

SCIENTIFIC ASSAYS ABOUT MITEGONE METHOD™ (Varroa destructor ORGANIC TREATMENT). GRAN CANARIA ISLAND. SPAIN.

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ABSTRACT:

Varroa destructor is the most serious sanitary problem of the professional apian world. Varroa destructor has built up resistance to traditional chemical pesticides. This resistance has created a very dangerous situation; beekeepers are now seeking alternative organic and natural substance solutions to these problems. Natural substance treatments have several advantages as they are less costly, do not leave residues in hives, which is ideal for organic honey production, and do not build resistance in Varroa; however, these treatments have several problems: they are often more complicated in application and have a much lower efficacy than chemical pesticides.

MiteGone is an application method that uses formic acid, an organic treatment, that was designed by Bill Ruzicka of Mitegone Enterprises Inc., in Canada.

The scientific research that follows examines this method in an apiary of Gran Canaria (Canary Islands) that has severe Varroa destructor infection and very bad sanitary status (PMS, chalk brood, and deformed wing virus). We have done Natural drop and MiteGone drop (after treatment) of Varroa to identify the infection level of the apiary and the evolution of this level after the application of the Mitegone treatment.

Our results show that if the MiteGone method is used following the maker's instructions and the MiteGone dose tables for Spain (designed by H&T SL Enterprises), this type of treatment can achieve very high efficacy against Varroa infection (between 90-100%) and greatly improve the sanitary status for the apiary. In our research, after the Mitegone treatment, the putrid brood and chalk brood signs disappeared. Also the colonies increased in strength.

Our conclusions show that the MiteGone method is an easy application method for formic acid. The treatment is less expensive than chemical pesticides, has high efficacy levels, and helps to improve the general sanitary status of the colonies and the apiary; therefore, using the MiteGone applicator and formic acid is a serious alternative treatment for Varroa control. Chemical pesticides cannot do all of this; they can only kill the mite.

INTRODUCTION:

The European Union had designed a new Common Agrarian Politic where the alimentary security takes a very important place. It is for this, that the organics treatment against different diseases of the animals must be potentate. On the other hand, in the specific case of Varroa destructor, exist the problem of the resistances against the traditional pesticides like Flouvalinate, Amitraz and Coumaphos (see the conclusions point).

In Canary Islands, the apiculture exists before the Spain conquest of these Islands. In this archipelago exist one sub-specie of black bee of the world (Canary black bee) and these Islands have a very high vegetal biodiversity. These circumstances and our specially climate make the high quality of the bee products in Canary Islands. The origin of Varroa destructor infection in this archipelago was around the eighty years (XX century) because some beekeepers imported bees of Europe. Only La Palma Island is free of this disease in this archipelago. On the other hand, these islands have a high climatic variability, as there exist nine climatic zones with different temperatures and humidity characteristics.

The MiteGone™ is a method for treatment of the Varroa infection based in acid formic application, designed by Bill Ruzicka (MiteGone Enterprises Inc., Canada). The objectives of this scientific work are:

- Demonstrate the effective level of MiteGone method against Varroa Infection in Canary Islands.
- Demonstrate that the MiteGone dose tables for Spain (designed by H&T S.L. Enterprise) are correct.
- Demonstrate the fast general sanitary status improves of the colonies after MiteGone application.

To satisfy these objectives we have designed a scientific experience with two parts: the first part was done in October (last summer treatment, 2004) and the second was done at the end of March (Spring treatment, 2005).

The characteristics of the apiary where was done this scientific experience were:

- **Geografic situation:** Barranco de Santidad (altitude 400-500 meter). Arucas. Gran Canaria north coast. Canary Islands.
- **High mortality of hives by Varroa infection** (40 of 80 hives, 50 % of mortality). When we started our study, there were only 40 hives. In March (2005), after MiteGone treatment (October, 2004), there were 80 hives
- **Climatic characteristics:** Humid Subtropical. **October:** Medium humidity 75%, Medium Temperature 23.4 °C, Medium of Maximum Temperatures 25.5 °C, Medium of Minimum Temperature 21.3 °C, Temperatures interval (34.0 – 17.4 °C). **March:** Medium humidity 70%, Medium Temperature 18.9 °C, Medium of Maximum Temperatures 21.0 °C, Medium of Minimum Temperature 16.7 °C, Temperatures interval (29.2 – 10.8 °C). (Guía resumida del clima en España 1961-1990).
- **Based in the dosing H&T S.L. Enterprise studies,** we think that the evaporation ratio of formic acid in the apiary zone could be near to 3 grams / half pad / day. The estimated duration of this treatment was 40 days.
- **The apiary was sitting in a ravine.** The situation of the hives in the apiary is rightly (NE – SW). The entrances of the hives are toward to Southeast and weren't exposed to the dominant wins (Alisios Wins NE). In the place of apiary there are good insulation and ventilation.
- In the tenement where there is this apiary, there is an orange vendor and vegetables plantings. Also there is a pond with water. The owner of this tenement uses compatible pesticides with bees to treat the diseases of these plantings. There exist other apiaries near this apiary in the zone.



Fig.1.Apiary picture.

MATERIAL AND METHODS:

A. SELECTING SAMPLES HIVES.

For the realization of our tests we selected hives that had the necessary characteristics to allow for the Natural Drop of Varroa test and the after MiteGone treatment drop of Varroa test. The characteristics required were:

- Colonies with almost 30.000 bees (10 frames of bees)
- Almost 3 – 4 brood frames.

10 hives were selected with these characteristics and with this situation in the apiary zone:

- 4 hives of extremes of the apiary zone. 2 contiguous hives in every one of two extremes of the apiary.
- 6 hives of the central zone of the apiary (3 groups of 2 contiguous hives).

At the first part of the study (October 2004), the hives of the occidental extreme of the apiary could not be selected because they didn't have enough bees (30.000 bees). All the hives selected were Langstroth with two boxes.

With this selecting process we obtained a representative selection of hives of this apiary and with contiguous hives we worked doing a case – control processing (for compare the effective level after treatment using MiteGone™ maker dose and H&T S.L. dose system for Spain and Canary Islands).

B. NATURAL DROP AND AFTER MITEGONE™ TREATMENT DROP TESTS.

For the realization of these tests we have used cardboards to cover the bottom of the selected hives. These cardboards were covered with solid Vaseline and with bee-excluding grates.

- **NATURAL DROP TEST:** with this test we obtained a medium infestation level reference value of the analysed hives. This value is representative infection level of the apiary. For doing this test we put the

cardboards into the selected hives for 3 – 5 days. Then, the cardboards were removed and varroa were counted. The counted varroa number was divided by the hours that the cardboards were in the hives for the determination of the medium apiary infection level.

- **AFTER MITEGONE™ TREATMENT DROP TEST:** with this test we obtained a medium treatment effective level reference value of the analysed hives. This value is a representative treatment effective level of the apiary. For doing this test we put the cardboards into the selected hives for 24 – 48 hours. Then, the cardboards were removed and varroa were counted. The counted varroa number was divided by the hours that the cardboards were in the hives to determine the multiple and the medium apiary treatment effective level.

The next tables (fig. 2) are important for understanding this test realization.

C. EXPERIENCE FIRST PART (OCTOBER, 2004).

The doses recommended by MiteGone™ maker to obtain an effective level between 90-100% is 12 – 18 grams of gas of 65 % formic acid dilution into two boxes Langstroth hives. In Canada (Continental Weather) this dose can be obtained with two or three half pads in spring and late summer. H&T S.L have demonstrated that the evaporation ratio with MiteGone™ changes with different weather conditions following a predictably relationship between the temperature and the humidity of the climatic zone of the apiaries treated with MiteGone™ method (not publishing paper). J.L. Fleitas has designed MiteGone™ dosing tables for Spain and Canary Islands using the documents of mentioned studies (see in [www. Mitegone.com](http://www.Mitegone.com), specifically information for Spain link). The objectives for first part were:

1. Determination of the Varroa infection level: to obtain this objective we realized the Natural drop test to the half of the ten selected hives. These hives were the control for the determination of objective number 2.
2. Determination of the efficacy for recommended maker MiteGone™ dose (3 half pads per 2 boxes Langstroth hives): to obtain this objective we realized an after MiteGone treatment drop test to the rest of contiguous selected hives and the medium multiple value and the medium efficacy level value were calculated. These hives were the control for the determination of objective number 3.
3. Determination of the efficacy level for recommended H&T S.L. dose North coast of Canary Islands (4 half pads per 2 boxes Langstroth hives): for obtain this objective we realized an after MiteGone treatment drop test to the hives that were selected for Natural drop test hives and the medium multiple value and the medium efficacy level value were calculated.
4. Determination of the apiary general sanitary status.

D. EXPERIENCE SECOND PART (MARCH, 2005).

The objectives for the second part were:

1. Determination of the Varroa infection level: for obtain this objective we realized the Natural drop test to the half of the ten selected hives. These hives were the control for the determination of objective number 2. These hives were the control for the determination of objective number 2.
2. Determination of the effective level for recommended maker MiteGone™ dose (3 half pads per 2 boxes Langstroth hives: now 2 vertical pads and 1 horizontal pad): to obtain this objective we realized an after MiteGone treatment drop test to the rest of contiguous selected hives and the medium multiple value and the medium effective level value were calculated. These hives were the control for the determination of objective number 3.
3. Determination of the effective level for recommended H&T S.L. dose North coast of Canary Island (4 half pads per 2 boxes Langstroth hives: now cutting 2 extremes of the pad): to obtain this objective we realized an after MiteGone treatment drop test to the hives selected for Natural drop test hives and the medium multiple value and the medium effective level value were calculated.
4. Determination of the apiary general sanitary status.
5. Determination of Varroa infection level evolution comparing the natural drop tests results of the two parts of experience.
6. Determination of the apiary general sanitary status evolution.

Very important note: the ten hives selected for the first and for the second part were different.

The principal bibliography consulted for the material and methods realization was:

- Apicultura (3ª edición). P.Jean-Prost. 2001. (Spanish edition).
- Enfermedades de las abejas. Wolfgang Ritter. 2001. (Spanish edition).
- MiteGone TM Enterprises Inc. – Handbook. B. Ruzicka. 2004.

Fig 2. Natural Drop and Efficacy Calculate Table.

NATURALDROP TABLE.

<u>MITES / DAY.</u>	<u>INFECTION LEVEL</u>
0 – 8	LIGHT
8 – 15	MODERATE
15 – 30	GRAVE
Más de 30	VERY GRAVE

MULTIPLE AND EFFICACY CALCULATE TABLE.

<u>MÚLTIPLE.</u>	<u>EFFICACY.</u>
Más de 30	95 – 100 %
20 – 30	85 – 95 %
10 – 20	70 – 85 %
5 – 10	50 – 70 %

RESULTS:

EXPERIENCE FIRST PART (OCTOBER, 2004).

A. GENERAL SANITARY STATUS.

This apiary was treated six months ago (before beginning this study) against Varroa with Fluvalinate (Klartan TM impregnate wood tablets). The beekeeper was using this type of treatment the last 2 years. He used 2 years ago APITIMOL TM (based in thymol application). Before APITIMOL, he used APIVAR TM (amitraz, two consecutive years) and APISTAN TM (fluvalinate during same years).

Clinical examination was done to all apiary hives (during first and second part of the experience).

- **BROOD DISEASES:** High prevalence of Chalk Brood Disease (produced by *Ascophera apis*) and Putrid Brood Syndrome or P.B.S. (PMS) (the hives who died were very effected) was observed during the clinical examination. At the end of this examination our conclusion was that the severe Varroa infection extended the hives of the apiary and facilitated the proliferation of these diseases. The possible presence of American or European Putrid Brood was discarded. But, how the clinics signs of P.B.S. were very similar to the American P.B.S. and a varying of European P.B.S. produced by *Paenibacillus alvei*. (S.E. Borraci and col. 2004, A.M. Allipi and col. 1991 – 2002, Steven P. Djordjevic and col. 1999) laboratorial analytical probes were realized (pending of microbiological identification).
- **ADULT BEES DISEASES:** Important prevalence of deformed wings virus disease was observed in the apiary (30 % of the selected hives for the first part of this study). It was interesting that large numbers of adult bees died during the first days of MiteGone TM treatment. This mortality wasn't a result of formic acid overdosing as the typical signs of overdosing were absent. We think that this mortality was occasioned for the colonies debility (Varroa high infection level and bad general sanitary status).

B. SELECTED HIVES. MACROSCOPICAL LY STUDY.

All the selected hives for first part of experience had more that 30.000 bees (ten frames of bees) and they were 2 boxes Langstroth hives. The upper box had 9 frames with new wax (some of them had been worked by the bees at the moment of this macroscopically study). There were adult drones and some drone broods, typical at the lust summer.

The signs of active and fecund queen presence were studied in all of selected hives. All the selected hives had an active and fecund queen. The next table have a resume of the most important macroscopically characteristics of the selected hives.

Fig 3. Selected hives. Macroscopically study (October, 2004).

IDENTIFICACIÓN	BROOD BOX.						CHALK MUMMIES BROOD	FORETIC VARROA	DEFORMED WINGS DISEASE
	BROOD FRAMES	FOOD FRAMES	NEW WAX WORKED FRAMES	NEW WAX FRAMES	FRESH EGGS	DRONE BROOD			
HIVE 1	4	6	-	-	+	-	++*	-	++
HIVE 2	4	1	2	3	+	-	+	+	-
HIVE 3	4	1	3	1	+	-	-	-	-
HIVE 4	7	3	-	-	+	-	-	-	-
HIVE 5	7	3	-	-	+	-	-	+	+++
HIVE 6	5	4	1	-	+++	-	+++***	+	+++
HIVE 7	8	-	2	-	+	-	-	-	-
HIVE 8	4	-	6	-	+	+	-	-	-
HIVE 9	4	1	5	-	+	-	-	-	-
HIVE 10	4	1	5	-	+	-	-	-	-

* Putrid Brood Syndrome initial status; ** Defective fresh eggs; *** Putrid Brood Syndrome.

C. NATURAL DROP AND AFTER MITEGONE TREATMENT DROP TEST RESULTS (OCTOBER, 2004).

The next tables show the different values obtained after realization of all our tests:

Fig 4. Experience first part results tables.

IDENTIFICACIÓN.	NATURAL DROP TEST (VARROAS/DAY).
HIVE 2.	134 (VERY GRAVE)
HIVE 6.	186 (VERY GRAVE)
HIVE 7.	109 (VERY GRAVE)
HIVE 9.	49 (VERY GRAVE)
HIVE 10.	*
NATURAL DROP MEDIUM VALUE (VARROAS/DAY)	
119.50 VERY GRAVE	

IDENTIFICACIÓN.	AFTER MITEGONE TREATMENT DROP TEST WITH 3 HALF PADS / HIVE (VARROAS / DAY)
HIVE 1.	240
HIVE 3.	456
HIVE 4.	446
HIVE 5.	1136
HIVE 8.	481
TREATMENT DROP TEST MÉDIUM VALUE. 3 HALF PADS / HIVE (VARROAS / DAY).	
551.80	

IDENTIFICACIÓN.	AFTER MITEGONE TREATMENT DROP TEST WITH 4 HALF PADS / HIVE (VARROAS/DAY)
HIVE 2.	*
HIVE 6.	1624
HIVE 7.	295
HIVE 9.	18
HIVE 10.	14
TREATMENT DROP TEST MÉDIUM VALUE. 4 HALF PADS / HIVE (VARROAS / DAY).	
487	

* **NULL. PROCESSING MISTAKES.**

D. MULTIPLE VALUES EFFECTIVE LEVEL DETERMINATION (OCTOBER, 2004).

- **MULTIPLE 1 (TREATMENT WITH 3 HALF PADS / HIVE) = $551.80 / 119.5 = 4.61$**
- **MULTIPLE 2 (TREATMENT WITH 4 HALF PADS / HIVE) = $487 / 119.5 = 4.07$**

The material and methods point c tables about the multiples calculation and effective level show that these values corresponding with low multiples, but these tables were designed for testing with ideal climatic conditions. In our case, the whether conditions when the hives were tested (with different doses) weren't ideal conditions. When we tested the hives for first dose (3 half pads / hive), the temperatures surpassed the medium values and were near the maximum value (referring to October) and the humidity descended. During this test the dominant winds were the south winds (hot and dry weather): this weather is the best for the evaporation of formic acid. On the other hand, when we tested the hives for second dose (4 half pads / hive), the temperatures

descended and were near the minimum value (referring to October) and the humidity ascended. During this test the dominant winds were the north winds (temperate or cold and humid weather) and the test day was raining: this weather isn't so good for the evaporation of formic acid as the South winds weather.

With these circumstances, is sure that in the apiary zone studied, the MiteGone maker dose (3 half pads) is insufficient. On the other hand, the second dose (4 half pads / hive) wasn't probed with ideal whether conditions. With these results, we decided treat the apiary using the second dosing (H&T S.L. dosing tables for Spain and Canary Islands).

We treated all the hives with MiteGone™ with this dosing (OCTOBER 2004):

- **2 BOXES HIVES: 4 VERTICALS HALF PADS.**
- **1 BOX HIVE (MINIMUM 7-8 FRAMES OF BEES): 2 VERTICALS HALF PADS.**
- **1 BOX HIVE (5 FRAMES OF BEES): 2 HORIZONTAL HALF PADS (ON BROOD FRAMES).**
- **BABYS (5 FRAMES OF BEES): 1 VERTICAL HALF PAD.**
- **BABYS (3 FRAMES OF BEES): 1 HORIZONTAL HALF PAD (ON BROOD FRAMES).**

SECOND PART OF EXPERIENCE (MARCH, 2005):

A. GENERAL SANITARY STATUS.

The evolution of the apiary general sanitary status after October treatment with MiteGone™ was very satisfactory. After this treatment, the prevalence of the deformed wings virus disease descended very much. Putrid Brood Syndrome and Chalk Brood Disease Disappeared. The illness brood was removed out.

The formic acid helps to clean activity of the bees. This is a very good preventive quality of MiteGone™ against diseases like Nosoema apis Disease (didn't exist signs of this disease in this apiary after winter). A characteristic brightness of the bee wings was observed and the colonies were very strong. The mortality after March MiteGone application descended very much and the bees were working with high activity.

B. SELECTED HIVES. MACROSCOPICAL LY STUDY.

The main brooding period start in the apiary zone at approximately the beginning of March . This second part of the experience started at the 22nd of March. The colonies were very strong and they had brood frames in the two boxes. Some another colonies gathered a scattered swarm of bees before start the second part of our study.

The selected hives in this occasion had 6 – 12 brood frames and 40.000 – 60.000 bees. Exist strong drones population in to the hives (young and adults or fecund) and drone brood.

The signs of active and fecund queen presence were studied in all of selected hives. All the selected hives had an active and fecund queen. The next table have a resume of the most important macroscopically characteristics of the selected hives.

Fig 5. Selected hives. Macroscopically study (March, 2005).

BROOD BOX.									
IDENTIFICACIÓN	BROOD FRAMES	FOOD FRAMES	NEWWAX WORKED FRAMES	NEWWAX FRAMES	FRESH EGGS	DRONE BROOD	CHALK MUMMIES DISEASE	FORETIC MITES	DEFORMED WINGS DISEASE
HIVE 1	8	2			+	+	-	-	+
HIVE 2	6	3		1	+	+	-	-	-
HIVE 3	7	3			+	++	-	-	-
HIVE 4	6	3	1		+	+	-	-	-
HIVE 5	7	2		1	+	-	-	-	-
HIVE 6	4	6			+	+	-	-	-
HIVE 7	6	4			+	++	-	-	-
HIVE 8	6	4			+	++	-	-	-
HIVE 9	4	6			+	-	-	-	-
HIVE 10	8	2			+	++	-	-	-

UPPER BOX.					
IDENTIFICACIÓN	BROOD FRAMES	FOOD FRAMES	NEW WAX WORKED FRAMES	NEWWAX FRAMES	FRESH EGGS
HIVE 1	4	1	1		+
HIVE 2	1	1	4	1	+
HIVE 3	4	6			+
HIVE 4			6	3	-
HIVE 5	5	4			+
HIVE 6	1		7		+
HIVE 7	1	5		2	+
HIVE 8			9		-
HIVE 9	2	5			+
HIVE 10			5	4	-

C. NATURAL DROP AND AFTER MITEGONE TREATMENT DROP TEST RESULTS (OCTOBER, 2004).

The next tables show the different values obtained after realization of all our tests:

Fig 6. Experience first part results tables.

IDENTIFICACIÓN.	NATURAL DROP TEST (VARROAS/DAY).
HIVE 2.	5.18 (LIGHT)
HIVE 3.	2.74 (LIGHT)
HIVE 4.	3.05 (LIGHT)
HIVE 6.	26.82 (GRAVE)
HIVE 9.	10.67 (MODERATE)
NATURAL DROP MEDIUM VALUE (VARROAS/DAY)	
9.69 (MODERATE)	

IDENTIFICACIÓN.	AFTER MITEGONE TREATMENT DROP TEST WITH 3 HALF PADS / HIVE (VARROAS / DAY)
HIVE 1.	30.5
HIVE 3.	14.5
HIVE 4.	32.5
HIVE 5.	66.5
HIVE 8.	17.5
TREATMENT DROP TEST MEDIUM VALUE. 2 HALF PADS VERTICALLY + 1 HALF PAD HORIZONTALLY / HIVE (VARROAS / DAY).	
32.20	

IDENTIFICACIÓN.	AFTER MITEGONE TREATMENT DROP TEST WITH 4 HALF PADS / HIVE (VARROAS/DAY)
HIVE 2.	144
HIVE 6.	*
HIVE 7.	22.32
HIVE 9.	1148.65
HIVE 10.	55.81
TREATMENT DROP TEST MEDIUM VALUE. 4 HALF PADS / HIVE (VARROAS / DAY).	
342.69	

* NULL. PROCESSING MISTAKES.

E. MULTIPLE VALUES EFFECTIVE LEVEL DETERMINATION (MARCH, 2005).

- MULTIPLE 1 (TREATMENT WITH 3 HALF PADS / HIVE) = $32.20 / 9.69 = 3.32$
- MULTIPLE 2 (TREATMENT WITH 4 HALF PADS / HIVE) = $342.69 / 9.69 = 35.36$

These results show that the first dose (2 vertically half pads + 1 horizontally half pad) was insufficient. On the other hand, the medium result for second dose (4 half pads) was fantastic. This value correspond with a efficacy level 95 – 100 %. The weather in this occasion was better than the first experience part weather, but in the morning of the second dose test was raining. This rain could interfere with the formic acid evaporation (humid ascended). This could be the explication for individual values of the hives 4 and 9.

F. NATURAL DROP MEDIUM VALUE EVOLUTION.

The natural drop medium value progressed satisfactorily after October MiteGone™ treatment:

- NATURAL DROP 1 (OCTOBER, 2004) = 119.50 Mites / Day. (VERY GRAVE)
- NATURAL DROP 2 (MARCH, 2005) = 9.69 Mites / Day. (MODERATE)

These results show that the efficacy of the October treatment was in the interval (90 – 100 %, the value is 91.9 %). This is the best efficacy decrypted for organics treatments and comparable with chemicals pesticides in places where don't exist Varroa resistances against this type of pesticides.

G. HORIZONTAL TREATMENT.

In the cases of treated hives with horizontal variant, 1 BOX HIVES (5 FRAMES OF BEES) and BABYS (3 FRAMES OF BEES), a very satisfactory evolution of this hives was observed.

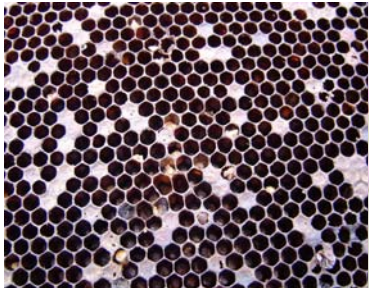


Fig 7. Putrid and Chalk Mummies Brood.



Fig 8. Putrid Brood samples Microbiologic Culture. Bacillus Gram -. 72 Hours. 37 °C. (Columbia Agar Medium)



Fig 9. Macroscopically study March,2005.

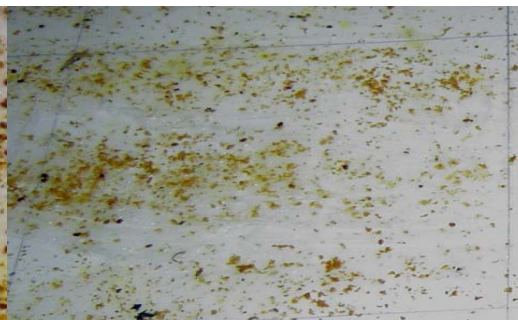


Fig 10. These images show the natural mite drop evolution: Left picture (first part, hive 2) show a cardboard with more than 100 mites and chalks mummies (before October MiteGone™ treatment). Right picture (second part, hive 9) show another cardboard with approximately 15 mites and with out chalk mummies. Both of these images show the same area of cardboard (approx. 10 x 10 centimetres). The individual values of these hives were near to their respectably experience medium values.

CONCLUSIONS.

- A. The evolution of the Natural drop test medium value after the October MiteGone™ treatment (using H&T S.L. Enterprise dosing, estimated treatment duration 40 days) was very satisfactory. **The efficacy of this treatment was around 91.9 % (90 – 100 %). The infective level evolution was VERY GRAVE to MODERATE - LIGHT.**
- B. **For estimate the efficacy of the treatments based in an evaporate processing, the evolution of the Natural Drop Test (NDT) Medium Value is better that the After Treatment Drop (ATD) Test Values.** The weather could change at the moment of the realization of these ATD tests and the evaporation rate and the efficacy changes too. The results of the NDT don't depend of climatic conditions so much as the ATD tests.
- C. **The last treatment applied before October MiteGone™ treatment based in Fluvalinate application was insufficient for Varroa infection control.**
- D. **The general sanitary status of the apiary improved very much with MiteGone™ treatment.** Putrid Brood Syndrome and Chalk Mummies disease disappeared. The hives showed clean aspect and the colonies were very strong. The mortality of bees after the march MiteGone™ treatment descended very much because the bees were stronger that before October MiteGone™ treatment. Didn't exist signs of Nosoema apis disease after winter.
- E. **The dosing estimated based in H&T S.L. Enterprises studies for this experience worked correctly.**
- F. **The MiteGone™ method is adaptable to different colonies and different climatic conditions.** The Horizontal variant of MiteGone treatment worked correctly with 1 BOX HIVES (5 FRAMES OF BEES) and BABYS (3 FRAMES OF BEES).

DISCUSSION.

Varroa destructor has been the most important sanitary problem of the professional beekeepers the last three decades. The economic losses and the proliferation of other diseases produced by V. destructor are a problem need alternative solutions.

The mite resistance against chemicals pesticides is another international problem for the control of this disease. In countries like Canada and USA the appearance of resistances has alerted the Animal Health Authorities. In these countries exist research works that show the existence of resistances against Fluvalinate, Amitraz and Coumaphos (B. Ruzicka, 2002). The first case of resistance against fluvalinate in Europe Union was observed in Italy (in Sicilia, 1992), then this phenomenon was observed in the North of this country (Loglio and Plebani, 1992), South of France (Vanadame et al., 1995; Colin et al., 1997) and exists other studies that show resistances cases in different countries of the European Union (see Bibliography). In Spain, the study by Garcia, P and Luzón, J., 2003, show fluvalinate resistances cases in this country and amitraz obtained efficacies were in the limits of the resistances apparition for this substance (this year, 2005, the author of this paper have notices of amitraz resistance cases in Spain).

With this situation and with the new challenges about the residuals and Alimentary Security of the Agrarian Politic of the European Union, search alternative treatment and solutions to this problem is necessary. How ever, in Europe exist organism are studying new alternative and organics treatment that permit a good control of this disease without residual action. The organic acids (like formic acid) and essential oils have been shown to be serious alternatives for treat the V. destructor infection.

The results of the present study in addition with another research works like Pajuelo and col., 2004 y B. Ruzicka 1995 – 2004, demonstrate that the MiteGone™ method is used following the maker instructions, this method obtain high efficacies (the highest registered for this type of organics treatments).

The MiteGone™ has been observed as the easiest formic acid application method, adaptable to different conditions, it is cheap and is very sure (don't produce queen losses using a correct dose).

In addition, the correct application of formic acid with MiteGone™ method helps to bees improve the general sanitary status of the hives and apiary. Beneficial effects of formic acid against other bee diseases (mycosis, chalk mummies, putrid brood, Nosoema apis disease) and others (hive cleaning activity help, for example) don't exist when the hives are treating with chemicals or essential oil treatments. These beneficial effects accelerate the improvement of the sanitary status of the treated hives and improve the production of these hives.

MiteGone™ method is adaptable to different climatic zones. The number of pads per hive must be adapted to the climatic conditions of the zone. Exist H&T S.L. Enterprise study demonstrates a predictable relation between the humidity, temperature and MiteGone™ evaporation ratio (Non published article). The dosing tables for Spain and Canary Islands were designed based this relation. If the dose of formic acid into hive is inferior to 12 grams / day (treating 2 boxes Langstroth hives) the bees can tape the pads with propolis.

Finally, the horizontal variant of MiteGone method is ideal for small colonies that can't ventilate as vigorously as larger colonies.

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Dedicated for Gran Canaria Beekeeper Association, for beekeepers members of this association collaboration.

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