

Table S1. Primers used for molecular disease screenings. SB: stonebrood, CB: chalkbrood, AFB: American foulbrood, CER: *Nosema ceranae*, APIS: *Nosema apis*, RpS5: ribosomal protein S5 of *Apis mellifera*.

Primer	Sequence (5'-3')	Product length (bp)		Ref.
SB-F	GGTAACCAAATCGGTGCTGCTTTC	A. fumigatus	549	[1]
		A. flavus	550	
		A. niger	531	
SB-R	ACCCTCAGTGTAGTGACCCTTGGC	A. terreus	564	
		A. clavatus	562	
		A. nidulans	475	
CB-F	TGTCTGTGCGGCTAGGTG	648		[2]
CB-R	CCACTAGAAGTAAATGATGGTTAGA			
AFB-F	TTCGGGAGACGCCAGGTTA	131		[3]
AFB-R	CTTTCATGACTTCTTCATGCGAAG			
CER-F	CGGCGACGATGTGATATGAAAATATTAA	218		[4]
CER-R	CCCGGTCATTCTCAAACAAAAAACCG			
APIS-F	GGGGGCATGTCTTTGACGTACTATGTA	321		
APIS-R	GGGGGGCGTTTAAAATGTGAAACAACATG			
RpS5-F	AATTATTGGTCGCTGGAATTG	115		[5]
RpS5-R	TAACGTCCAGCAGAATGTGGTA			

Table S2. Comparisons in residual deviance between models containing no interactions, ABPV-BQCV interaction, DWV-KV-VDV1 interactions, and ABPV-BQCV and DWV-KV-VDV1 interactions using the likelihood ratio test for each disease. χ^2 : Chi-square statistic, Df: degrees of freedom.

Response variable	Interaction effects	Deviance	χ^2	Df	<i>p</i> -value
Varroa	NA	789.67			
	ABPV-BQCV	788.80	0.8620	1	0.35
	DWV-KV-VDV1	784.88	3.9198	2	0.14
	All	783.78	1.1074	1	0.29
SB	NA	117.92			
	ABPV-BQCV	117.19	0.73	1	0.39
	DWV-KV-VDV1	113.87	3.32	2	0.19
	All	113.09	0.78	1	0.38
Nosema	NA	156.23			
	ABPV-BQCV	156.14	0.09	1	0.77
	DWV-KV-VDV1	153.89	2.26	2	0.32
	All	153.74	0.15	1	0.70
AFB	NA	134.45			
	ABPV-BQCV	133.85	0.60	1	0.44
	DWV-KV-VDV1	131.64	2.21	2	0.33
	All	131.27	0.37	1	0.54
DWV	NA	3625.1			

	KV-VDV1	3606.4	18.67	3	<0.001
	All	3606.3	0.07	2	0.79
KV	NA	3407.2			
	ABPV-BQCV	3406.8	0.43	0	NA
	DWV-KV	3393.2	13.60	1	<0.001
	All	3393.2	0.02	1	0.88
VDV1	NA	3631.6			
	ABPV-BQCV	3631.6	0	0	NA
	DWV-KV	3614.5	17.16	1	<0.001
	All	3611.1	20.53	2	<0.001
ABPV	NA	2194.0			
	DWV-KV-VDV1	2187.9	6.08	3	0.11
BQCV	NA	3145.0			
	DWV-KV-VDV1	3144.4	0.65	3	0.88

References

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