Varroa destructor: Enemy #1 of the European honey bee

Ing.-BSAE Winfridus Bakker

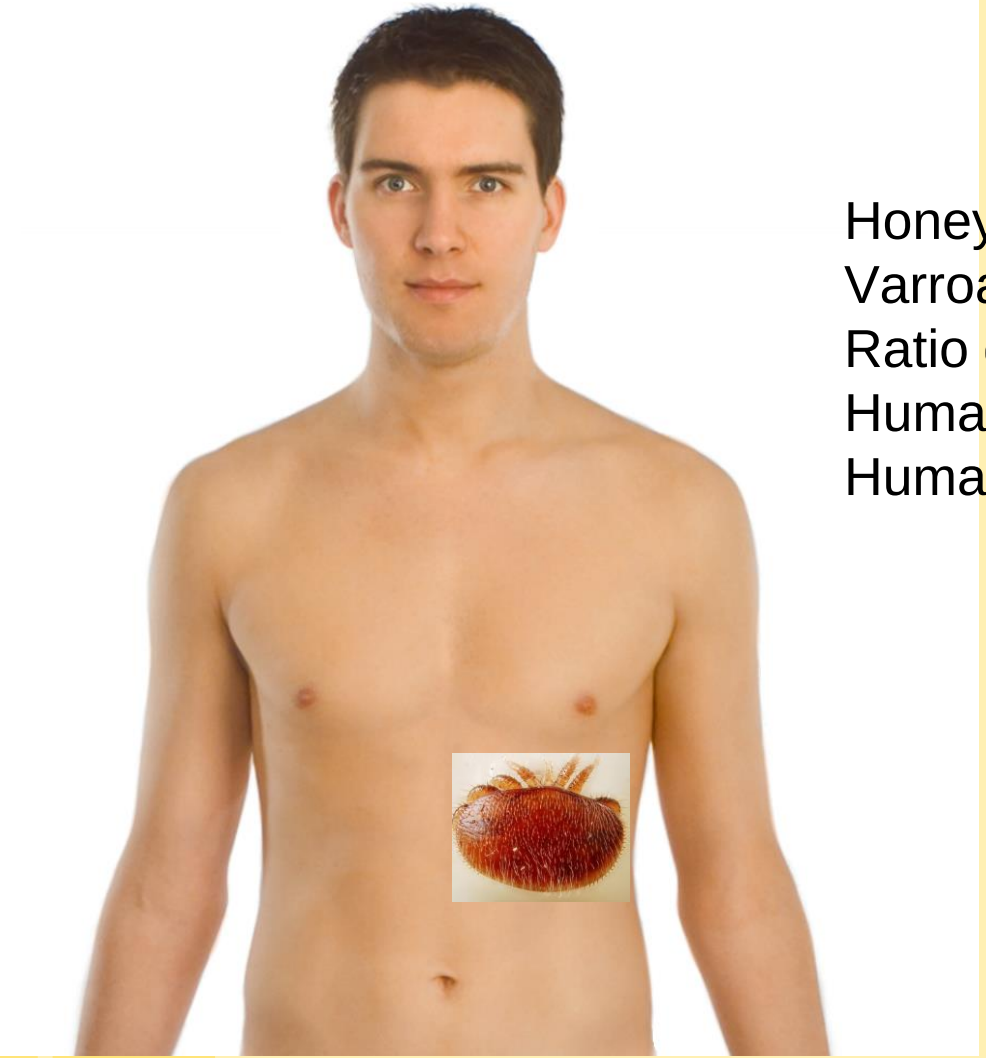
45 minutes

Bee parasites…Mainly Mites

The adult female varroa mite has a reddish-brown, oval body about 1.1 mm long & 1.7 mm wide (± 0.07”).

The male mite is smaller, with a yellowish, spherical body ± 0.8 mm in diameter.
Both are visible with naked eye.

- Varroa (Varroa destructor): Natural host is also Apis cerana, from SE Asia & feeds on brood & adults.
- Tracheal mite (Acarapis woodi): Natural host is Apis cerana, from SE Asia & affects adult bees.



Honey bee weighs = 160 mg
Varroa mite weighs = 0.453 mg.
Ratio difference is 253.
Human weight of 176 lbs÷253 =0.5 lbs
Human weight of 80 kg ÷ 253 = 226 g.

Varroa, a different species complex

Dr. Anderson (1997) (Apimundia ‘99) concludes that **Varroa** consists of different species.
Only one has jumped from Apis cerana to Apis mellifera.
The original Varroa jacobsoni is smaller than the Varroa destructor.
Varroa j. can not easily reproduce on brood of Apis mellifera.

Genetic DNA has determined that there are 2 haplotypes (variations in the DNA that are so close together that they tend not to recombine).

- Korean one which is the bad strain & called now Varroa destructor &
- Indonesian - Japanese - Thai strain, which is the original Varroa j.

The Korean Varroa strain is the one that has jumped from the Apis cerana to the Apis mellifera (European honey bee) causing issues worldwide.

History

- First discovered in 1904 in Java,
- Dutch investigator called Oudemans.
- Korea 1950,
- Japan 1958,
- USA 1987,
- Now present worldwide.
- External mite.
- Feeds on hemolymph & bee body fat.
- Mites transmit different viruses.
- Natural host to the Apis cerana co-existing for millennia.
- Reproduces in cells with developing worker and drone brood.

- European bee only recently exposed to Asian Varroa mite,
- Has little tolerance,
- Little grooming,
- Is larger than Apis cerana,
- Has less hair for protection,
- Biggest threat to European bees.

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Fast spread of Varroa

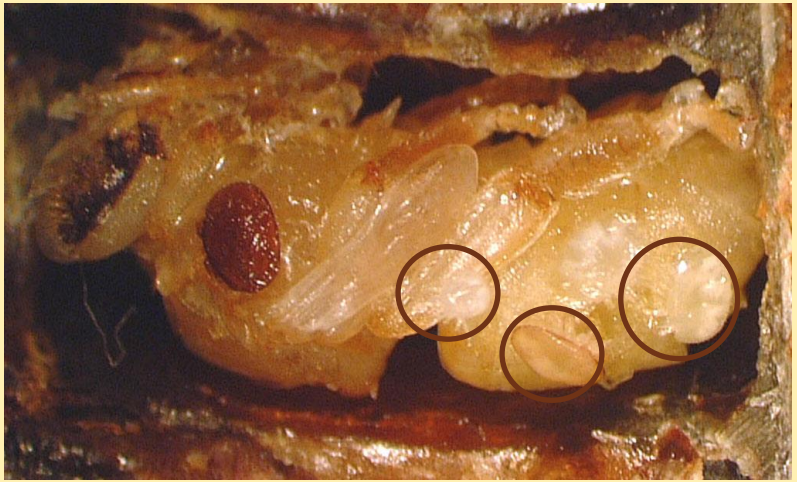
- Honeybees raised in high-density hives →high densities of mites.
- Commercial beehives can maintain extremely damaging infestations.
- Slower development of *Apis m.* relative to *Apis c.* →more mite reproduction.
- Once introduced in a region, mites spreads quickly between bee colonies.
- Spread quickly due to swarming, robbing & drifting bees.
- Contact between drones outside of bee-garden.
- Transport on secondary hosts such as bumblebees → could be a factor?
- Road transport commercial bee keepers & buying infested colonies.

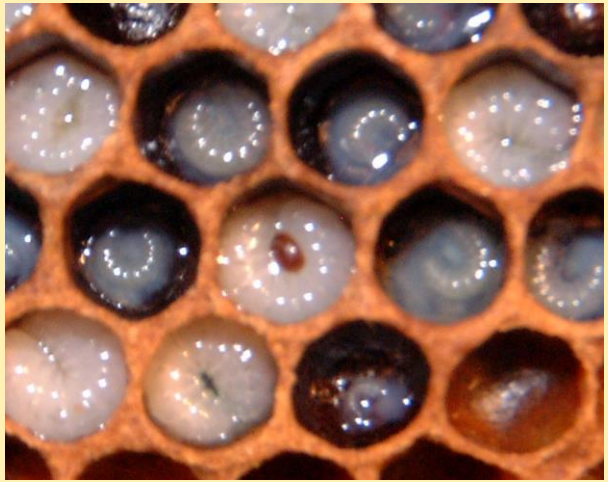
- Unlike a bacterial/viral epidemic, the spread of varroa does not spread immunity.
- Few resistant strains of *A. mellifera* identified, mostly re-infestations occur.
- The mite has spread to wild honeybees → a reservoir for re-infestations?

Varroa destructor

a parasite of honey bees

Phoretic





Some background info on Varroa mite

- Life span between 25 days and 5 months.
- Mite do not have eyes.
- Get around recognizing chemicals which float in the air.
- It knows its location just from the smell.
- Mites get chemical signal from the bees when they can start invading bee cells & start mite reproduction.
- The more brood cells, the more invasive are the mites.
- Freshly capped brood cells activate oogenesis (reprod.) in ♀ mites.
- 2-3 ♀ offspring from drone cells & 1-2 viable ♀ from worker cells.

Life cycle Varroa d.

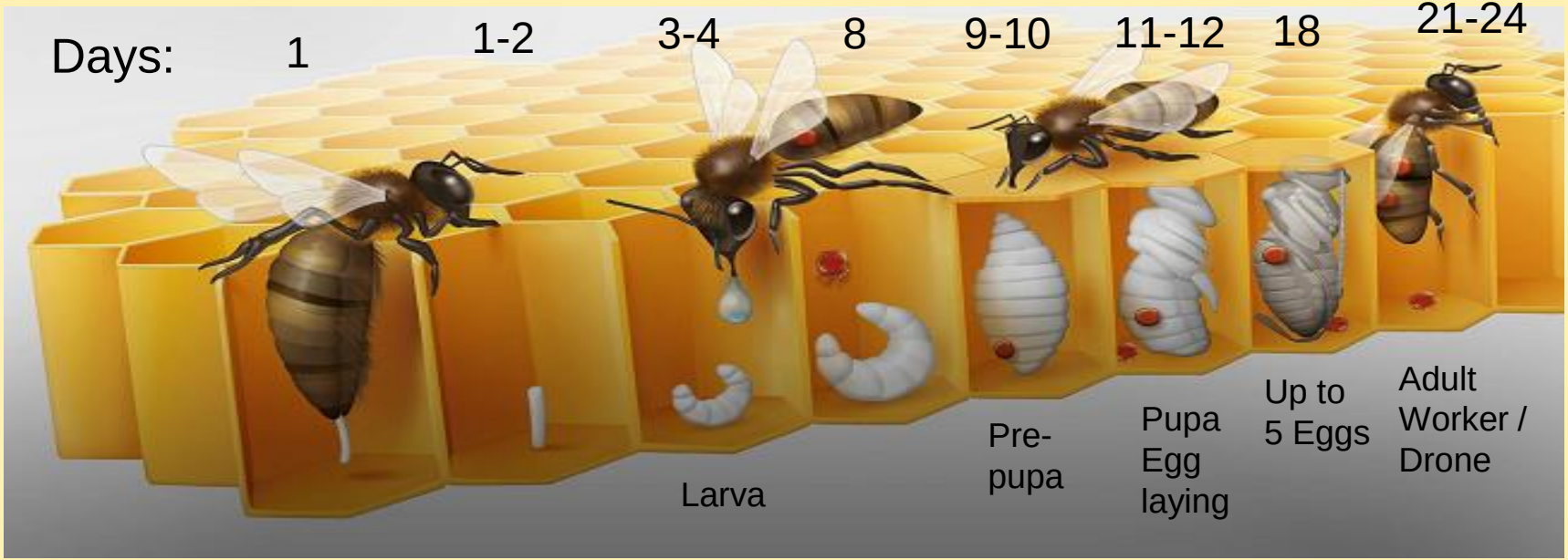
2 Stages:

PHORETIC stage: riding on worker & drone bees.
Period between 5 to 11 days with brood in colony.
Mites hop between bees & spreading viruses.
When they jump & miss they fall down on sticky board for us to count.
Natural mite drop is a fraction of existing mites.

REPRODUCTION stage: in sealed brood cells.
♀ Mother mite will start laying 1st egg 70 hrs (±3 days) after cell is capped.
First egg will be a male to fertilize the ♀ sisters that emerge later.
Young ♀ mites are already mated when they emerge from cells together with mother mite that can repeat cycle up to 7 times.
Males & white (underdeveloped) ♀♀ will die when cells are opened.

1-Varroa Life Cycle & Stages

Incubation	
Queen	16
Worker	21
Drone	24



Mite control, Monitoring & IPM (Integrated Pest Management)

Varroa – Infestation threshold

- Know your infestation rate, checking hives once a month.

OPTIONS

- Mite drop on a sticky bottom board placed below the screened bottom board, ***not as accurate***, needs practice; <1-2 mites/day threshold in spring & 10/day end summer. Has many advantages:
  - No need to disturb bees going in the hive & no killing of bees.
  - Confirms if there is a laying queen, can see how dirty the sticky board is.
  - Can see if there are intestinal problems in the bees.
  - Can see activity in hive on the bottom board, infestation of moth/SHB.
- Sugar roll method: 300 bees in a jar with powdered sugar, 12 to 25 mites is a threshold.
- Alcohol roll method: Will kill bees, easier to count & very accurate.

Severe infestation rate

31 SHB

Severe infestation rate

616 mites

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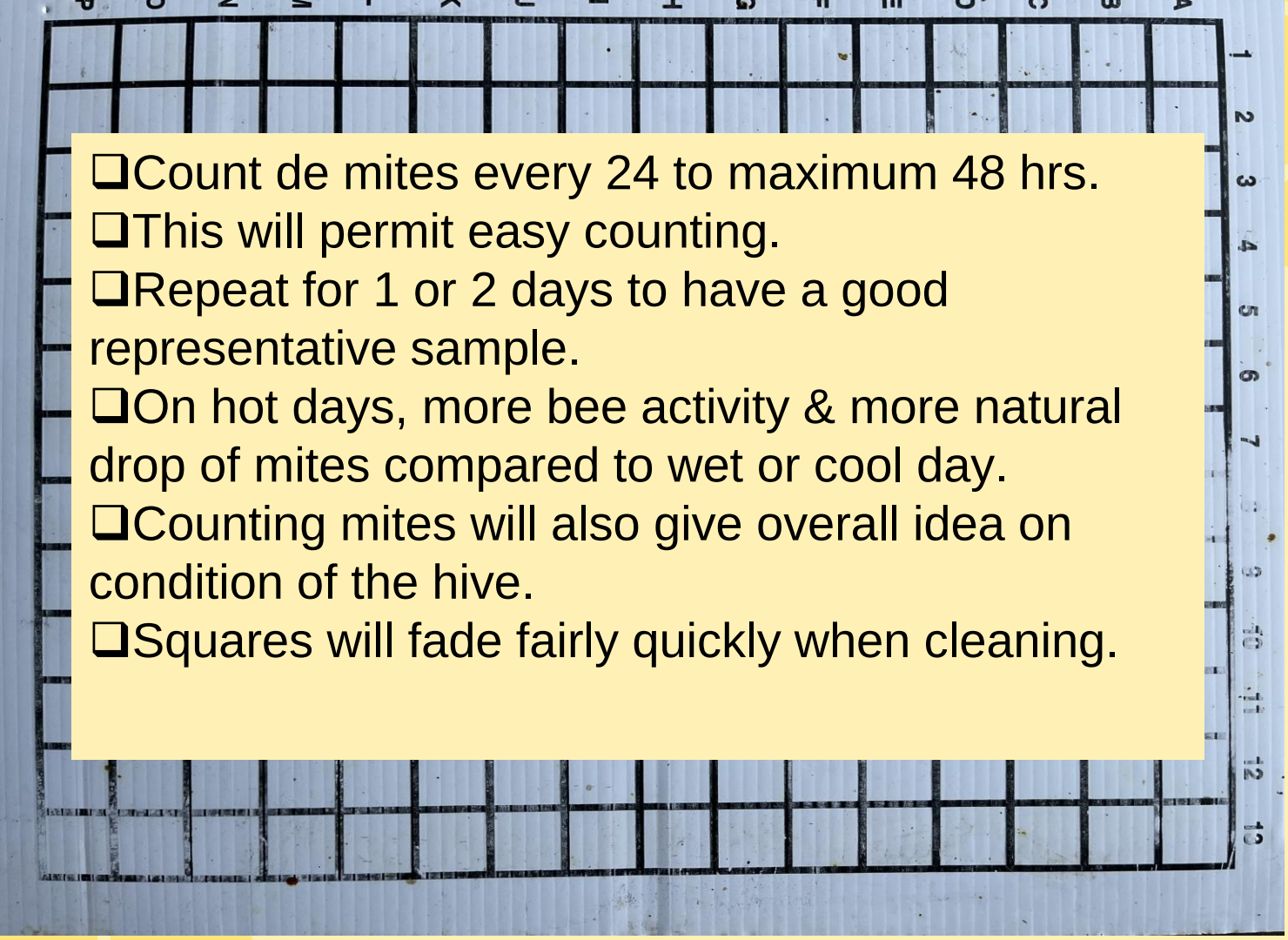
148 mites



- Count de mites every 24 to maximum 48 hrs.
- This will permit easy counting.
- Repeat for 1 or 2 days to have a good representative sample.
- On hot days, more bee activity & more natural drop of mites compared to wet or cool day.
- Counting mites will also give overall idea on condition of the hive.
- Squares will fade fairly quickly when cleaning.

With squares easier to count the mites, but…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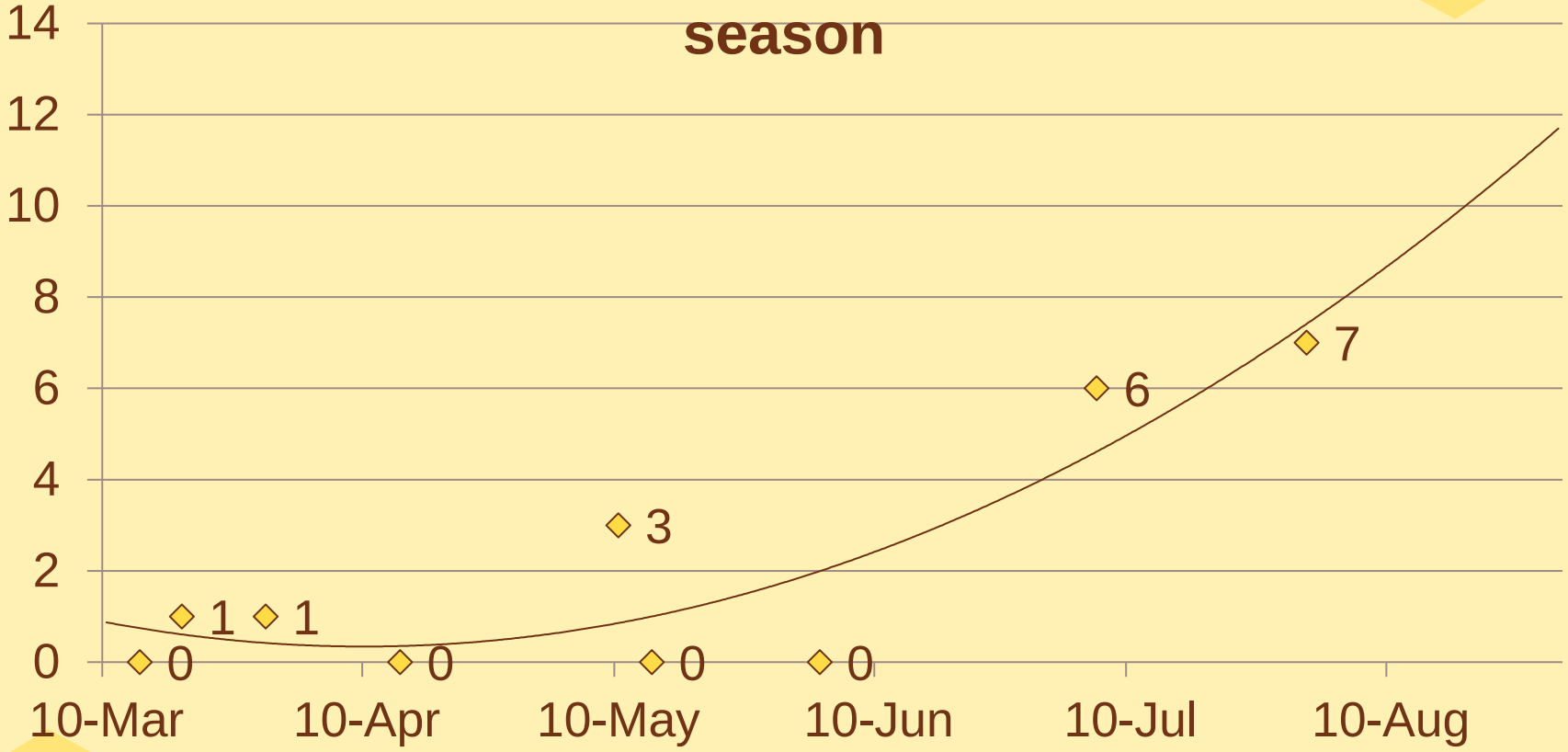
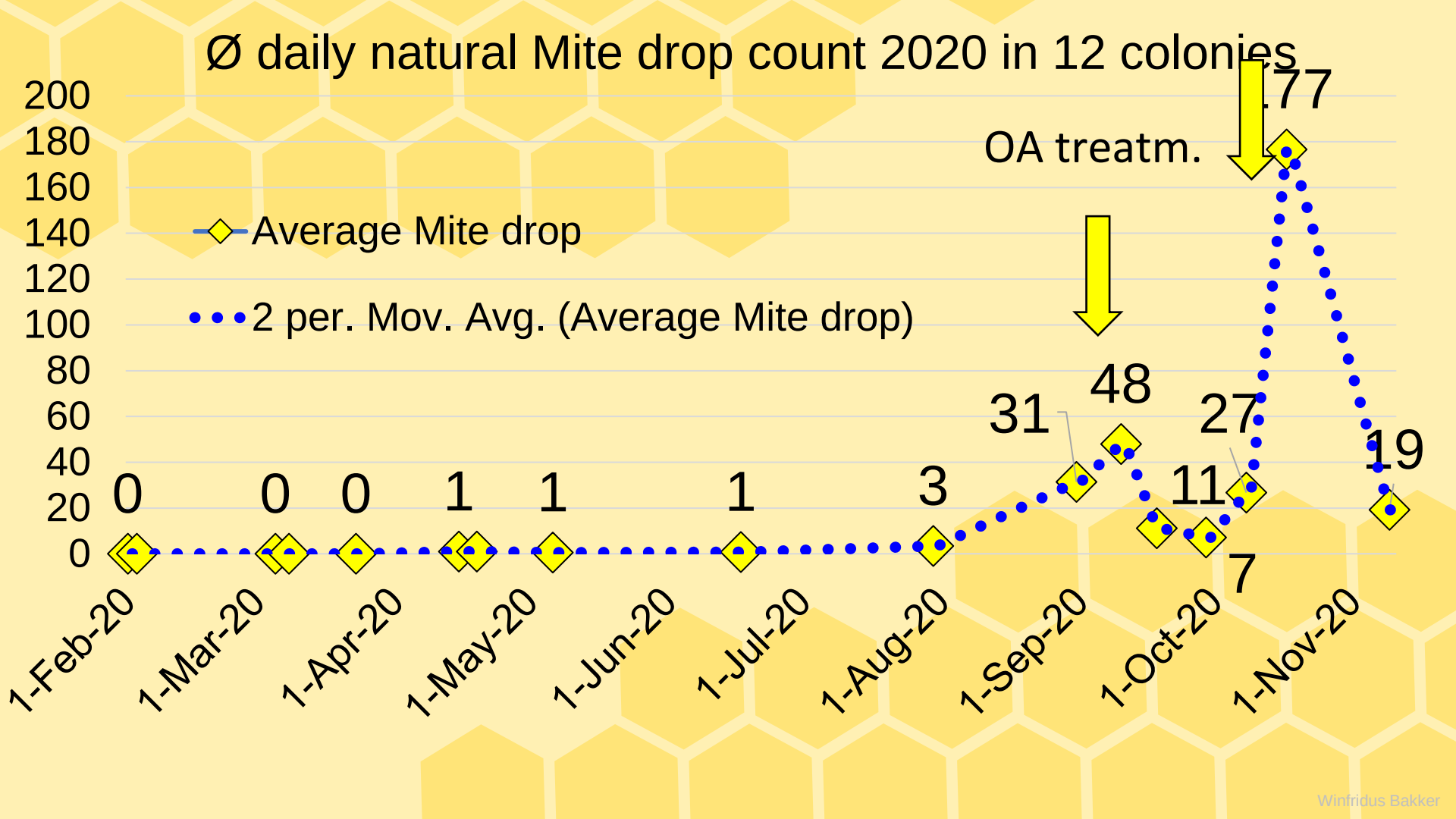
Daily mite count on a sticky board during a season



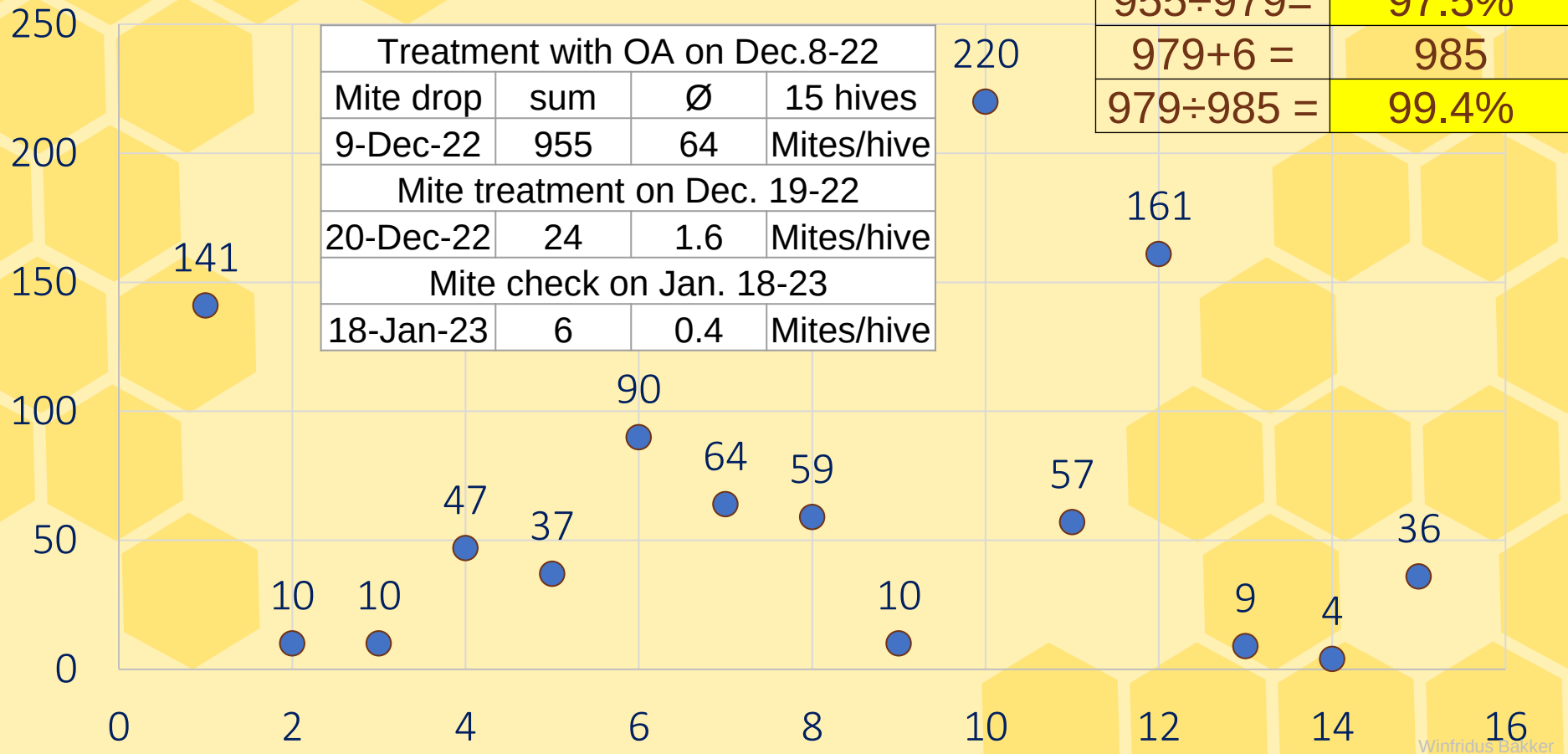


Hive	2022 before	OA Treatm	Colony	Mite count
#	OA treatm.	11-Feb-22	strength	14-Feb-22
8D	1	*	+++	58
2	7	*	-	5
8A	5	*	++	79
12	27	*	+++	415
8	4	*	++	18
11B	5	*	+++	70
8B	1	*	++	256
8E	1	*	++	47
SB-7A	15	*	++	692
7	5	*	+	175
9	1	*	+++	88
11A	0	*	+	9
12B	1	*	+++	76

1 Day mite drop > OA treatment
Dec. 9-2022

#	Efficiency
955 +24 =	979
955÷979=	97.5%
979+6 =	985
979÷985 =	99.4%

Treatment with OA on Dec.8-22			
Mite drop	sum	Ø	15 hives
9-Dec-22	955	64	Mites/hive
Mite treatment on Dec. 19-22			
20-Dec-22	24	1.6	Mites/hive
Mite check on Jan. 18-23			
18-Jan-23	6	0.4	Mites/hive



How many mites do you have in your hive?

With sticky board evaluation

- Phoretic: # of mite drop/day * 67 (personal evaluation).
- Reproductive hive: 80% of mite # are in brood cells.
- 20% are phoretic & only a few induce natural drop.
- More natural drop with active colonies (temp. related too).

What is acceptable? (personal).

- Early spring 1 day drop: low = <2 active hive.
- Early summer 1 day drop: low = <5 active hive
- Late summer 1 day drop: low = <10 active hive with queen.

Life span reduction by 50% & honey yield loss by 40%.

1-Varroa - Control

- Freezing drone brood for 72 hours.
- Treatment with **soft** chemicals:
  1. Organic acids like Formic acid.
  2. Thymol - essential oil & very popular.
  3. Oxalic acid - plant based acid (3.5 g/ hive).
  - Oxalic acid - probably one of the most effective products.
    - 2x or 3x/year to control infestation.
    - Hive must be broodless, no supers on top for honey extraction.
    - Gasification of the hive → temperature dependent.
    - Drip method (most secure effective method).

2-Varroa - Control

- Treatment with hard chemicals – miticides.
- Lipophilic → chemicals absorbed by fat and lipids.
- Resistance has developed in mites from prolonged use.
- Chronic exposure to low doses over time affects bee health.
- Cannot be used during the honey flow.

- Hard chemicals are absorbed in wax. Products not recommended. Mostly used by commercial bee keepers or emergencies.
- Have a consistent program against Varroa that starts with measuring mite load. (IPM = Integr. Pest Mgmt).
- Freezing drone brood, test outside hives, swarms that you bring in.
- Queen selection for hygienic behavior (long term).

Genetic crosses / selections

- **V**arroa **S**ensitive **H**ygienic behavior (**VSH**).
  - Reproduction of varroa mites triggers removal by bees.
- Reproduction of mites is simply more pronounced in highly productive colonies.
- Selecting for better queens also covers:
  - Gentle behavior,
  - Low swarming instinct,
  - Productivity,
  - Activity based on temperature.

Deformed Wing Disease

Conclusions

- The varroa mite is strongly parasitic on European bee colonies.
- Control viral hive diseases by controlling mites.
- Use entrance reducers to control robbing & drifting bees.
- Have good ventilated and sunny spots for hives.
- Have sufficient food sources nearby for strong colonies.