

OP-112 [Bee Health]

Open source Varroa resistance through breeding selection

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Problem and goal

Even though the western subspecies of *Apis mellifera* originally showed little resistance to varroosis, I observed as early in as the beginning of the 1980s that different origins showed different levels of infestation. Since 1990, I have tried to integrate increased Varroa resistance into the selection of the breeding lines of our Buckfast bee using intensive breeding methods.

Methodology and technique

The only varroa-reducing measure was just one treatment per year. Without further treatments, the differences can be recognised in the following year from mid-July and conclusions can be drawn for breeding selection. Epigenetic effects are also important: even if the genetics are fully or partially present, the colony never manifests its resistance potential if intensive treatment against Varroa is carried out continuously.

The technique of sD insemination (according to John Harbo) as a filter, infections and counts in small colonies as well as the safe overwintering of the elites have been brought to practical maturity for our region with Belgian colleagues and with ARISTA.

Breeding methods

Combination breeding has proven to be an advantageous breeding method for enriching lines with resistance traits. The precise selection of haploid drones is of particular importance here.

RESULTS: We have not treated the breeding station for seven years and the production colonies for four years, and have hardly any losses due to mites. An old non-selected line with eight to ten colonies on a separate apiery serves as a comparison to all this. From this we 'harvest' around 10,000 mites a year to infect the test series at the breeding station. This old line must be treated with the AS vaporiser in August. These results were already predicted announced in 2018 in an external scientific test by the French INRA/ISTAP and have since been confirmed by many thousands of colonies in the practising beekeeping community at home and abroad. Medication and supplements are taboo.

Open source breeding

Varroa resistance genetics are made available to beekeepers in the region on 2 mating places. Beekeepers who have understood and apply the principle of inheritance, enthusiastic and rarely have to treat a colony.

Varroa resistance

Paul Jungels

Who we are

49th Apimondia Congress Copenhagen-Varroa Resistance Paul Jungels

Apiculture Jungels

Bienenprodukt aus dem Naturpark Our

- Beekeeper since 1968
- We founded our family business in 1984
- With time comes change...

...Victor took over the business in 2023

Our core business:

- Beekeeping → Sustainable colony maintenance & harvest
- Production → Producing homemade bee-products
- Sales → We make a living by selling our homemade products (not queens)

Website QR



How & why

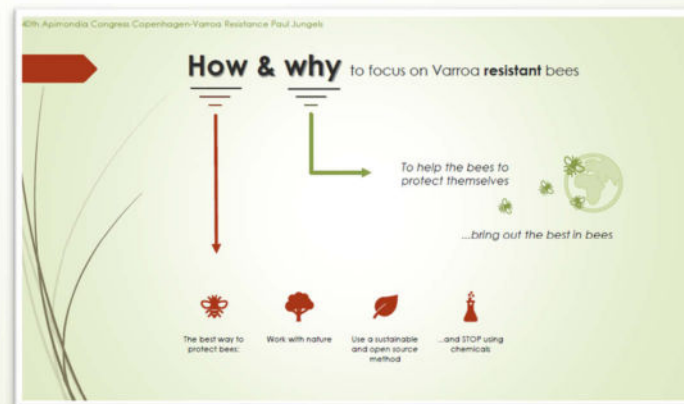
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How & why

to focus on Varroa resistant bees

To help the bees to protect themselves

...bring out the best in bees



The best way to protect bees:

- Work with nature
- Use a sustainable and open source method
- ...and STOP using chemicals

Call for action

49th Apimondia Congress Copenhagen-Varroa Resistance Paul Jungels

Call for action

...and a few onliners to help you spread the word

to bee (resistant) or not to bee...?
...that's the question to our answers!

today's actions = tomorrow's results

What does this mean for the average beekeeper?

We need open mating stations where resistance genetics predominate.

→ open source breeding

No other beekeeping measure has saved beekeepers and nature more than the breeding of disease-resistant bees.

spread genes, not chemicals

Don't waste time on pesticides → focus on resistance

Quit chemical dependence → choose Beehabitation!



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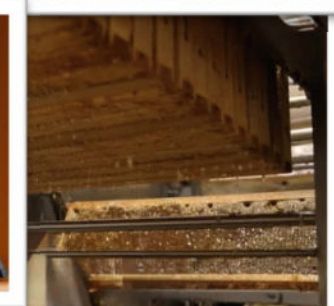
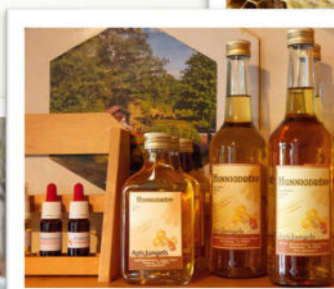
Our core Beesiness



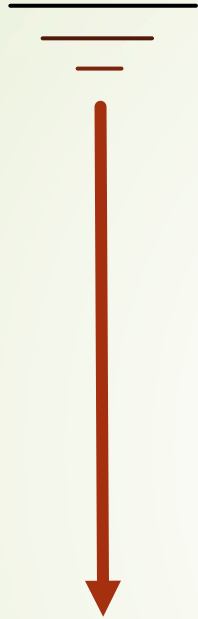
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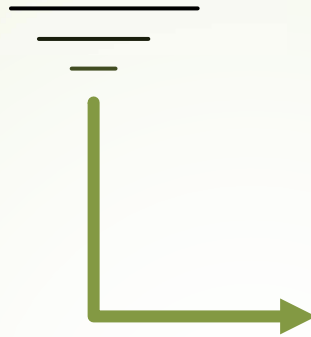
Website QR



How & why to focus on Varroa resistant bees



The best way to protect bees:



To help the bees to protect themselves



...bring out the best in bees



Work with nature



Use a sustainable and *open source* method



...and STOP using chemicals



How to:



work with nature



use a sustainable &
open source method



...and STOP using
chemicals



Queens that do not match quality standards get replaced in autumn or spring

Vitality and disease resistance have been the most important breeding goals in our apiary for over 40 years.

The best queens are transferred to the breeding station



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Resistance mechanisms we know today that bees pass on to each other

- **VSH = Varroa Sensitive Hygiene**, (highly heritable) better hygiene (by removing conspicuous brood) in the colony
- **SMR = suppressed mite reproduction** is the result of the clearing behaviour (VSH) and the disturbances in the cycle of Varroa reproduction in the brood (partially unresearched).
- **Absence of signals (kairomones)** from the brood to the Varroa mites.
- **Epigenetics:** Excessive treatments can result in disabled resistance traits
- **Grooming** = hardly heritable according to Harbo and Harris 1999

The goal:
Take the best Buckfast bees and make them Varroa resistant

Results of our breeding



August 2020 was the last time we treated the colonies – and subsequently found during inspections that the infestation in 75% of the colonies did not justify this.

No further treatments
and no other varroa-reducing measures!
We lose about 4% of our colonies each year during hibernation.

- Our colonies are strong and productive throughout the year
- the queens live longer again (treatment = poison?)
- The bees are spared the torment of acid treatments



Our Buckfast lines today are just as true to their heritage

- high-yielding
- slow to swarm
- extremely gentle
- far more disease-resistant than the original lines 40 years ago

Above all, they are now resistant to varroa mites



How to:



work with nature



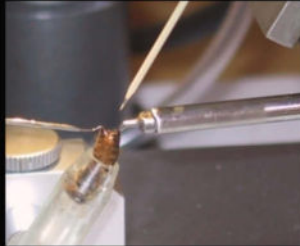
use a sustainable &
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...and STOP using
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Determine resistant colonies: main steps

Single drone insimination



Harvest varroa mites from colonies (old Buckfast lines without Varroa resistance)

- 1) Get the mites out of the brood by locking the queen in a special cage (no open or closed brood)
- 2) Remove the mites with powder sugar



Right age for evaluation

With this kind of targeted infection and counting of the brood, all resistance mechanisms of a bee colony are measured, not only VSH (some of the mechanisms are not researched yet)



Several mite trays: At the beginning of my breeding programme in 1995, these photos taken after the Varroa treatment, served as the only phenotypic selection criteria



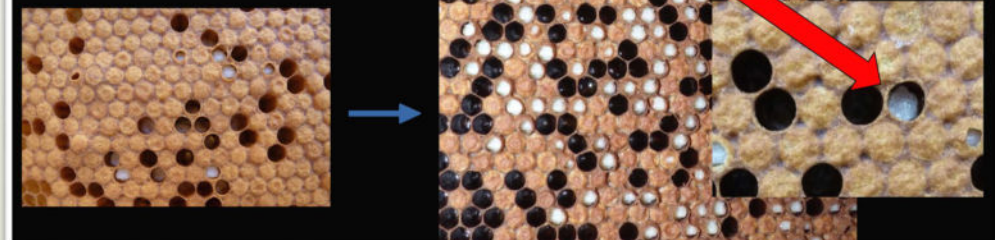
In these colonies, Varroa infestation falls below the damage threshold within 4-5 bee generations...

Introduce 150 mites (depending on colony size) per colony on a wet paper towel with the remaining sugar. The mites will jump on the bees and from there into open brood.



This is what a previously closed brood comb can look like 12 days after infection of a resistant colony.

Removing damaged brood protects against the dreaded DWV virus and other secondary infections.
Please note: it is not ill brood that is removed here, but apparently completely healthy, fairly young pupae that are infested with Varroa.



External testing by
BeeStrong from the
French INRA:

- 26 yield colonies
- sampling 31 July to 3 August 2018
- Not from the resistance programme: 703; 183; 184
- RED: survival apiary, last treatment in 2002

ID Imker	Varroa/100 Bienen	geöffnete Zellen	N° Varroa infizierte Zellen	N° Zellen mit einer Muttermilbe	% infizierte Zellen	N° Zellen mit SMR	% SMR
219= V22insV951	0	350	0	0	0%	0	/
703= B240insB180	1	488	37	35	8%	23	66%
181= B11insVmix	1	700	8	6	1%	5	83%
182= B11 nat.	2	700	37	32	5%	20	63%
183= B221insB184	2	225	48	32	21%	15	47%
184= B? F1	3	191	38	33	20%	25	76%
185= B282 nat.	1	480	39	33	8%	13	39%
186= B11 nat. (col. 300)	2	700	30	23	4%	8	35%
187= B11 nat (col. 293)	7	145	42	35	29%	11	31%
188= B11 nat. (col. 284)	1	700	8	8	1%	5	63%
256= B11 nat. (col.205)	0	350	3	2	1%	2	100%
237= B11 nat. (col. 226)	1	350	2	2	1%	0	0%
238= B11ins Vmix	0	350	1	1	0%	0	0%
239= B11 nat. (col. 227)	0	350	0	0	0%	0	/
240 = B11 nat.	1	350	0	0	0%	0	/
241= B11insVmix	0	350	2	2	1%	2	100%
242= B11 nat. (col. 228)	0	350	0	0	0%	0	/
243= B11insVmix	0	350	0	0	0%	0	/
244= B11 nat.	0	350	2	2	1%	1	50%
213= V2 nat.	0	700	35	35	5%	22	63%
215= V2 nat.	1	582	37	35	6%	15	43%
216= V2 nat.	0	700	16	16	2%	8	50%
217= V2 nat.	2	211	44	35	21%	23	66%
218= V2 nat.	1	700	25	25	4%	13	52%
219= V2 nat.	1	342	37	35	11%	19	54%
220= V2 nat.	0	350	2	2	1%	1	50%



Sampling: **31-07-2018** to **03-08-2018**

- **Blue:** not from the resistance program
- **Red:** survival apiary, last treatment in **2002**

*Why do they only have a few mites?
The genetics are the same.*

Epigenetic effects?

Varroa/100 Bienen	% infizierte Zellen
0	0%
1	1%
2	5%
1	8%
2	4%
7	29%
1	1%
0	1%
1	1%
0	0%
0	0%
1	0%
0	1%
0	0%
0	0%
0	1%
0	5%
1	6%
0	2%
2	21%
1	4%
1	11%
0	1%





Selection of drone lines for 2026

- Majority of the lines have high resistance
- We are in a situation where we now pick out the low resistant colonies of the lines

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Group	2025															
B	Short comr	Hive	%V	Qu	Mother	Drone I	Sir	In			N	FA	Inf. Ra	Comments		Ca
PJ.				26-1	B?(PJ)	nat.	4	260	4	0	0%	4	1,5%			
PJ.	Recount	mD		21-1	B125(PJ)	B103(PBO)	0	124	0	0		0	0,0%	with R - no more old brood		
PJ.		mD												NR is dead. No more old brood		
PJ.		mD	100	21-2	B125(PJ)	B103(PBO)	1	250	0	1	100%	1	0,4%	No more brood		
PJ.	Recount	mD	High ?	21-3	B125(PJ)	B103(PBO)	0	48	0	0		0	0,0%	No more brood		
PJ.	Recount	mD	High ?	21-4	B125(PJ)	B103(PBO)	0	67	0	0		0	0,0%	No more brood		
PJ.		mD	100	23-1	B125(PJ)	B103(PBO)	1	203	0	1	100%	1	0,5%			
PJ.		mD	100	23-2	B125(PJ)	B103(PBO)	0	182	0	0		0	0,0%	No more brood		
PJ.		mD	87,5	23-3	B125(PJ)	B103(PBO)	3	300	1	2	67%	3	1,0%			
PJ.		mD	100	23-4	B125(PJ)	B103(PBO)	0	250	0	0		0	0,0%	No more brood		
PJ.		mD	100	25-1	B125(PJ)	B103(PBO)	1	279	0	1	100%	1	0,4%	NR is dead		
PJ.		mD	100	25-2	B125(PJ)	B103(PBO)	0	300	0	0		0	0,0%			
PJ.		sD	100	71-1	B125(PJ)	B24(PJ)1dr	2	300	0	2	100%	2	0,7%	1 NR is dead		
PJ.	Recount	sD	50	71-2	B125(PJ)	B24(PJ)1dr	2	301	1	1	50%	3	1,0%	Multi is R, 1 NR is dead		
PJ.		sD	100	71-3	B125(PJ)	B24(PJ)1dr	1	300	0	1	100%	1	0,3%			
PJ.	Recount to define score (needed ?)	sD		79-3	B125(PJ)	B24(PJ)1dr	5	470	4	1	20%	5	1,1%			

Call for action

...and a few catchphrases to help you spread the word

to bee (resistant) or not to bee...?
...that's the question to our answers!

today's actions
= tomorrow's results



Varroa resistance traits are, according to current knowledge, inherited as recessive.

What does this mean for the average beekeeper?

We need open mating stations where drones with resistance genetics predominate.

= open source breeding

Don't waste time on pesticides
→ focus on resistance

No other beekeeping measure has served beekeepers and nature more than the breeding of disease-resistant bees.

- Tracheal mite
- Nosema
- Chalkbrood
- AFB (American -foulbrood)
- Varroa

spread genes, not chemicals



Quit chemical dependence
→ choose Beehabilitation!



Questions & Answers



...thank you!

