outside the cluster of bees. then there will be an insufficient evaporation. Should the brood have spread to two brood boxes, a second vaporizer should be placed on the upper box, and placed on the opposite side to that underneath.

STARTING TREATMENT
The treatment should start as soon as the last honey has been harvested, and winter feeding begun. The treatment lasts for 7 to 10 days. After the treatment is complete winter feeding can resume.

THE SIZE OF THE WICK
With an early feeding , i.e. in the beginning of August, the smaller piece of cardboard should be inserted. For later treatment, e.g. at the end of September, when the bees have taken all their winter feed, the larger piece of cardboard should be used.

Using 85% formic acid solution the smaller piece should be used. This treatment lasts from 14 to 21 days. Check to see that the vaporizer still contains liquid - it may be necessary to refill it.

FILLING

It is recommended that one acquires a squirt bottle to fill the vaporizer with, since it is difficult to do so otherwise without spilling. Check to see that about 10 ml has evaporated every day in the initial treatment.

THE NASSENHEIDER IN A BOX

A further development of the Nassenheider was brought onto the marker last year, making it possible to treat bees in a whole brood box. What's new here is that one can now put the vaporizer on feet, so that it can be placed on top of the frames. Under the vaporizer an evaporation cloth is laid, which is supplied through a wick from the reservoir. Dependent on the temperature inside the hive, a large or small evaporation area from the cloth is effected. We have scant experience of this type of vaporizer from Denmark.

THE APIDEA VAPORIZER

A completely new form for vaporizer on the Danish marked is the apidea vaporizer. The principal is similar to that of the Kråmer board . The vaporizer consists of a tray in which a "dishcloth" is placed , which is able to absorb the formic acid. The tray is encloses by two surfaces, in a hollow system. The opening is created, and regulated, by moving the surfaces away from one another. Evaporation is only created from one side. The vaporizer is best filled using a squirt bottle out in the apiary. The vaporizer should be raised, just like the Kråmer boards, about 2 cm. over the frames. According to the German manual., it is operated with 60, 70 and 85% formic acid solutions. Testing with 85% soln. in Denmark has shown good results, but testing with a 60% soln. has shown less promising results than the Kråmer board method.

THE LIEBERFELDER DISPENSER

The Swiss Bee Research Institute in Lieberfeld, together with The Swiss Beekeeper's Association have developed a vaporizer similar in principal to the Apidea. The size of the openings are regulated using a rotating disc. The dispenser is supplied with legs which raise it 1.5 cm. above the frames. The dispenser has been tested in Denmark, but is not available for sale here.

THE UNIVERSAL VAPORIZER

Again a dispenser which operates in a similar way to the Krâmer board method. Here a circular plastic container, 3 cm. in height and 16 cm in diameter, is used , containing "oasis" (the absorbent material used in floral decorations) . Above this are two circular discs with a range of openings, which can be regulated according to need. The clever part of this apparatus is that it is supplied with a close fitting lid, which allows the dispenser to be filled at home. The apparatus is tested in Denmark but is not available for sale here.

OTHER VAPORIZERS

There are at the moment two other types of vaporizers that are being researched in Europe. In Southern Germany a so-called plate vaporizer is in use. It works from a drip bottle being suspended on a timber frame and dripping formic acid onto a plate. The method has shown promising results.

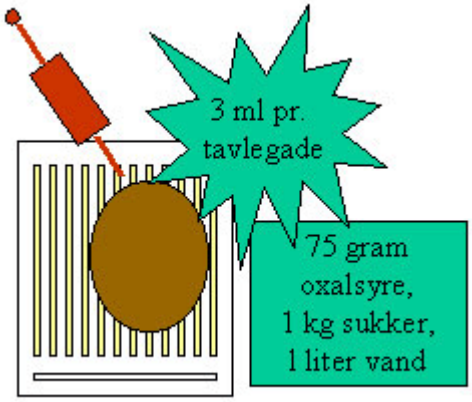
In Sweden trials using a so-called "burk" vaporizer, in which a honey jar filled with saw-dust containing formic acid is used. On the top of the jar is a piece of foam. The whole jar is then inverted onto the frames. The method is being tried out in Sweden at he moment. Up until now it has given varied results along with a much too explosive vaporization in the initial treatment.



Oxalic acid trickling

Oxalic Acid Trickling Method

By David Ashton



The late season varroa – control is important. The treatment should take place when autumn feeding has finished, and the colony is free of brood.

Oxalic Acid trickling

Oxalic acid is an organic acid, which is found naturally in honey. The method is extremely effective, very quick and inexpensive.

Safety

For varroa control the Oxalic acid is used in a very weak solution (3.2%). This solution is a very weak corrosive. But you must be very careful to avoid contact with the skin as oxalic acid can be absorbed through the skin. During treatment it is important to use acid resistant rubber gloves. Whilst mixing the solution you should use, gloves, safety goggles, and respirator (P2 Dust Mask).

Treatment in Brood Free Period

'Oxalic Acid trickling', does not work behind the brood cells sealed cap, this is the reason why treatment should take place in periods when none or very little brood as possible is present. We would normally recommend a treatment in late October - November (but account should be taken of climate for example in western seaboard of British Isles the gulf stream keeps the temperature up so brood rearing goes on into December) As the climate warms its important to check if brood rearing has stopped, so it could well be that treatment should take place in November or December. The important thing however is that the beekeeper must not fall in to the trap of forgetting to use an oxalic acid treatment. Bees, which for various different reasons go into winter and hibernation with too many mites, will suffer a large amount of damage and harm. One should there for in your considerations consider what is said. " Treatment when brood free, so that those mite present can do the least amount of damage " In other countries outside of Denmark, there is a tradition because of climate to give a much latter treatment!

It has previously been said that the colonies should be treated so the bees will have a couple of flying days after treatment. There is however no research that shows this to be necessary

Mixing the Solution

For the treatment then use oxalic acid – bi hydrate

The Oxalic Acid is mixed in proportions 1 litre distilled water: 1 kg sugar: 75 g oxalic acid – bi hydrate. This is enough for 55 colonies. You need to adjust this in proportion or use the Danish beekeepers oxalic acid **calculator**. You need to be aware that mixing very small amounts for example just two colonies for example, can create problems, as ordinary kitchen scales can give the wrong mixture. Consider weighing a minimum of 0.5 litre distilled water: 0.5 kg sugar: 37.5 grams oxalic acid – bi hydrate.

Durability (Shelf Life)

When we only recommend autumn treatments, there is no reason to keep your surplus mixture; it is best put down the drain.

If however you wish to keep your mixture, we should draw attention to the fact that it will keep up to six months in the dark in the cold of a cellar. The mixture should also be kept in child safe and secure bottle.

How to use it?
The Oxalic Acid mixture should be look warm. You should use a 50 ml dosing syringe. You trickle 3- 3.5 ml per frame space with bees. That is to say 35 ml per colony. This is a very small quantity so it's a good idea first of all to practise with ordinary water. It is important that the trickling takes place direct onto the bees and not just on the frame tops were the bees would let it lie.

Temperature
The outdoor temperature above 0 degree C

Damage to bees
If the Oxalic Acid is used correctly, in the correct dosage there is no risk to the bees or the risk is very small. If you over dose then you can loose a lot of bees and weaken the colony.

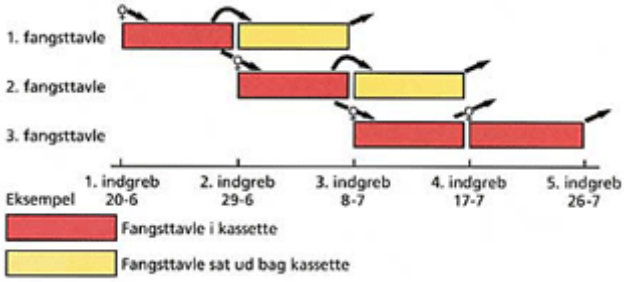
How often should you treat?
Danish and international research has shown that if bees are treated more than once per generation, it can result in damage to the bees and a reduction in the strength of the colony. We recommend there for that you should only treat the bees once each season. The best time to treat is in the autumn early winter when the colony is brood free. We have however with large-scale beekeepers treated with success both in the autumn and in the spring with Oxalic Acid Trickling Method.

Caging the queen

CAGING THE QUEEN
AN EFFECTIVE BEEKEEPING INTERVENTION
Af Henrik Hansen & Camilla J. Brødsgaard. Danmarks JordbrugsForskning, Projektgruppe Biavl

* Using this method the queen is caged inside a frame for almost four weeks
* The varroa mite numbers can be kept to an acceptable level using queen caging combined with the removal of drone brood.
* Queen caging prevents swarming.

PROCEDURE
* Queen caging can be carried out on one or more framed. Here caging inside a cassette on a single frame is described.
* Queen caging tales place before the Spring oil-seed-rape honey flow. The intervention is carried out every eight or nine days
* In the first intervention the queen is put on a frame inside the cassette
* At the second intervention remove all the queen cells. The first frame is set behind the cassette, and the queen is then put onto the second frame inside the cassette.
* Under the third intervention remove the first frame. The second frame is then placed behind the cassette, and the queen is the placed on the third frame inside the cassette.
* At the fourth intervention remove the second frame. The queen is then released from the cassette, while the third frame remains in the cassette.
* At the fifth intervention remove the cassette and the third frame.



BAIT FRAMES
* The "bait" frames which have been removed can be destroyed. They can also be treated with formic acid or by heat treatment , if there are not dead brood in the frames
* Using formic acid treatment the brood must not be more than 16 to 17 days old.
* Six to seven bait frames are set into an isolated box.
* At the top and the bottom a thin. porous wood fibre board in placed and each is given 25 ml of 85% formic acid solution. The box is then covered with an air tight cover and bottom.
* One hour later the treatment is complete. The frames may only be placed in hives from which a honey harvest is not to be taken.
* Using heat treatment the brood must not be more than 16 - 17 days either. The treatment as described in the section on heat treatment should be followed.

Heattreatment

HEAT TREATMENT OF BROOD FRAMES
AN EFFECTIVE PHYSICAL METHOD

Af Camilla J. Brødsgaard & Henrik Hansen. Danmarks Jordbrugs-Forskning, Projektgruppe Biavl

* Heat treatment of sealed brood provides an effective control of the varroa mite
*The varroa mite is more sensitive than bee brood to temperatures that lie above the normal brood temperature
* Heat treatment can be carried out in various types of thermostatically controlled boxes
* Only frames without dead brood should be treated
* Below the Borgstadter -Thermo- Box and Apitherm boxes are described.

BORGSTADTER - THERMO - BOX

* One can heat treat 16 -17 day old brood frames from queen caged frames (see previous article
* Treatment lasts for four hours at 44°C
* Few brood injuries - some shortening of the bees life

APITHERM BOX

* Varroa can be treated exclusively with this apparatus
* treatment can be carried out at any time on sealed brood, irrespective of the honey flow, e.g. at the end of May or June
* One makes a decision about how many treatments are required from the results of monitoring surveys.
* One treats brood frames where at least 75% of the cells are sealed. The open
brood dies.
* Up to 18 frames can be treated at any one time
* The treatment is carried out for three hours, under which the temperature gradually rises to just under 44° C.
* The bees develop normally and their lifespan is not shortened.
* An Apitherm box, for which the electricity in generated by solar cells, is under development in Germany.

THE EFFECT

* Borgstadter-Thermo- Box: 100% mite mortality immediately
* Apitherm Box: varroa females and nymphs are injured under treatment. The main part die within 24 hours. Those that survive lose their ability to procreate.

Lactic acid

TREATING ADULT BEES USING LACTIC ACID

Af Camilla J. Brødsgaard, Danmarks Jordbrugs-Forskning, Projektgruppe Biavl &
Carsten W. Hansen, Danmarks Biavlerforening

Lactic acid is an organic acid which is distributed widespread in nature. It is formed, for example, in the human body when energy is burnt as well as occurring naturally in honey and other foodstuffs. Furthermore, lactic acid is often added to our foodstuffs.

SAFETY MEASURES

A 15% lactic acid solution is used for treating varroa. This concentration causes irritation to skin and mucous membranes and should be handled with care. Rubber gloves, protective glasses and masks are recommended . In a concentrated form lactic acid is corrosive, and should one get concentrated acid on one's skin water should be applied liberally. Likewise , if eyes come into contact with the acid,they should be rinsed with water for at least 15 minutes, and medical help should then be sought. If one mixes the solution oneself, one should remember to add the acid to the water and not the other way round, to avoid the possibility of the acid boiling over. The mixture is then stirred until the lactic acid is evenly distributed. This mixture will last for a few months, but must not be stored at under 0°C.

TRACES IN WAX AND HONEY

Following treatment the lactic acid content of honey increases for only a short while, as the product breaks down fairly quickly. After circa eight weeks the lactic acid content is down to normal levels.

RESISTANCE

No problems concerning the varroa mite building up a resistance to lactic acid have been noted.

WHEN CAN IT BE USED?
Lactic acid can be used up to eight weeks before the honey harvest. Lactic acid treatment should only be carried out in colonies without brood, since lactic acid does not penetrate the sealed brood.
It is most suitable to use lactic acid in the autumn, when there are not sizable amounts of brood in the colonies. Quite often there are a number of mild days in October, in which treatment can ideally be carried out. It will also be possible to carry out a treatment very early in Spring, if one has a feeling that there are too many mites in the colony. However, before they have large amounts of sealed brood ,it is difficult to work with bees, and the treatment would achieve too small an effect. Take note that in some cases queen loss has been recorded in connection with spring treatment.
Lactic acid is very useful in treating swarms. Bees to be used in mating cassettes can also be treated with lactic acid.

HOW IS IT USED?
Three treatments should be carried out with two day intervals. A 15% solution should be used, and 5 ml should be applied with a water sprayer to each side of each frame. The necessary number of pumps required on the spray should be tested beforehand. Treatment should be carried out either so early or late in the day that there is no noticeable flying activity. The lactic acid is sprayed on the bees so that they all become damp. If there are sealed brood present in the colony during this first treatment, they should be removed. A moderate removal of brood can be carried out in Autumn without weakening the colony, but it is not advisable to do so in Spring, since the first bees to develop are of vital importance to the later development of the colony. With a little practice, three treatments with a water-sprayer can be carried out in about 10 minutes per colony.

THE EFFECT
When lactic acid is used in a colony without brood, the effectiveness of the treatment is very high. In tests carries out jointly by The Danish Beekeepers Association and The Danish Agricultural Research Station's " Project Beekeeping", a mortality of 95% or more has been recorded.

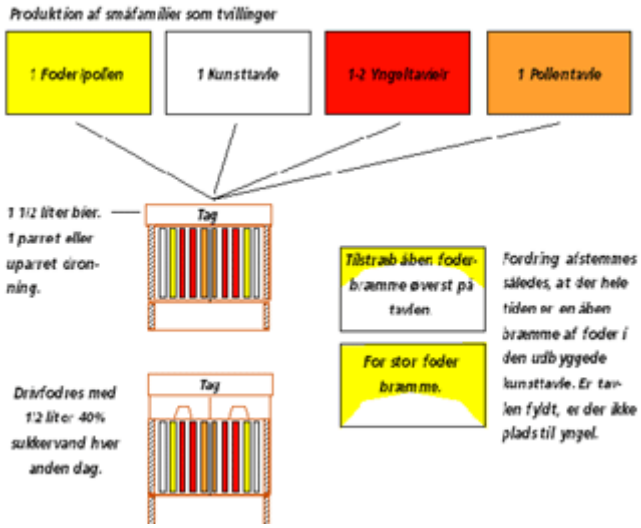
THE COST OF TREATMENT
A 30 Kg. container of 80% lactic acid purchased at The Danish Dairy Wholesalers costs ca. £60 + VAT. It can also be purchased at beekeepers suppliers and at pharmacies in small bottles, but at a far higher price.
In the treatment of a colony on ten frames about 0.3 L of 15% lactic acid solution is used. Through bulk buying the price for this amount is about 10p.

Nuclei - new colonies

NUCLEI - NEW COLONIES

SMALL COLONIES ARE AN IMPORTANT PART OF VARROA TREATMENT AND ENSURE NEW COLONIES

By Carsten Wolff Hansen



With the production of new nuclei, one has more time for varroa treatment, and greater certainty that one decides oneself, how many colonies one has nest season.
When the bees and the queen in newly established colonies produce a mass of brood at the end of the season in order to build a new colony, one utilises the bees reproductive ability in contrast to the varroa mites, and the new colony has the optimal opportunity to produce good winter bees, who can ensure survival and development next season.
This article provides a plan and some advice on how simply and easily one can produce new colonies, and at the same time carry out an effective varroa treatment.

The production of a number of new nuclei ought to be a more natural part of beekeeping than it is today for a great number of beekeepers. Throughout the latter years there has been a great demand for nuclei in Spring. Should one therefore, produce more nuclei than meets ones own needs, they can easily be sold to other beekeepers. One also establishes a good safety net under ones own honey production - and one decides oneself how many colonies one will have.
There are many methods to make nuclei. One can decide on having colonies which will become as strong as normal production colonies, or one can decide on nuclei which over winter in a hive shared with a second colony, and divided by a narrow partition, and where each colony has its own entrance block.
If one makes new nuclei as small colonies, one has extra queens, bees and brood to use in reinforcing colonies that emerge weak in Spring. If one uses a queen from such a small colony, one can without problems unite the now queenless colony with another small colony in Spring, and carry on with them as a normal production colony. There are many possibilities when one has extra colonies, and as stated, one achieves a far greater control over having the desired number of colonies.

HIVES FOR NUCLEI

All sorts of hives can be used for creating nuclei. In some old trough hives there is an extra entrance block at the side of the hive, and if a bee-tight partition is erected between that part of the hive and the original colony, a nucleus can be established at the back of the hive. Trough hives can be rebuilt so that there can be three or four nuclei , each with their own entrance, in a single hive.
Normal hives with special bottoms are the most suitable for nuclei, and here it will be, in most cases, suitable to have one or two nuclei in each hive. It is also possible to have three or four nuclei in each hive, dependent on the size of frame and box. Nuclei ought to be established on at least three frames, and ideally on five. The five frames make it easier control feeding, without blocking for the queen's egg laying. Feeding should take place separately for each colony. If several nuclei have access to the same fodder source, problems will easily arise, and the one queen will succumb and the bees will collect around the second queen.

HOW, WHEN AND HOW MANY?

As in all successful beekeeping , one should in good time plan how, where and how many new nuclei one should have in a season. It is, of course,a requirement that one has the number of queens needed. If one buys ones queens, one should have an

agreement with a queen producer as to when one wants to create new nuclei. If one produces ones own queens , then it is recommended that one use the first queens for nuclei, since it is often difficult to introduce new queens into established colonies. If one wishes to wishes to increase the number of colonies one has, one can plan to double the numbers. If one wishes to have a safety net under the number of colonies desired, it can be a good idea to make half as many nuclei as the number of colonies one started with. Should it be planned properly, one can, in fact, multiply the numbers of colony in a season.
There are many methods to make nuclei, and in Tidskrift for Biavl (Beekeeping Monthly) there are regular descriptions on how this is done.

NOTES ON VARROA TREATMENT FOR NUCLEI
In relation to varroa treatment in nuclei, two factors are especially important. The first thing one should remember is that sealed brood frames can contain many varroa mites, so therefore both bees and brood frames should be taken from colonies with little or moderate attack of varroa. The second factor is this: if one makes nuclei with virgin queens and sealed brood frames without open brood, it will mean, dependent on mating weather, a shorter or longer period , where there is not sealed brood in the colony. This provides some optimal conditions for varroa treatment with lactic acid, or with oxalic acid. Oxalic acid is, unfortunately, at the time of writing not permitted for this use. If one should prefer to establish nuclei with mated queens, it may be a good idea to spray the bees one is to use with lactic acid initially, and treat the newly sealed brood frames without bees with either lactic acid or heat treatment. Brood about to hatch is sensitive towards these treatment methods and, therefore, they must be newly sealed brood frames. Later, when the nuclei are well established, varroa treatment can be carried out in the normal way.

LET US GET STARTED
In this connection only one piece of advice is offered, which is as sure as it can be, when one is working with bees. Many beekeepers have bad experiences in taking bees and brood frames from the ordinary production colonies. It will weaken them, and one has advanced nowhere if one has destroyed some families in order to establish others. Therefore, on ought to have some colonies which are set aside just for this purpose. The bees that are to be used for nuclei, ought to, if there is a pause in the honey flow, be taken to a new apiary at least 3 Km. from where they came.