OP-136 [Bee Health]
EurBeSt study on varroa resistance and relevant selection criteria in European honey bees

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The EU Commission assigned an international expert team (EurBeSt) to explore the level of varroa resistance in commercially available honey bees and the possibilities of increasing it through selective breeding.

As a central part of the EurBeSt study, 23 pre-selected lines from breeders throughout Europe were tested by 21 performance testers across 5 regional case studies in different countries (France, Germany + Austria + Croatia, Greece, Italy and Poland). Besides general beekeeping traits, the study assessed annual varroa infestation development, HYG (brood hygiene via pin test), SMR (suppressed mite reproduction), REC (recapping of infested cells) and VSH (varroa sensitive hygiene). The testing methodology followed standard protocols (Büchler et al 2024) and is described in detail in the study report (EU 2022).

Average adult bee infestation in summer after one year without any treatment ranged between 0.11 (+/- 1.59) and 14.63 (+/- 1.34) mites per 10g bees and showed significant differences between lines ($F = 3.75$, $p < 0.001$) and apiaries ($F = 4.55$, $p < 0.001$). Lines specifically selected for low mite population development displayed lower infestation rates than lines not selected for this trait ($F = 0.29$, $p < 0.002$). Several lines in the German and Polish case studies remained below the economical threshold of 3 mites / 10 g of bees.

The adult bee infestation at the end of the test season was significantly correlated with VSH ($r = -0.194$) and HYG ($r = -0.130$) but not with SMR and REC. However, REC showed a significant positive correlation with VSH ($r = 0.345$) and HYG ($r = 0.135$) and may thus be used as an additional trait for the selection of varroa resistance.

Beekeepers can immediately benefit from queens selected for low mite population development, VSH, HYG and REC behaviour. There is a realistic perspective of reducing high colony losses and minimizing the need for applying medication against varroosis by establishing locally adapted and mite resistant honey bee populations.

EurBeST

Restructuring of the honey bee chain and varroa resistance breeding and selection programme

EurBeST study

on varroa resistance and relevant selection criteria in European honey bees

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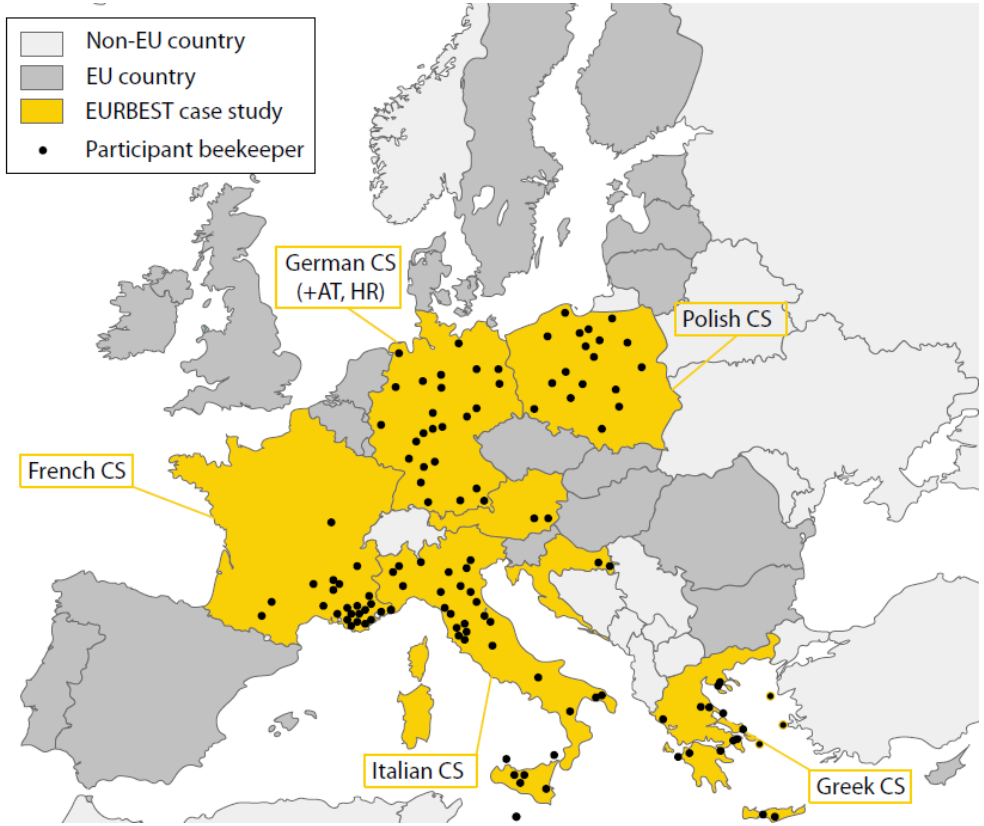
EurBeSt study

- Mandated by the European commission, running period December 2017 – June 2021
- International expert group
- **One season (2019-2020) field study by performance testers on 20 pre-selected stocks in apiaries without any treatment**
  - Bee population dynamic
  - Gentleness
  - Swarming behaviour
  - Honey yield
  - **Varroa infestation**
  - **Brood hygiene, REC, VSH, MNR**

Genotypes and test apiaries



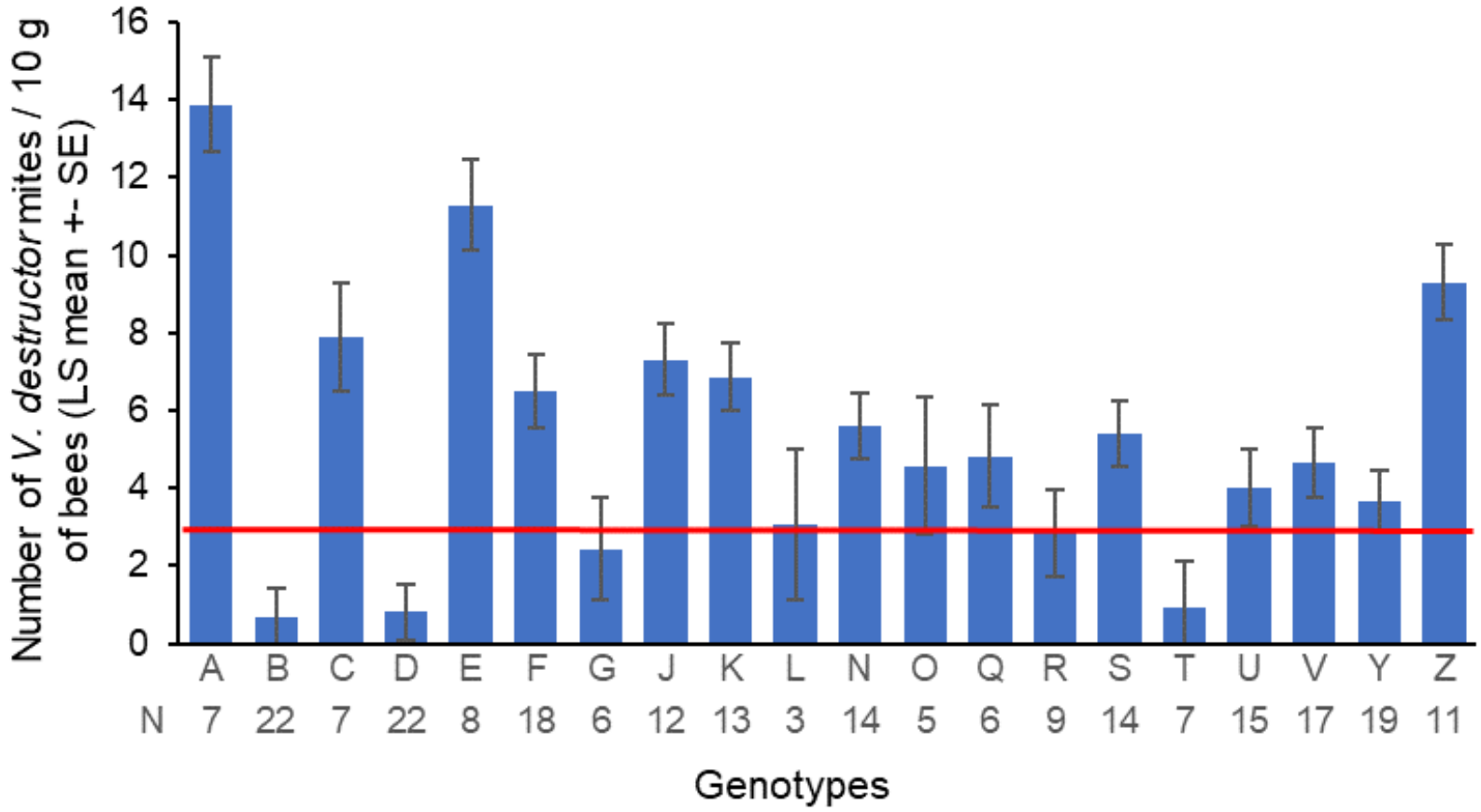
Genotype	Country of origin*	Subspecies / Race	Selection criteria**	Case study of testing	No. of Apiaries	No. of colonies
A	EL	Unspecified	SUR	EL	2	7
B	DE	*A.m.carnica*	HYG, MPD, REC, MNR	DE	3	21
C	FR	Hybrid	SUR	DE, FR, IT	3	7
D	AT	*A.m.carnica*	HYG, MPD, MNR	DE, PL	3	21
E	EL	Unspecified	MPD	EL, IT	2	8
F	IT	Buckfast	SUR	DE, FR, IT	3	18
G	PL	*A.m.carnica*	HYG	PL	1	5
J	FR	Hybrid	MNR, VSH	FR	3	12
K	FR	Hybrid	MNR, HYG	FR	3	13
L	PL	*A.m.carnica*	HYG	DE	1	2
N	IT	*A.m.ligustica*	SUR	IT	3	15
O	DE	Buckfast	MPD, MNR	DE	2	6
Q	EL	*A.m.macedonica*	MPD	EL	2	6
R	PL	*A.m.carnica*	HYG	DE, PL	2	7
S	IT	*A.m.ligustica*	HYG	EL, IT	3	13
T	DE	Buckfast	MPD	DE	1	7
U	HR	*A.m.carnica*	HYG, REC, MNR	DE	3	14
V	DE	Buckfast	MPD, MNR	DE	3	17
Y	DE	*A.m.carnica*	HYG, MPD, MNR	DE	3	17
Z	FR	Hybrid	MNR	FR	2	10

*) AT-Austria, DE-Germany; EL-Greece; FR-France; HR-Croatia; IT-Italy; PL-Poland

**) HYG = general hygiene behaviour, MPD = reduced mite population development, REC = Recapping of infested cells, MNR = Varroa mite non-reproduction, SUR = survival of untreated colonies, VSH = Varroa sensitive hygiene

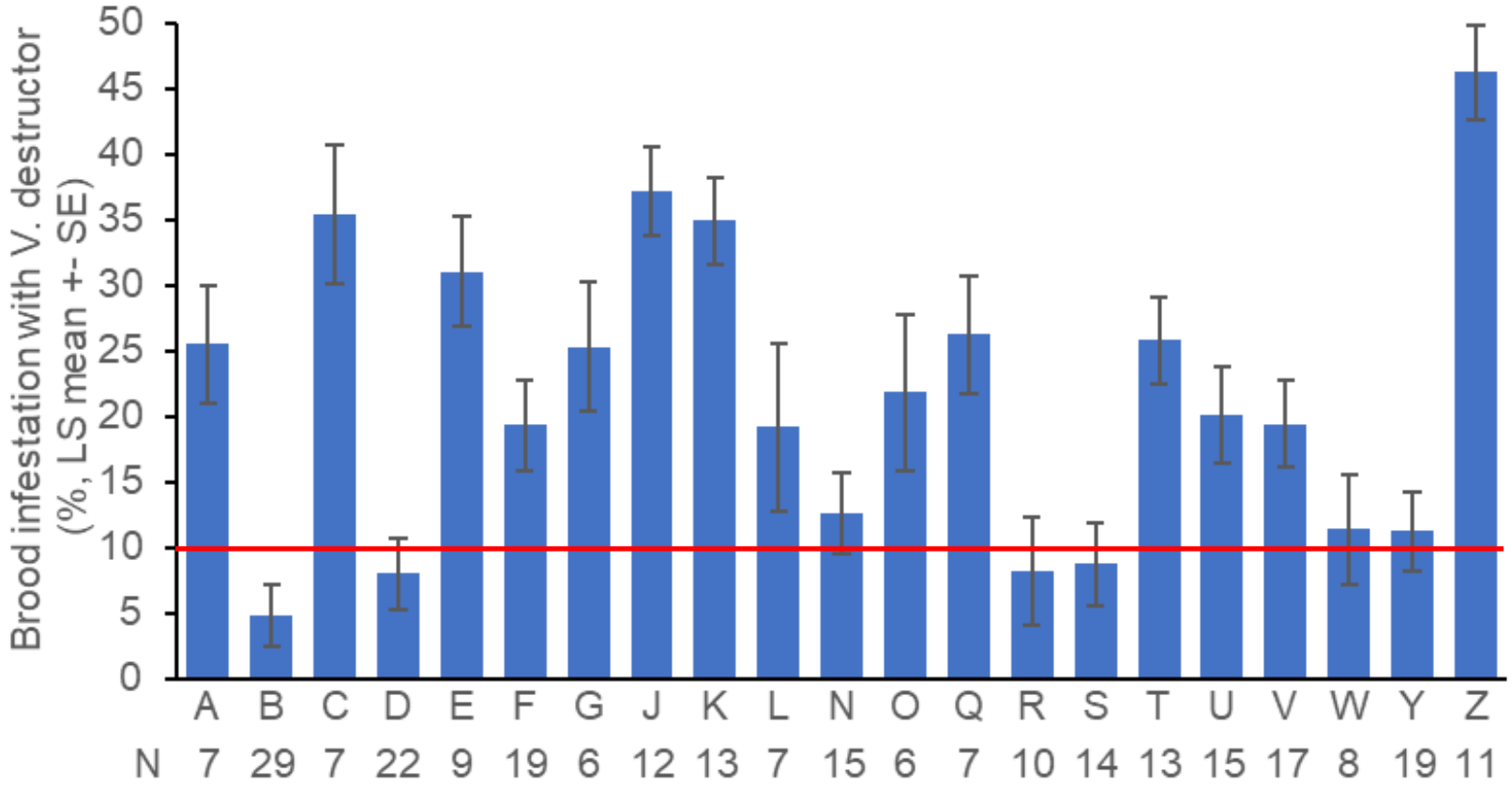
Varroa infestation at the end of season

(adjusted means +/- SE)

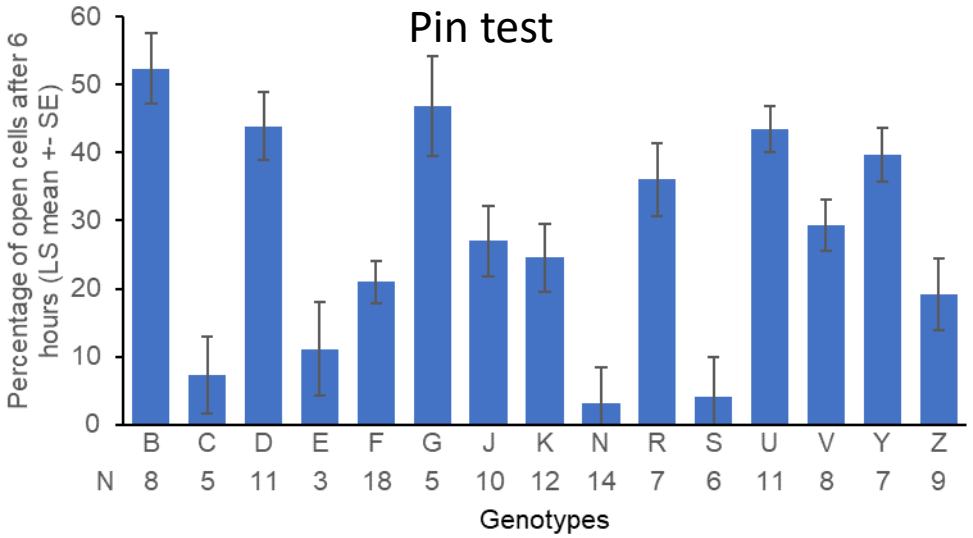


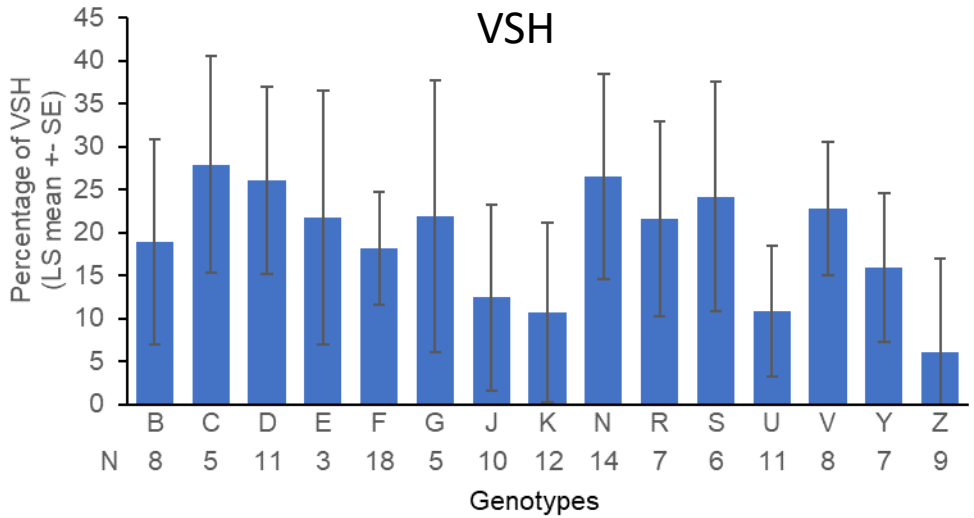
Brood infestation at the end of season

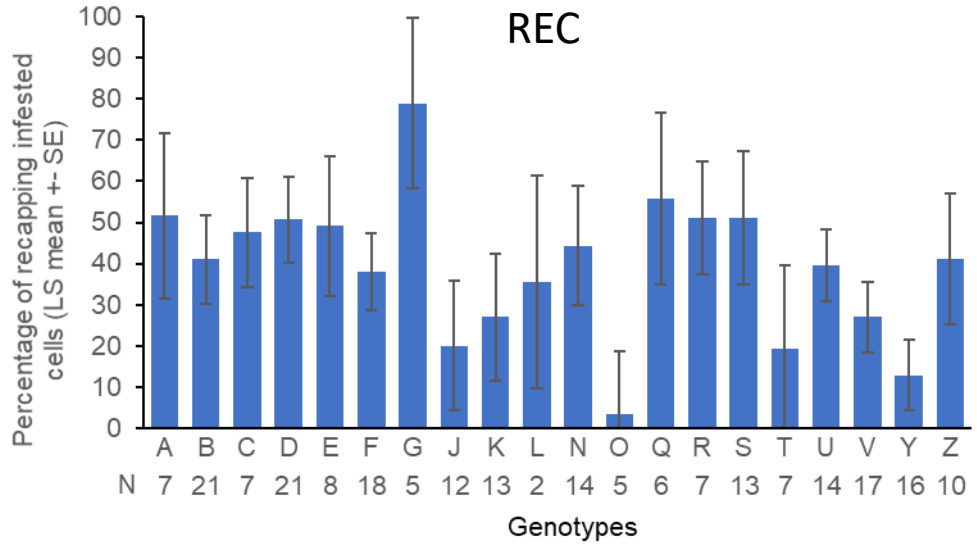
(adjusted means +/- SE)

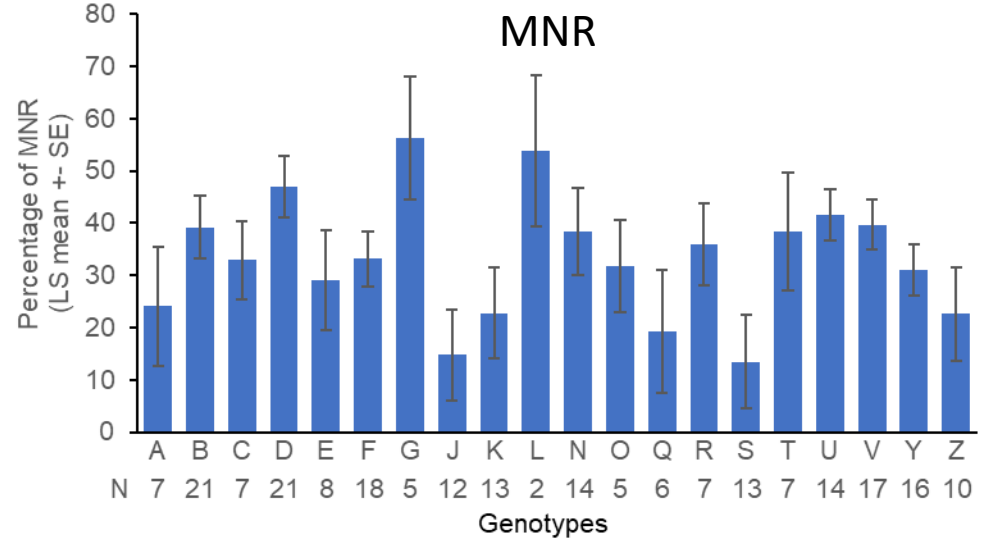


Resistance traits
(GLM analysis with all other traits regarded as covariates)

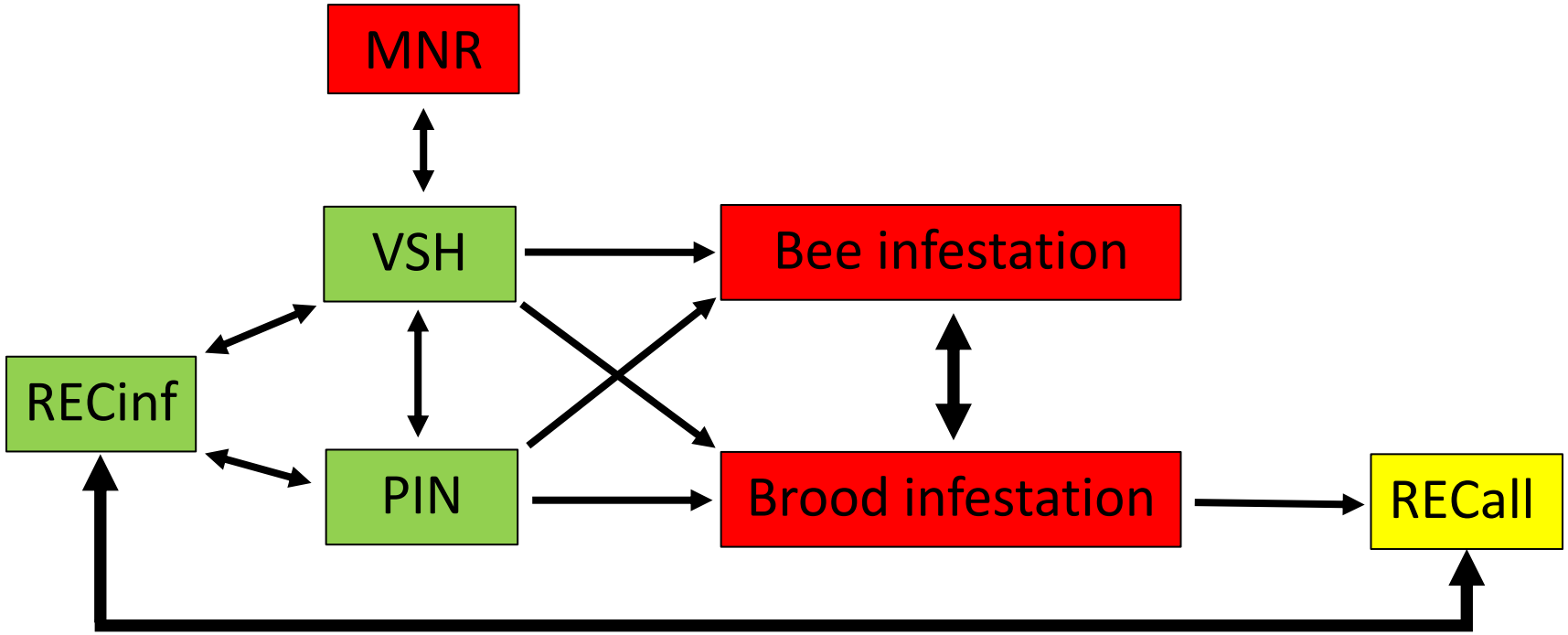








Correlation of resistance traits



	REC inf.	MNR	VSH	PIN	Brood inf.	Bee inf.
REC all	0.769**	0.073	0.313*	0.056	0.347**	0.209
REC inf		0.033	0.345*	0.135*	0.078	0.053
MNR			-0.104*	-0.060	0.066	0.072
VSH				0.294*	-0.178*	-0.194*
PIN					-0.159*	-0.130*
Brood inf.						0.592**

Study conclusions

- Strong apiary effects on infestation levels and most resistance traits
- Significant differences between genotypes for final infestation levels and brood hygiene (Pin-test)
- Pin-test and VSH identified as useful selection traits for lower infestation levels

Further reading

- Method handbooks, lectures etc. (in most European languages):
  www.eurbest.eu
- Final study report, Executive summary and leaflets (EN, DE, FR):
  https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cmef/research-innovation-and-technology/restructuring-honey-bee-chain-and-varroa-resistance-breeding-selection-programme_en