

***Varroa destructor* Anderson & Trueman 2000**

**Mesostigmata: Varroidae**

**(Previously known as *Varroa jacobsoni* Oudemans, 1916)**



Penn State Image



**Penn State Image**

A “string-winged” worker in FL, 4 Apr 2006.



# Drone Pupa with Varroa Mites: *Varroa destructor*.

Penn State Image

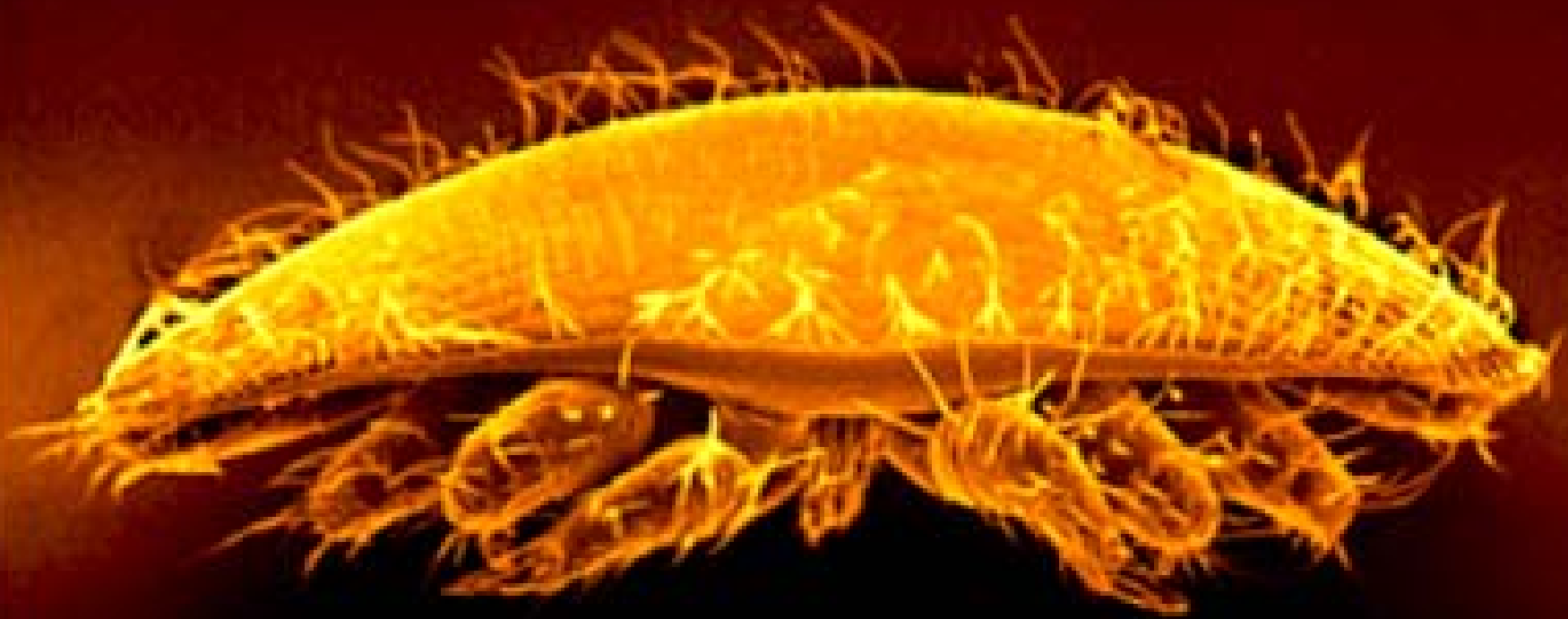




**Brood and dead varroa mites removed after formic acid treatment, FL, 4 Apr 06.**

# Face view of Varroa Mite (cheliceral stylets withdrawn).

Penn State Image



**Varroa Mites are resistant to fluvalinate [Apistan], coumaphos [Checkmite] and amitraz in most areas.**

**We received a call in October 2004 from Oregon: two beekeepers with 3500 colonies had huge numbers of mites in each hive – despite using Checkmite, mineral oil fog, etc.**

**They asked what they could do . . .**

**It was too late to treat in Oregon!**

**The only solution: move bees south to southern Nevada, California, Arizona, etc.; then feed them HBH and treat them with the 50% formic fumigator (see below).**







**Newly emerged female *Varroa* mites enter brood cells, preferably drone, and are sealed in the cells for 13-14 days without producing eggs. This first cycle allows the mites' reproductive system to develop.**

**On the second and subsequent cycles, she reproduces normally; the first egg is a male- laid 60 hours after capping; subsequent eggs are females- laid at 30 hr intervals.**

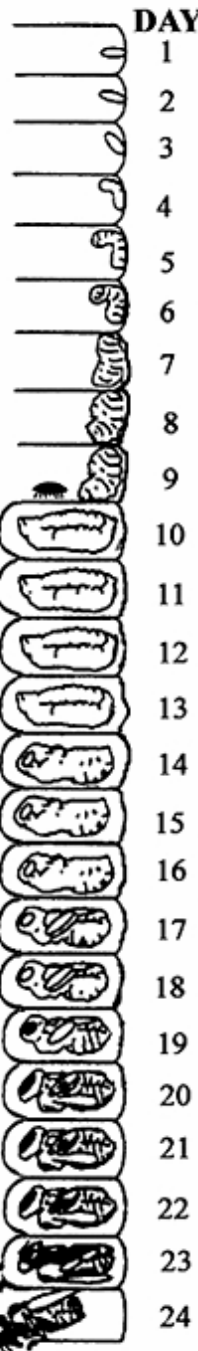
**A female *Varroa* mite may complete 8 or more brood cycles in her life time, producing up to 32 to 40 daughter, reproductive females.**

**In many cases, two or more females enter the same cell. This allows females to mate males from other lines, preventing inbreeding. Feeding by so many mites deforms the workers. The blood-sucking mites also transmit several viruses.**

KEY:

-  Adult female
-  Adult male
-  Egg
-  Protonymph
-  Deutonymph ♀
-  Deutonymph ♂

# DRONE CELLS



# WORKER CELLS

Mite survival in worker cells:

Immatures	0
1 <sup>st</sup> female	94%
2 <sup>nd</sup> female	38%
3 <sup>rd</sup> female	1.3%
Male	0

Mite survival in drone cells:

Immatures	0
1 <sup>st</sup> female	98%
2 <sup>nd</sup> female	94%
3 <sup>rd</sup> female	84%
4 <sup>th</sup> female	76%
5 <sup>th</sup> female	63%
Male	0

Brood is capped for 13-14 days

Brood is capped for 13 days

After Martin, 1997:  
ABJ 137(5): 382-385.

## **How do Varroa Mites Spread?**

- 1. Migratory beekeepers moving infested colonies Around the country.**
- 2. Lost bees from dying colonies- they join healthy Colonies and bring their mites with them.**
- 3. Drifting drones. Drones can enter or exit any Hive without being challenged; they have been Shown to drift for miles from their original hive.**
- 4. Infested bees placed into package bees, into Nukes or transferred to weak colonies for buildup.**
- 5. When your bees rob weak or dying colonies.**

## Grease Patty Formula:

**4 lbs [1.8 kg] granulated sugar**

**1.5 lbs [0.68 kg] hydrogenated vegetable oil [Krisco]**

**1/4 lb [.113 kg] honey**

**and 1/4 lb [.113 kg] of mineralized salt**

**[available at feed stores at \$7 for 50 lbs; put salt into a blender to pulverize]**

**1.6 ozs [45 cc] of natural wintergreen oil.**

**One batch will treat about 8-10 hives, depending on number of brood chambers, size of patties, etc. We place 5 small patties (about 2 ozs each) on top of each brood chamber and a 1/2" [1.27 cm] "roll" across the entrance, about 3/4" [1.9 cm] back in (otherwise, rain will wash it away).**

# Grease Patties



**Salt Patties**



**Rolled Salt Patty at Entrance**



**Dadant Screened Bottom**



**Salt Patty Results**



**William C. Schnute, [wschnute@honeyflowfarm.com](mailto:wschnute@honeyflowfarm.com)  
Uses our salt pattie mix in grease guns + SBB;  
had 86% success in 150 colonies last few years.**



**William C. Schnute's patty mix applied to front Entrance of hive.**

# Feeding Essential Oils In Sugar Syrup

## The development of Honey-B-Healthy



Honey-B-Healthy



Emulsion Testing



Top Feeding



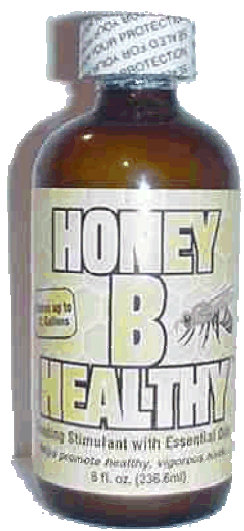
Boardman Feeder



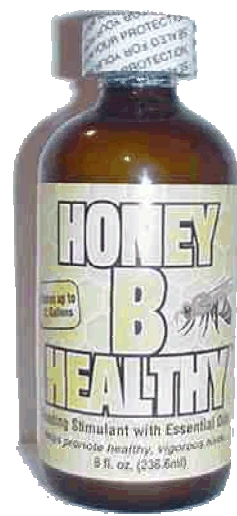
Bees Consuming Treatment



Bottom Reservoir Feeder



# Honey-B-Healthy Video



**Video Of Colony Brought  
Back From PMS**

**October 1995**



**September 28, 2000**

# Honey-B-Healthy Feeding

## WVU Agronomy Farm, Sep 2000



Hort Farm Experiment



Healthy Hive



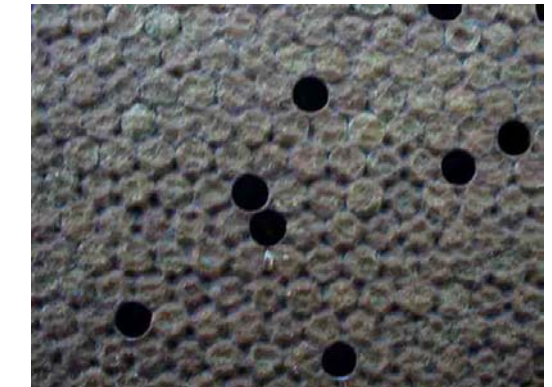
Healthy Bees On Comb



Checking Cells



Trace Amounts Of Deformed Bees



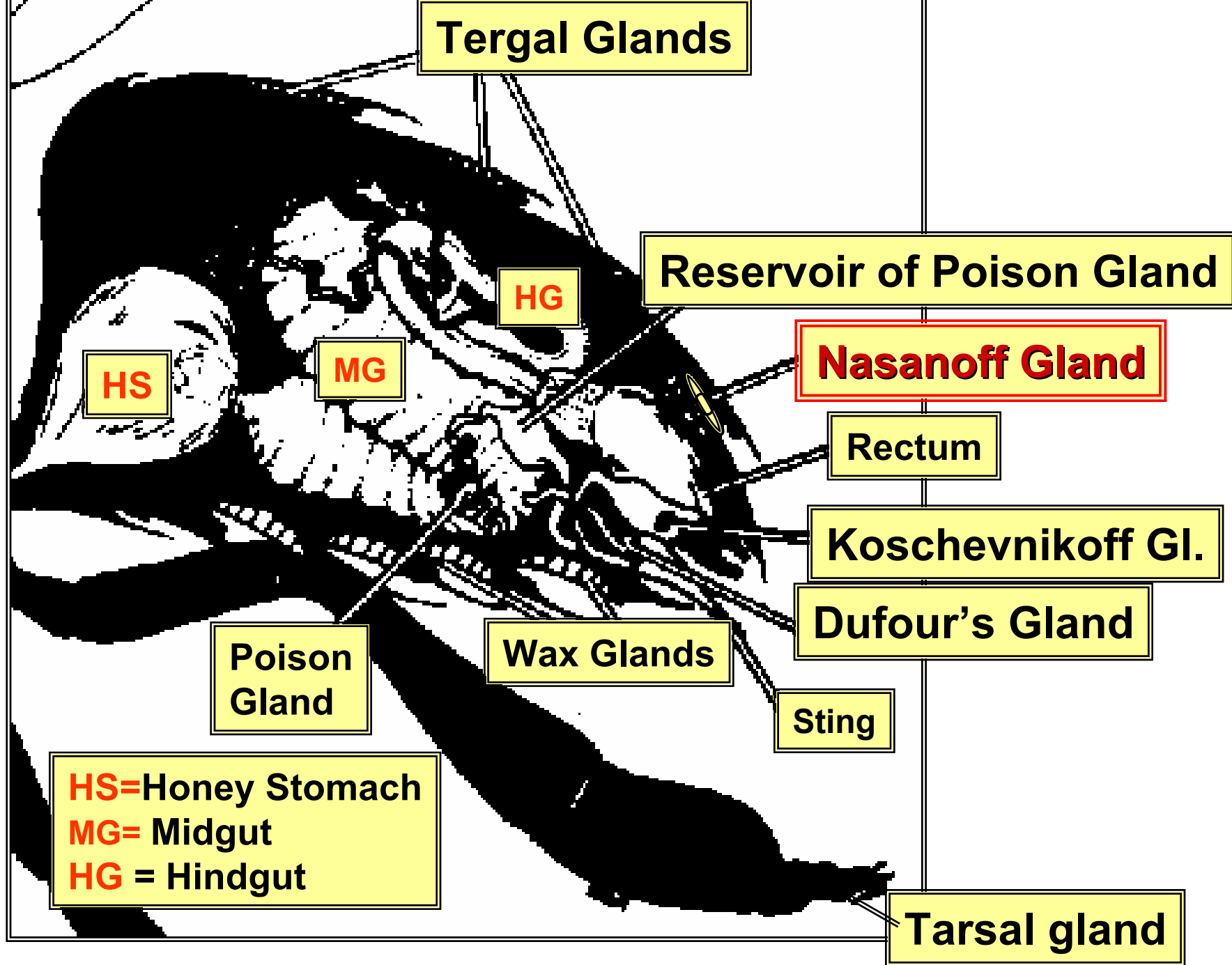
Healthy Brood Comb

# The Nasanoff Gland

Functions to attract workers

To a swarm

<u>Pheromone</u>	<u>Chemical</u>	<u>Function:</u>
Nasanoff	<b>Geraniol</b>	Orientation
	Nerolic Acid	"
	Geranic Acid	"
	<b>(E)-Citral</b>	"
	<b>(Z)-Citral</b>	"
	(E-E)-Farnesol	"
	Nerol	"
	Others?	?



# Constituents of Lemongrass Oil

Source - Harvested from:

Tropical Grasses: *Cymbopogon citratus* (DC.) Stapf  
*Cymbopogon flexuosus* (Nees) Stapf.

Constituents: Citral (75-85%)

Methylheptanone

Citronellal

Geraniol

Limonene

Dipentene

Others?

Underlined components are HB pheromones.

# Using Honey-B-Healthy

**Two teaspoonfuls in a quart of 1:1 sugar syrup delivers a total of one cc of both essential oils (0.5 cc each);**

**The essential oils are evenly distributed throughout the syrup.**

**Honey-B-Healthy produces rapid build up of bees and [in our opinion] helps to reduce pathogens. However, Honey-B-Healthy does not significantly reduce mite numbers. It also helps to introduce queens: spray the brood frames and queen cage with a little syrup containing HBH, and the bees will accept the queen with no chance of balling. It also helps to reduce stings: sprinkle the bees and mix a little on your hands and watch the difference in bee behavior- - you will get very few or no stings at all. An important use is with formic acid fumigators [see below]; it greatly reduces queen loss and queen malfunction.**

# Formic Acid Fumigator



**Top View; outside dimensions: 18" by 12 1/2"**

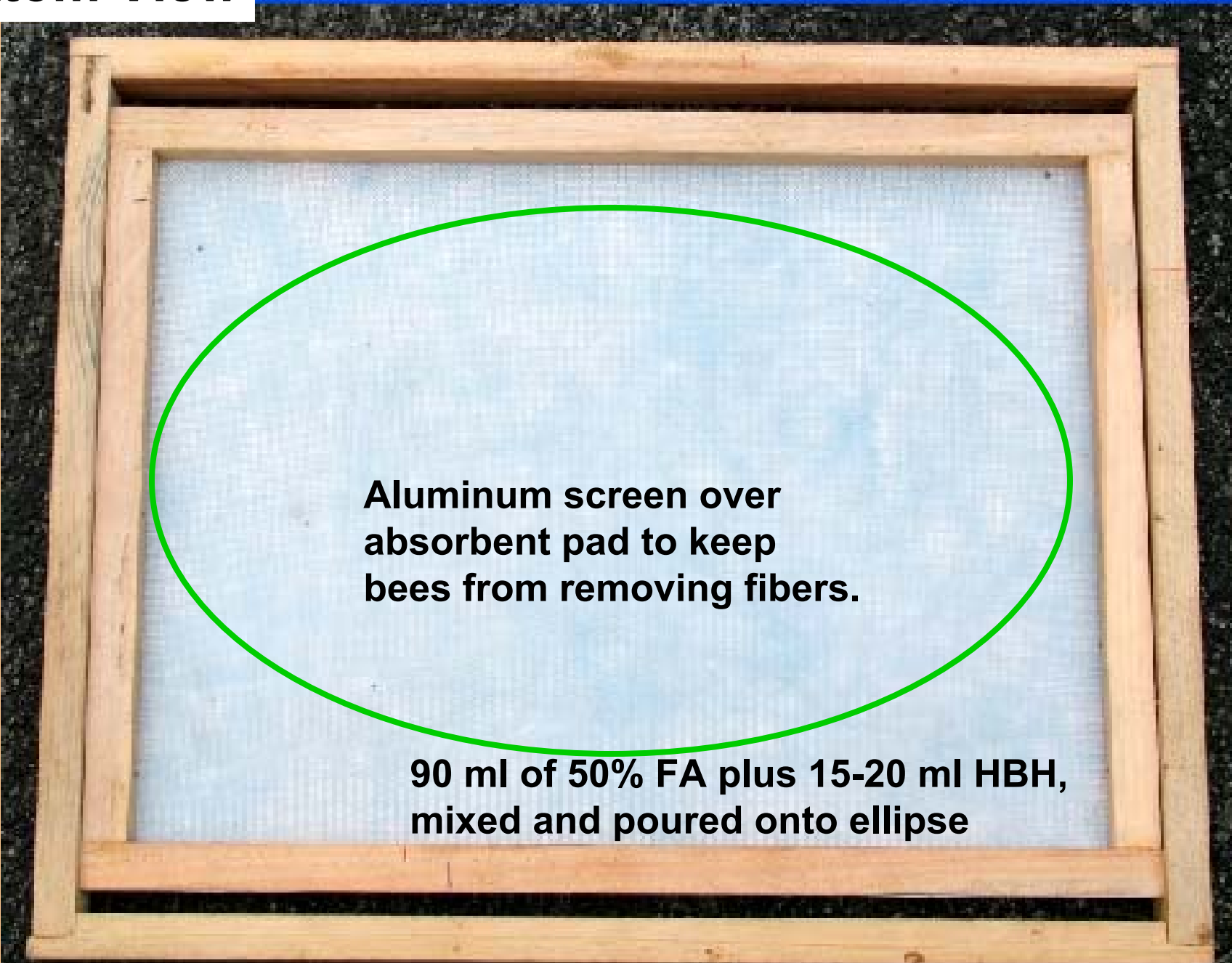


**Aluminum flashing**

**bee way**

**bee way**

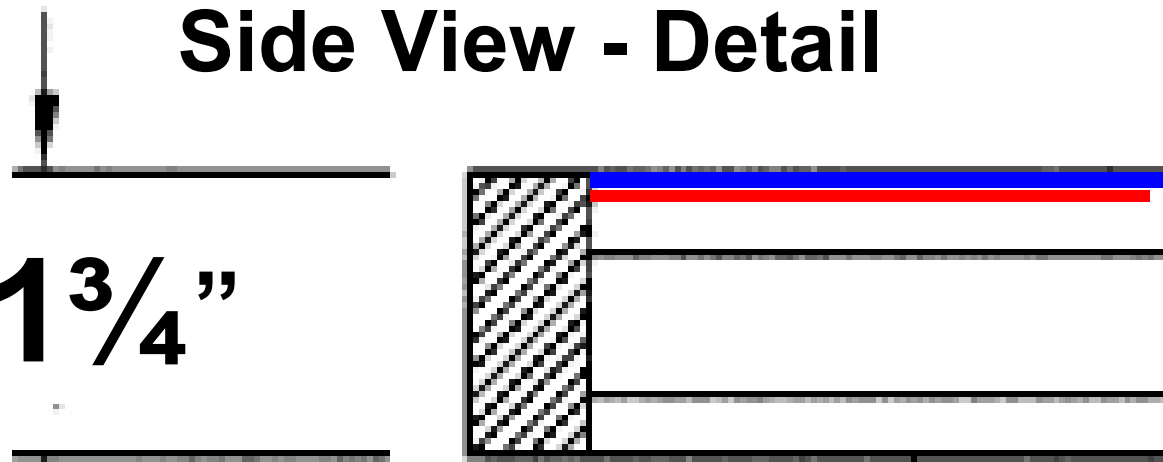
# Bottom View



**Aluminum screen over  
absorbent pad to keep  
bees from removing fibers.**

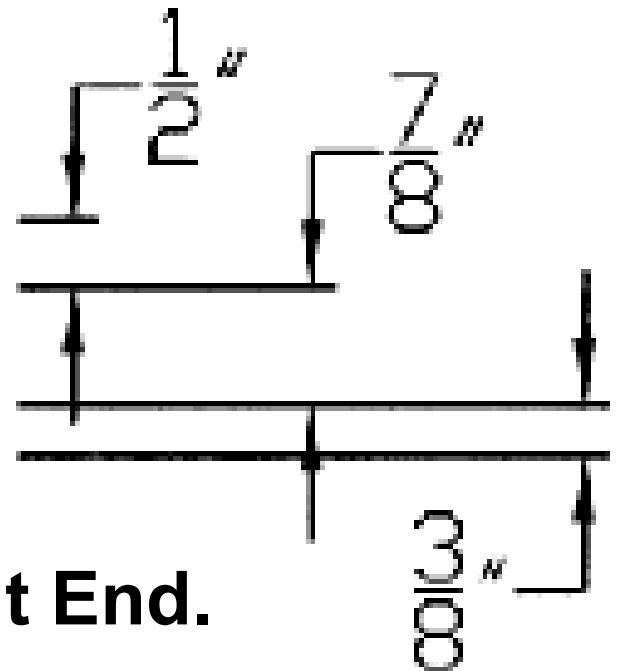
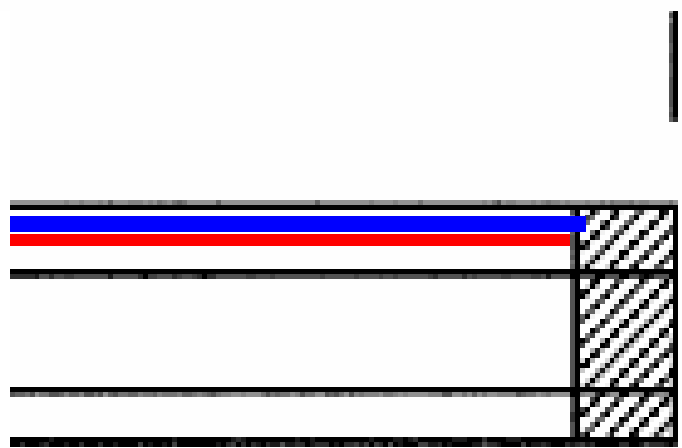
**90 ml of 50% FA plus 15-20 ml HBH,  
mixed and poured onto ellipse**

# Side View - Detail

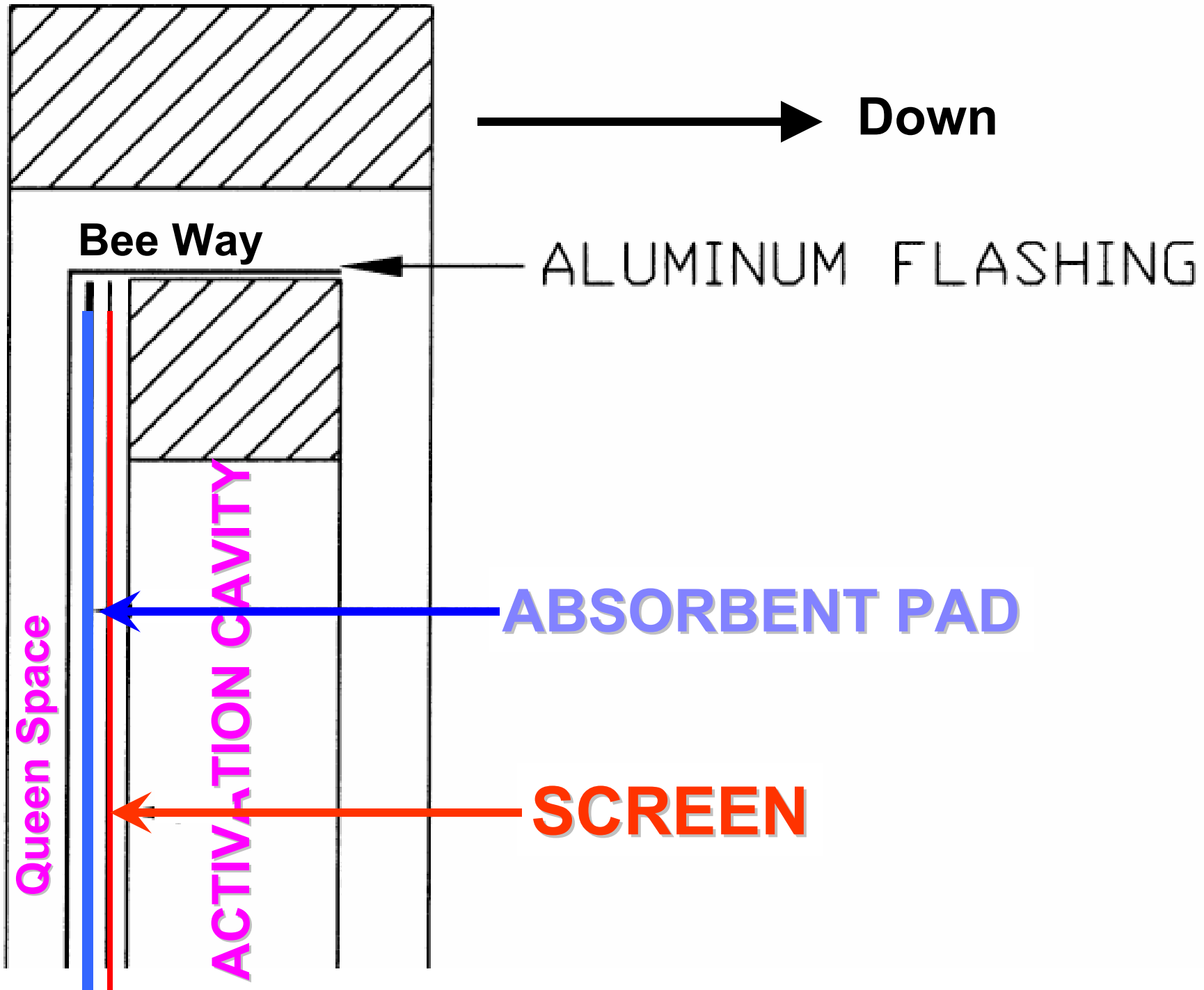


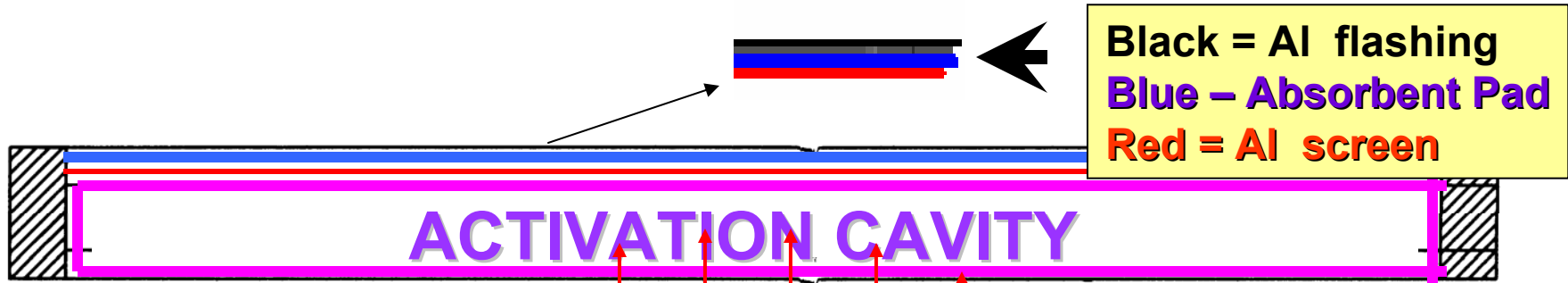
Black = Al flashing  
Blue – Absorbent Pad  
Red = Al screen

# Side View, Left End.



# Side View, Right End.





The space [purple lines] below the Aluminum screen [red] is critical to the function of the fumigator. **Heat** from the brood rises into this 'activation cavity'; the heat causes the 50% formic acid and HBH to quickly evaporate, and the bees vigorously fan this formic-HBH vapor throughout the hive. In three separate experiments (Sep 01) -10 hives each- when 5 or more frames of brood were present, the temperature in the brood nest was 94° F, in the Activation Cavity, 92° F, and at the entrance, 90° F. By noon the next day, virtually all formic acid had evaporated and the fumigator was removed. Brood cells were opened and all mites were dead; no bee brood were killed; only a very few varroa invading food at the bottom of the cell were still alive.

## **Application:**

- 1. Ambient Temperature should be 60 to 95° F.**
- 2. Apply treatment between 13:00 & 18:00.**
- 3. Manage all brood frames in one or two brood chambers.**
- 4. Add 85cc (2.8oz) of 50% FA solution to container, then 15cc HBH, mix thoroughly, pour onto absorbent pad in fumigator. Place above upper brood chamber.**
- 5. Tape all openings shut; if using screened bottom board, close with masonite or aluminum sheet.**
- 6. Reduce entrance to 3” [7.5cm] at center.**
- 7. Remove fumigator next day between 12:00 & 18:00.**

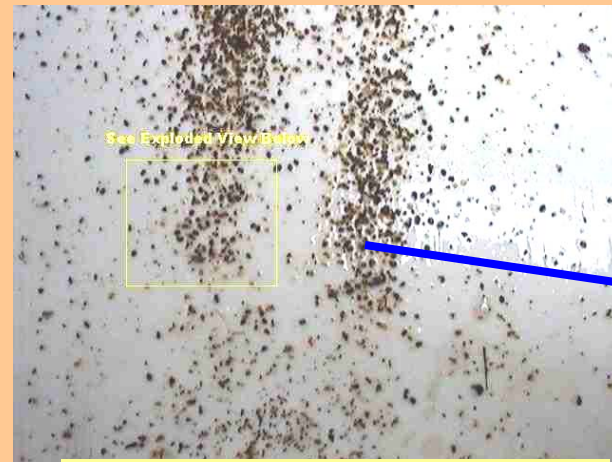
**In most cases, only one treatment is needed per season. We often go two seasons between treatments, depending on mite density in brood cells.**

# Formic Acid Fumigator

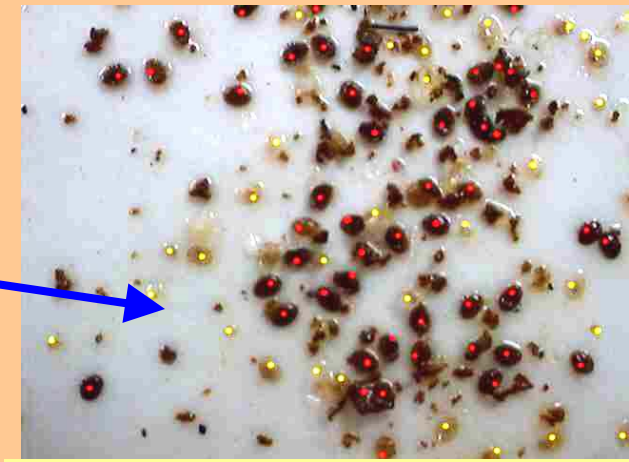
Top three pictures show initial treatment on 09/12/2000  
Bottom two pictures show second treatment on 09/28/2000



Test Hive #5 Rick's; 12Sep00



Results Hive #5 Rick's



Close-Up Hive #5-49 mites

## Second Treatment 16 Days Later:



Rick's Hive #5 9/28/00



Exploded View 9/28/00, 8 mites

# Results of Using the 50% Formic Acid Fumigator



**Video I**

**Detector Board Demonstration**



**Video II**

**Mite Drop**

## **Typical Results:**

- 1. Varroa Mites are killed in cells as well as on the bees.**
- 2. Dectector boards show large mite drop for 13-14 days after treatment [time required for brood emergence].**
- 3. A few varroa mites in newly capped cells survive the fumigation; they immerse themselves in larval brood food at the bottom of the cell.**

## **Cost for FA treatment using the Bob Noel Formic Acid Fumigator.**

**Cost of 15 gallons of 90% FA, about \$100 (\$142 with deposit).**

**One gallon of 90%FA = \$6.66 (\$9.47).**

**Dilution of 1 gal. to 50%, makes up about 1.8 gallons  
(6.81 liters).**

**@ \$6.66/gal. or  $\$6.66/6.8$  liters = \$0.979 per liter (\$1.39).**

**One treatment requires 90cc or .09 liters of mix,  
(.09\*\$0.979) = \$0.088 (or \$0.125) per treatment [cost of FA].**

**One gallon of 90% FA [\$6.66] will make 1.8 gallons  
of mix at 50%, = 6.81 liters =  $6,810\text{cc}/90 = 75.67$  treatments.  
( $\$6.66 / 75.67 = \underline{\$0.088}$  or  $\$9.47/75.67 = \underline{\$0.125}$  per treatment)**

**Source for Formic Acid: Chemicals & Solvents, Inc.,  
1140 Industry Ave., SE, Roanoke, VA;  
phone: 703-427-4000. They sell a 15 gallon, heavy  
plastic drum of 90% FA + \$42 drum deposit for \$142.**

# **Cost of HBH Concentrate - eliminates Queen Loss (about 25% in hives treated with FA only.)**

A bottle of HBH costs \$12.95, = 8 ozs = 237 cc

We add 15cc of HBH per treatment of 90cc of FA,  
=  $12.95 / (237/15) = 12.95/15.8$  doses = \$0.82 per hive.

One 8 oz bottle of HBH is sufficient for 15.8 colonies.

One 16 oz bottle of HBH is sufficient for 31.6 colonies.

Cost of Syrup [one quart of 1:1 Syrup]:

Sugar:  $1.1 \text{ lb}/50 * 24.00 = \$0.53/20 = \$0.03$  per treatment.

Add 20cc HBH to 1 Qt of 1:1 syrup:  $(20/237)*12.95 = \$1.09$ ;

1 Qt of Syrup does 20 hives  $(\$1.09/20) = \$0.055$  each.

Total for HBH-Syrup:  $\$.03 + \$.055 = \$0.085$  per hive.

**Total cost of one FA treatment (less labor):**

**FA \$0.088 + HBH \$0.82 + Syrup \$0.055 = \$0.963.**

**After mixing with HBH, the final concentration of  
Formic Acid is about 43%.**

**Will the honey bee become...**

... **EXTINCT?**