

Table S1. Bee pathogen spillover and prevalence identified in hymenopteran hosts, of which are reported condition, stage, geographical area and year.

Host			Geographic area	Year	Pathogen	Prevalence (%)	Reference
Taxon	Condition	Stage					
BEE							
<u>Andrenidae</u>							
<i>Andrena</i> spp.	Wild	Adult	France	2021	ABPV	25.0%	[100]
					IAPV	25.0%	
					BQCV	25.0%	
			U.S.A.	2005	BQCV ^A	25.0%	[38]
					SBV ^A	12.5%	
					DWV ^A	62.5%	
	2008	<i>Wolbachia</i> spp.	69.2%	[128]			
		<i>Ascosphaera</i> spp.	84.6%				
<i>Andrena bicolor</i>	Wild	Adult	Germany	2014	DWV	-	[109]
			Georgia		DWV	-	
<i>Andrena haemorrhoa</i>	Wild	Adult	Germany	2014	DWV*	-	[109]
<i>Andrena helianthi</i>	Wild	Adult	U.S.A.	2013	IAPV	16.7%	[127]
					SBV	41.7%	
					DWV	66.7%	
					LSV	25.0%	
<i>Andrena helianthiformis</i>	Wild	Adult	U.S.A.	2013	IAPV	16.7%	[127]
					SBV	41.7%	
					DWV	66.7%	
					LSV	25.0%	
<i>Andrena helvola</i>	Wild	Adult	Germany	2014	DWV	-	[109]
<i>Andrena labialis</i>	Wild	Adult	France	2021	ABPV	100%	[100]
<i>Andrena rudbeckiae</i>	Wild	Adult	U.S.A.	2013	IAPV	16.7%	[127]
					SBV	41.7%	
					DWV	66.7%	
					LSV	25.0%	
<i>Andrena thoracica</i>	Wild	Adult	Kyrgyzstan	2014	DWV	100%	[109]
<i>Andrena trimmerana</i>	Wild	Adult	Georgia	2014	DWV	-	[109]
<i>Andrena ventralis</i>	Wild	Adult	Belgium	2012	LSV ^B	100%	[37]
					<i>AmFV</i> ^B	100%	
					<i>N. ceranae</i> ^B	100%	
					<i>Apicystis bombi</i> ^B	100%	
<i>Andrena vaga</i>	Wild	Adult	Belgium	2012	BQCV ^C	33.4%	[37]
					SBV ^C	33.4%	
					LSV ^C	100%	
					<i>AmFV</i> ^C	100%	
					<i>C. bombi</i> ^C	100%	
					<i>Apicystis bombi</i> ^C	100%	
<i>Andrena wilkella</i>	Wild	Adult	U.S.A.	2013	IAPV	16.7%	[127]
					SBV	41.7%	
					DWV	66.7%	
					LSV	25.0%	
<i>Melandrena</i> spp.	Wild	Adult	U.S.A.	2014	BQCV	31.1%	[210]
					SBV	6.70%	
					DWV	10.0%	
<u>Apidae</u>							
<i>Anthophora plumipes</i>	Wild	Adult	Georgia	2014	ABPV	-	[109]
			Germany		ABPV	-	
			Kyrgyzstan		ABPV	-	
			Georgia		IAPV	-	
			Germany		IAPV	-	
			Kyrgyzstan		IAPV	-	
			Georgia		BQCV	-	
			Germany		BQCV	-	
			Kyrgyzstan		BQCV	-	
			Georgia		SBV	-	
			Germany		SBV	-	
			Kyrgyzstan		SBV	-	
			Georgia		DWV	-	
			Germany		DWV	-	
			Kyrgyzstan		DWV	-	
			Georgia		KBV	-	
			Germany		KBV	-	
			Kyrgyzstan		KBV	-	

<i>Anthophora plumipes</i>	Wild	Adult	Georgia Germany Kyrgyzstan	2014	SBPV SBPV SBPV	- - -	[109]
<i>Bombus</i> spp.	Wild	Adult	France	2021	ABPV	58.6%	[100]
					IAPV	27.6%	
					BQCV	14.4%	
			U.S.A.	2005	BQCV ^D	33.3%	[38]
			France	2021	SBV	82.8%	[100]
			U.S.A.	2005	SBV ^D	100%	[38]
			France	2021	DWV	6.89%	[100]
			U.S.A.	2005	DWV ^D	100%	[38]
			New Zealand United Kingdom	2019	KBV ^D	100%	[38]
				2013	KBV	-	[91]
<i>Bombuis agrorum</i>	Wild	Adult	United Kingdom	1964	<i>N. ceranae</i> ABPV*	21.0% -	[162] [99]
<i>Bombus atratus</i>	Wild	Adult	Colombia	2013	ABPV ^E	11.0%	[125]
			Argentina	2011	BQCV ^F	74.0%	
			Colombia	2013	BQCV ^E	74.0%	[126]
					SBV ^E	16.0%	[125]
			Argentina	2011	SBV ^F	100%	[126]
			Colombia	2013	DWV ^E	100%	[125]
			Argentina	2011	DWV ^F	100%	[126]
			Colombia	2013	LSV	68.0%	[125]
			Colombia	2013	<i>N. ceranae</i> ^E	100%	
			Argentina	2009	<i>N. ceranae</i>	12.5%	[160]
<i>Bombus auricomus</i>	Wild	Adult	U.S.A.	2013	<i>Spiroloplasma apis</i> IAPV	5.00%	[125]
					BQCV	3.13%	[127]
					SBV	15.6%	
					DWV	6.25%	
					LSV	62.5%	
<i>Bombus bimaculatus</i>	Wild	Adult	U.S.A.	2015	LSV	3.13%	
					BQCV* DWV*	65.9% 9.30%	[139]
<i>Bombus bellicosus</i>	Wild	Adult	Argentina	2009	<i>N. ceranae</i>	6.25%	[160]
<i>Bombus brasiliensis</i>	Wild	Adult	Argentina	2015	<i>N. ceranae</i>	100%	[161]
<i>Bombus cryptarum</i>	Wild	Adult	Kyrgyzstan	2014	SBPV	-	[109]
<i>Bombus dahlbomii</i>	Wild	Adult	Chile	2017	ABPV	7.69%	[92]
					BQCV	23.08%	[92]
					KBV	3.08%	
					CBPV	6.15%	
					<i>L. passim</i>	6.15%	
<i>Bombus funebris</i>	Wild	Adult	Peru	2018	<i>AmFV</i>	100%	[147]
			Bolivia		<i>L. passim</i>	40.0%	
<i>Bombus griseocollis</i>	Wild	Adult	U.S.A.	2013	IAPV	12.1%	[127]
					BQCV	6.10%	
					SBV	51.5%	
					DWV	45.5%	
					LSV	15.1%	
<i>Bombus hortorum</i>	Wild	Adult	United Kingdom	1964	ABPV*	-	[99]
				2014	ABPV	2.50%	[110]
			Slovenia	2018	ABPV	66.0%	[213]
			United Kingdom	2014	BQCV	11.0%	[110]
			Slovenia	2017	BQCV	100%	[213]
			United Kingdom	2014	SBPV	35.0%	[110]
			Slovenia	2018	SBV	33.0%	[213]
			Slovenia	2018	LSV	33.0%	[213]
				2008	Microsporida	42.9%	[128]
		Artificial Infection	United Kingdom	2014	<i>N. ceranae</i>	25.0%	[83]
		Wild	U.S.A.	2008	<i>Wolbachia</i> spp.	85.7%	[128]
					<i>Ascosphaera</i> spp.	85.7%	
<i>Bombus humilis</i>	Wild	Adult	France	2021	ABPV ^G	100%	[100]
					SBV ^G	100%	
			Slovenia	2018	BQCV DWV	100% 50.0%	[213]
<i>Bombus huntii</i>	Wild	Adult	U.S.A.	2011	BQCV*	-	[211]
	Laboratory				BQCV*	-	
	Wild				DWV*	-	[212]
	Laboratory				DWV*	-	

<i>Bombus ignitus</i>	Commercial	Adult	Korea	2010	IAPV	-	[116]
					BQCV	-	
					SBV	-	
					DWV	-	
					KBV	-	
					CBPV	-	
<i>Bombus impatiens</i>	Commercial	Adult	Mexico	2014	ABPV	2.00%	[23]
					IAPV	2.00%	
	Wild		U.S.A.	2011	IAPV	31.%	[93]
					BQCV ^H	60.0%	[38]
					BQCV	69.0%	[93]
					SBV	23.0%	
	Commercial		Mexico	2014	DWV	2.00%	[23]
	Wild		U.S.A.	2005	DWV ^H	100%	[38]
					DWV	62.0%	[93]
	Commercial		Mexico	2014	KBV	2.00%	[23]
<i>Bombus laesus</i>	Wild	Adult	Kyrgyzstan	2014	CBPV	3.34%	
					BQCV*	-	
<i>Bombus lapidarius</i>	Wild	Adult	United Kingdom	2014	ABPV	22.0%	[110]
			Slovenia	2017	ABPV	30.0%	[213]
			United Kingdom	2014	BQCV	7.50%	[110]
			Slovenia	2017	BQCV	60.0%	[213]
			Slovenia	2018	BQCV	90.0%	[213]
			United Kingdom	2014	DWV* ¹	9.14%	[83]
					DWV	2.00%	[110]
					DWV	25.0%	[128]
			Slovenia	2017	DWV	10.0%	[213]
			Belgium	2013	SBPV	3.57%	[112]
			United Kingdom	2014	SBPV	1.00%	[110]
			Germany		SBPV	-	[109]
			Kyrgyzstan		SBPV	-	
			Belgium	2013	LSV	3.57%	[112]
			Slovenia	2018	LSV	9.11%	[213]
			Belgium	2013	VdMLV	3.57%	[112]
			U.S.A.	2008	Microsporidia	50.0%	[128]
			United Kingdom	2014	<i>N. ceranae</i> ¹	9.14%	[83]
					<i>Wolbachia</i> spp.	75.0%	[128]
			U.S.A.	2008	<i>Wolbachia</i> spp.	75.0%	[128]
					<i>Ascosphaera</i> spp.	100%	
<i>Bombus lucorum</i>	Wild	Adult	United Kingdom	1964	ABPV*	-	[99]
				2014	ABPV	3.00%	[110]
	Artificial Infection Wild				BQCV	2.00%	[83]
					DWV*	30.0%	
					DWV	3.00%	[110]
					DWV	-	[109]
					DWV	-	
					SBPV	3.00%	[110]
					SBPV	-	[109]
					SBPV	-	
<i>Bombus monticola</i>	Artificial Infection	Adult	United Kingdom	2014	DWV*	100%	[83]
<i>Bombus morio</i>	Wild	Adult	Argentina	2009	<i>N. ceranae</i>	12.5%	[160]
<i>Bombus opifex</i>	Wild	Adult	Peru	2018	<i>AmFV</i>	100%	[147]
			Bolivia		<i>N. ceranae</i>	28.6%	
			Bolivia		<i>L. passim</i>	16.7%	
<i>Bombus pascuorum</i>	Wild	Adult	France	2021	ABPV	71.4%	[100]
			United Kingdom	1964	ABPV*	-	[99]
				2014	ABPV	1.50%	[110]
				2017	ABPV	7.69%	[213]
			Slovenia	2018	ABPV	3.40%	
			France	2021	IAPV	14.3%	[100]
			Spain	2016	BQCV	9.40%	[214]
			France	2021	BQCV	14.3%	[100]
			United Kingdom	2014	BQCV	5.00%	[110]
				2017	BQCV	23.1%	[213]
			Slovenia	2018	BQCV	65.5%	
			France	2021	SBV	100%	[100]
			Slovenia	2017	SBV	30.8%	[213]
			Slovenia	2018	SBV	48.0%	
			Spain	2016	DWV	6.30%	[214]
			Germany	2004	DWV	100%	[69]

<i>Bombus pascuorum</i>	Artificial Infection	Adult	United Kingdom	2014	DWV*	6.67%	[83]
	Wild		U.S.A.	2008	DWV	5.56%	[128]
			United Kingdom	2016	DWV	30.7%	[36]
			Belgium	2013	SBPV	32.5%	[112]
			United Kingdom	2014	SBPV	1.50%	[110]
			Germany	2014	SBPV	-	[109]
			Belgium	2013	LSV	5.00%	[112]
			Slovenia	2017	LSV	11.5%	[213]
			Slovenia	2018	LSV	24.1%	
					VdMLV	16.3%	
			U.S.A.	2008	Microsporidia	38.9%	[128]
			United Kingdom	2016	<i>N. ceranae</i>	12.3%	[36]
			U.S.A.	2008	<i>Wolbachia</i> spp.	75.0%	[128]
					<i>Ascospaera</i> spp.	22.2%	
<i>Bombus pauloensis</i>	Wild	Adult	Bolivia	2018	<i>AmFV</i>	100%	[147]
			Argentina		CBPV	100%	[117]
			Bolivia	2018	<i>N. ceranae</i>	33.4%	[147]
			Uruguay	2014	DWV	39.0%	[215]
					BQCV	80.9%	
					ABPV	20.0%	
					SBV	27.0%	
<i>Bombus pratorum</i>	Wild	Adult	Belgium	2013	VdMLV	16.3%	[112]
				2008	Microsporidia	14.3%	[128]
					<i>Wolbachia</i> spp.	71.4%	
					<i>Ascospaera</i> spp.	100%	
<i>Bombus ruderatus</i>	Wild	Adult	Chile	2017	ABPV	28.97%	[92]
			France	2021	ABPV	50.0%	[100]
			Chile	2017	BQCV	22.07%	[92]
			France	2021	BQCV	50.0%	[100]
					SBV	100%	
			Chile	2017	DWV	5.52%	[92]
			France	2021	DWV	25%	[100]
			Chile	2017	KBV	2.07%	[92]
			Chile	2017	CBPV	2.76%	[92]
					<i>L. passim</i>	2.76%	
<i>Bombus ruderaius</i>	Wild	Adult	United Kingdom	1964	ABPV*	-	[99]
<i>Bombus rupestris</i>	Wild	Adult	Germany	2014	BQCV	-	[109]
<i>Bombus soroeensis</i>	Wild	Adult	Kyrgyzstan	2014	BQCV*	-	[109]
<i>Bombus sylvarum</i>	Wild	Adult	Georgia	2014	DWV	-	[109]
			Slovenia	2018	BQCV	91.7%	[213]
					SBV	16.7%	
					LSV	8.30%	
<i>Bombus ternarius</i>	Wild	Adult	U.S.A.	2005	IAPV [†]	100%	[38]
					BQCV	50.0%	
					SBV [†]	50.0%	
					DWV [†]	100%	
<i>Bombus terrestris</i>	Wild	Adult	Chile	2017	ABPV	5.56%	[92]
			France	2021	ABPV	72.1%	[100]
			United Kingdom	2014	ABPV	10.0%	[110]
				1964	ABPV*	-	[99]
				2014	ABPV	6.00%	[110]
	Artificial Infection		Belgium	2014	IAPV	60.0%	[216]
				2015	IAPV	-	[217]
					IAPV	-	[218]
				2018	IAPV	-	[219]
	Wild		France	2021	IAPV	16.3%	[100]
			Korea	2014	BQCV	7.09%	[138]
			Chile	2017	BQCV	33.3%	[92]
			France	2021	BQCV	20.9%	[100]
			United Kingdom	2014	BQCV	5.00%	[110]
			Germany		BQCV*	-	[109]
			Georgia		BQCV*	-	
	Commercial	Adult	Kyrgyzstan	2014	BQCV*	-	
	Wild		France	2021	SBV	95.3%	[100]
			United Kingdom	2014	SBV	2.50%	[110]
			Korea	2010	SBV	-	[116]
			Korea	2014	DWV	7.09%	[138]
			Chile	2017	DWV	13.1%	[92]
			France	2021	DWV	18.6%	[100]

<i>Bombus terrestris</i>	Wild	Adult	U.S.A.	2008	DWV	29.3%	[128]
			United Kingdom	2014	DWV	6.00%	[110]
			United Kingdom	2016	DWV	22.3%	[36]
	Artificial Infection		Germany	2014	DWV*	-	[109]
			Georgia	2014	DWV*	-	
			Kyrgyzstan	2014	DWV*	-	[109]
			United Kingdom	2014	DWV*	5.30%	[83]
				2015	DWV	50.0%	[84]
			Germany	2004	DWV*	100%	[69]
	Commercial		Korea	2010	DWV	-	[116]
			United Kingdom	2013	DWV	15.0%	[20]
					DWV	15.0%	
		Pupae	Italy	2021	DWV*	100%	[68]
			Italy	2021	DWV*	100%	
					DWV*	100%	
					DWV*	100%	
	Artificial Infection	Adult	U.S.A.	2020	DWV*	-	[55]
		Larvae			DWV*	-	
	Artificial Infection	Adult	Belgium	2014	KBV	100%	[216]
			Chile	2017	KBV	6.06%	[92]
	Commercial				CBPV	1.52%	[92]
			Korea	2010	CBPV	-	[116]
			Belgium	2015	SBPV	-	[218]
	Artificial Infection		United Kingdom	2017	SBPV	100%	[111]
			United Kingdom	2014	SBPV	6.00%	[110]
			U.S.A.	2008	Microsporidia	8.62%	[128]
	Artificial Infection		United Kingdom	2014	<i>N. ceranae</i>	1.18%	[83]
				2016	<i>N. ceranae</i>	-	[162]
			United Kingdom	2016	<i>N. ceranae</i>	38.7%	[36]
	Wild		United Kingdom	2015	<i>N. ceranae</i>	20.0%	[23]
	Commercial		United Kingdom	2013	<i>N. apis</i>	15.0%	[20]
	Wild		Chile	2017	<i>L. passim</i>	4.04%	[92]
	Commercial		United Kingdom	2013	<i>M. plutonius</i>	15.0%	[20]
	Wild		U.S.A.	2008	<i>Wolbachia</i> spp.	91.4%	[128]
					<i>Ascosphaera</i> spp.	15.5%	
			Belgium	2016	<i>Ascophaera apis</i>	-	[220]
	Artificial Infection	Larvae			<i>Ascophaera apis</i>	-	
	Wild	Adult	U.S.A.	2005	IAPV ^K	100%	[20]
				2005	BQCV ^K	100%	
				2011	BQCV	100%	[93]
				2015	BQCV*	86.3%	[139]
				2005	SBV ^K	100%	[38]
				2011	SBV	50.0%	[93]
				2005	DWV ^K	100%	[38]
				2011	DWV	50.0%	[93]
				2015	DWV*	9.20%	[139]
<i>Bombus vestalis</i>	Wild	Adult	Germany	2014	BQCV*	-	[109]
<i>Bombus ephippiatus</i>	Wild	Adult	Mexico	2020	DWV	100%	[221]
					BQCV	100%	
<i>Bombus steindachner</i>	Wild	Adult	Mexico	2020	DWV	100%	[221]
<i>Ceratina dupla</i>	Wild	Adult	U.S.A.	2005	DWV	66.4%	[38]
<i>Ceratina smaragdula</i>	Wild	Adult	Hawaii	2015	DWV	27.0%	[222]
<i>Eucera</i> spp.	Wild	Adult	France	2021	ABPV	22.%	[100]
					IAPV	77.8%	
					BQCV	66.7%	
					SBV	55.6%	
					DWV	11.1%	
<i>Eucera nigrescens</i>	Wild	Adult	Georgia	2014	ABPV ^L	100%	[109]
					IAPV ^L	100%	
					BQCV ^L	100%	
					SBV ^L	100%	
					DWV ^L	100%	
					KBV ^L	100%	
					SBPV ^L	100%	
<i>Melecta albifrons</i>	Wild	Adult	Germany	2014	SBPV	-	[109]
			Georgia		SBPV	-	
<i>Melipona fasciculata</i>	Wild	Adult	Brasil	2015	<i>N. ceranae</i>	100%	[163]
<i>Melipona mandacaia</i>	Wild	Adult	Brasil	2015	<i>N. ceranae</i>	100%	[163]
<i>Melipona marginate</i>	Wild	Adult	Brasil	2015	<i>N. ceranae</i>	100%	[163]

Melipona quadrifasciata anthidiodes	Wild	Adult	Brasil	2015	N. ceranae	100%	[163]
Melipona rufiventris	Wild	Adult	Brasil	2015	N. ceranae	100%	[163]
Melipona scutellaris	Wild	Adult	Brasil	2015	ABPV	100%	[223]
Melipona colimana	Wild	Adult	Mexico	2019	DWV	33.3%	[221]
				2020	DWV	50.0%	[224]
				2019	BQCV	100%	[221]
				2020	BQCV	50.0%	[224]
Melissodes bimaculata	Wild	Adult	U.S.A.	2013	IAPV	20.0%	[127]
				SBV	80.0%		
				DWV	60.0%		
				LSV	10.0%		
Nomada distinguenda	Wild	Adult	France	2021	ABPV ^M	100%	[100]
					IAPV ^M	100%	
					BQCV ^M	50.0%	
					SBV ^M	50.0%	
Peponapis fervens	Wild	Adult	Argentina	2018	CBPV	100%	[117]
Plebeia emerinoïdes	Wild	Adult	Argentina	2017	IAPV	12.5%	[101]
Plebeia droryana	Wild	Adult	Argentina	2017	IAPV	20.0%	[101]
Scaptotrigona jujuyensis	Wild	Adult	Argentina	2015	N. ceranae	100%	[163]
Scaptotrigona mexicana	Wild	Adult	Mexico	2015	DWV	60.0%	[225]
				2020	DWV	60.0%	[221]
				BQCV	40.0%		
Tetragonisca fiebrigi	Wild	Adult	Argentina	2017	IAPV	3.70%	[101]
				2014	DWV	48.1%	[163]
				2015	N. ceranae	100%	
					N. ceranae	100%	
Trigona spinipes	Wild	Adult	Argentina	2017	IAPV	25.0%	[101]
Trigona fulviventris	Wild	Adult	Mexico	2020	DWV	100%	[221]
Nannotrigona perilapodes	Wild	Adult	Mexico	2020	DWV	100%	[221]
Tetragonula hockingsi	Artificial Infection	Adult	Australia	2019	N. ceranae	67.0%	[226]
Xylocopa atamisquensis	Wild	Adult	Argentina	2018	CBPV	50.0%	[117]
Xylocopa augusti	Laboratory	Larvae	Argentina	2013	DWV	30.0%	[85]
	Wild	Adult		2018	CBPV	87.5%	[117]
Xylocopa dissimilis	Wild	Adult	Kyrgyzstan	2014	CBPV	-	[109]
Xylocopa iris	Wild	Adult	France	2021	ABPV ^N	100%	[100]
					BQCV ^N	100%	
Xylocopa nigrocinta	Wild	Adult	Argentina	2018	CBPV	66.7%	[117]
Xylocopa violacea	Wild	Adult	France	2021	ABPV ^o	100%	[100]
					BQCV ^o	100%	
					SBV ^o	100%	
					DWV ^o	100%	
Xylocopa virginica	Wild	Adult	U.S.A.	2005	BQCV ^P	50.0%	[38]
				2011	BQCV	100%	[93]
				2005	SBV	100%	
					DWV ^P	75.0%	
<u>Colletidae</u>							
Colletes spp.	Wild	Adult	Mexico	2020	DWV	100%	[221]
					BQCV	100%	[221]
Hylaeus dilatatus	Wild	Adult	France	2021	ABPV	20.0%	[100]
					IAPV	40.0%	
<u>Halictidae</u>							
Agapostemon viriscens	Wild	Adult	U.S.A.	2013	IAPV	55.3%	[127]
					SBV	41.7%	
					DWV	66.7%	
					LSV	5.26%	
Augochlora pura	Wild	Adult	U.S.A.	2005	IAPV ^Q	100%	[38]
				2013	DWV ^Q	100%	[127]
					BQCV	16.7%	
Augochlorella auratus	Wild	Adult	U.S.A.	2013	SBV	100%	[127]
					LSV	33.3%	
Halictus spp.	Wild	Adult	France	2021	ABPV	75.0%	[100]
					IAPV	25.0%	
					BQCV	25.0%	
					SBV	25.0%	
					DWV	50.0%	
			U.S.A.	2011	DWV	25.0%	[93]
				2008	Wolbachia spp.	70.0%	[128]
				Ascosphaera spp.	70.0%		
Halictus fulvipes	Wild	Adult	France	2021	ABPV	58.8%	[100]

<i>Halictus fulvipes</i>	Wild	Adult	France	2021	BQCV SBV	11.8% 29.4%	[100]
<i>Halictus ligatus</i>	Wild	Adult	U.S.A.	2013	IAPV BQCV SBV DWV LSV	3.13% 15.6% 6.25% 62.5% 3.13%	[127]
<i>Halictus maculatus</i>	Wild	Adult	France	2021	IAPV	100%	[100]
<i>Halictus patellatus</i>	Wild	Adult	France	2021	ABPV	100%	[100]
<i>Halictus parallelum</i>	Wild	Adult	U.S.A.	2013	IAPV BQCV SBV DWV	3.13% 15.6% 6.25% 62.5%	[127]
			Georgia	2014	CBPV	-	[109]
			Kyrgyzstan		CBPV	-	
			U.S.A.	2013	LSV	3.13%	[127]
<i>Halictus rubicundus</i>	Wild	Adult	U.S.A.	2013	IAPV BQCV SBV DWV LSV	3.13% 15.6% 6.25% 62.5% 3.13%	[127]
<i>Halictus simplex</i>	Wild	Adult	France	2021	BQCV	100%	[100]
<i>Halictus tectus</i>	Wild	Adult	France	2021	BQCV SBV	50.0% 25.0%	[100] [100]
<i>Halictus ligatus</i>	Artificial Infection	Adult	U.S.A.	2020	<i>C. bombi</i> <i>C. mellificae</i>	- -	[203]
<i>Halictillus amplilobus</i>	Wild	Adult	Argentina	2018	CBPV	100%	[117]
<i>Lasioglossum</i> spp.	Wild	Adult	U.S.A.	2008	Microsporidia <i>Wolbachia</i> spp. <i>Ascospaera</i> spp.	2.22% 40.0% 51.1%	[128]
<i>Lasioglossum crassepunctatum</i>	Wild	Adult	France	2021	ABPV ^R IAPV ^R BQCV ^R SBV ^R	100% 100% 100% 100%	[100]
<i>Lasioglossum dialectus</i>	Wild	Adult	U.S.A.	2013	IAPV BQCV SBV DWV LSV	3.13% 15.6% 6.25% 62.5% 3.13%	[127]
<i>Lasioglossum malachurum</i>	Wild	Adult	France	2021	ABPV IAPV BQCV SBV	26.2% 33.8% 53.8% 43.1%	[100]
<i>Lasioglossum nigripes</i>	Wild	Adult	France	2021	BQCV	100%	[100]
<i>Lasioglossum pauperatum</i>	Wild	Adult	France	2021	IAPV BQCV SBV	16.7% 33.4% 33.4%	[100]
<i>Lasioglossum pauxillum</i>	Wild	Adult	France	2021	BQCV SBV DWV	100% 33.4% 33.4%	[100]
Megachilidae							
<i>Anthidium manicatum</i>	Wild	Adult	France	2021	ABPV ^S IAPV ^S	100% 100%	[100]
<i>Heriades truncorum</i>	Wild	Adult	Belgium	2012	BQCV ^T <i>N. ceranae</i> <i>Apicystis bombi</i> ^T	66.7%% 100% 33.3%	[37]
<i>Hoplitis adunca</i>	Wild	Adult	France	2021	IAPV ^U BQCV ^U SBV ^U	100% 100% 100%	[100]
<i>Megachile albisecta</i>	Wild	Adult	France	2021	SBV	100%	[100]
<i>Megachile brevis</i>	Wild	Adult	U.S.A.	2013	IAPV SBV DWV	11.7% 70.6% 52.9%	[127]
<i>Megachile brevis</i>	Wild	Adult	U.S.A.	2013	LSV	17.6%	[127]
<i>Megachile rotundata</i>	Wild	Adult	Canada	2013	SBV DWV	56.0% 48.0%	[100]
	Artificial Infection		U.S.A.	2021	<i>C. bombi</i>	59.0%	[202]
				2020	<i>C. bombi</i>	-	[203]

<i>Osmia bicornis</i>	Wild	Adult	Georgia	2014	ABPV	-	[109]
			Germany		ABPV	-	
			Kyrgyzstan		ABPV	-	
			Georgia		IAPV	-	
			Germany		IAPV	-	
			Kyrgyzstan		IAPV	-	
			Georgia		BQCV	-	
			Germany		BQCV	-	
			Kyrgyzstan		BQCV	-	
			Georgia		SBV	-	
			Germany		SBV	-	
			Kyrgyzstan		SBV	-	
			Belgium		DWV ^v	100%	[37]
			Georgia		DWV	-	[109]
			Germany		DWV	-	
			Kyrgyzstan		DWV	-	
			Georgia		KBV	-	
			Germany		KBV	-	
			Kyrgyzstan		KBV	-	
			Georgia		SBPV	-	
			Germany		SBPV	-	
			Kyrgyzstan		SBPV	-	
			Belgium	2012	LSV ^v	100%	[84]
					<i>AmFV</i> ^v	100%	
					<i>N. ceranae</i> ^v	100%	
					<i>C. bombi</i>	100%	
					<i>S. apis</i>	33.3%	
					<i>S. melliferum</i>	66.7%	
					<i>Ascosphaera</i> spp. ^v	100%	
					<i>Apicystis bombi</i> ^v	100%	
<i>Osmia cornuta</i>	Wild	Adult	Belgium	2012	BQCV ^w	100%	[84]
	Artificial Infection		Italy	2014	DWV*	3.43%	[40]
	Wild		Georgia		DWV	100%	[109]
			Belgium	2012	LSV ^w	100%	[84]
					LSV*	100%	[227]
					<i>AmFV</i> ^w	100%	[84]
			Belgium	2012	<i>N. ceranae</i> ^w	100%	
					<i>Ascoshpaera</i> spp. ^w	100%	
					<i>Apicystis bombi</i> ^w	100%	
<i>Osmia lignaria</i>	Artificial Infection	Adult	U.S.A.	2021	<i>C. bombi</i>	29.0%	[202]
				2020		-	[203]
				2020	<i>C. mellifica</i>	-	[203]
WASP							
<u>Bembicidae</u>							
<i>Bembix</i> spp.	Wild	Adult	U.S.A.	2005	BQCV ^x	100%	[38]
				2005	DWV ^x	100%	
<u>Cryptinae</u>							
<i>Xanthocryptus novozealandicus</i>	Wild	Adult	New Zealand	2019	DWV	100%	[91]
<u>Pompilidae</u>							
<i>Sphictostethus nitidus</i>	Wild	Adult	New Zealand	2019	DWV	100%	[91]
<u>Vespidae</u>							
<i>Ancistrocerus auctus</i>	Wild	Adult	France	2021	ABPV ^y	100%	[100]
					SBV ^y	100%	
<i>Dolichovespula sylvestris</i>	Wild	Adult	U.S.A.	2008	<i>Wolbachia</i> spp.	100%	[128]
<i>Polybia scutellaris</i>	Wild	Adult	Argentina	2010	<i>N. ceranae</i>	100%	[163]
<i>Polistes</i> spp.	Wild	Adult	France	2021	ABPV ^z	100%	[100]
					BQCV ^z	100%	
					DWV ^z	100%	
<i>Polistes arifer</i>	Wild	Adult	Hawaii	2015	DWV	45.0%	[222]
<i>Polistes chinensis</i>	Wild	Adult	New Zealand	2019	DWV	-	[91]
					Moku virus*	-	[91]
<i>Polistes domicula</i>	Wild	Adult	France	2021	ABPV	20.0%	[100]
					BQCV	20.0%	
					SBV	20.0%	
					DWV	20.0%	
<i>Polistes fuscatus</i>	Wild	Adult	U.S.A.	2005	DWV	16.7%	[38]
<i>Polistes humilis</i>	Wild	Adult	New Zealand	2019	Moku virus	-	[91]

<i>Polistes metricus</i>	Wild	Adult	U.S.A.	2005	BQCV ¹ SBV ^{1,2} DWV ¹	25.0% 50.0% 50.0%	[38]
<i>Polistes ninpha</i>	Wild	Adult	France	2021	ABPV	100%	[100]
<i>Vespa crabro</i>	Wild	Adult	Italy	2016	DWV*	100%	[45]
			Spain	2016	<i>N. ceranae</i> <i>N. thompsoni</i> <i>C. bombi</i> <i>C. mellificae</i> <i>L. passim</i> <i>A. bombi</i>	3.20% 9.70% 12.9% 3.2% 16.1% 29.0%	[228]
<i>Vespa velutina nigrithorax</i>	Wild	Adult	China	2011	IAPV*	100%	[48]
			Italy	2017	BQCV* DWV*	50.0% 75.0%	[46] [47]
				2018		100%	[229]
			Spain	2016	KBV* <i>N. ceranae</i> <i>N. thompsoni</i> <i>C. bombi</i> <i>C. mellificae</i> <i>L. passim</i> <i>A. bombi</i>	8.34% 2.50% 11.4% 17.7% 8.90% 3.80% 17.7%	[46] [228]
			Belgium	2016	Moku virus	100%	[151]
<i>Vespula</i> spp.	Wild	Adult	U.S.A.	2011	BQCV SBV DWV	29.0% 14.0% 57.0%	[93]
<i>Vespula germanica</i>	Wild	Adult	United Kingdom	2018	ABPV	31.3%	[94]
			France		IAPV	3.23%	
			New Zealand		DWV	24.2%	
			Germany		DWV	9.68%	
			U.S.A.	2008	DWV	25.0%	[128]
			New Zealand	2019	DWV* ³	100%	[91]
				2018	KBV	15.1%	[94]
				2019	KBV ³	100%	[91]
			United Kingdom	2018	KBV	6.25%	[94]
			New Zealand	2019	Moku virus * ³	100%	[91]
			U.S.A.	2008	<i>Wolbachia</i> spp. <i>Ascospaera</i> spp.	25.0% 25.0%	[128]
<i>Vespula pensylvanica</i>	Wild	Adult	Hawaii	2012	DWV DWV Moku virus Moku virus	100% - - 100%	[150] [130] [150]
<i>Vespula vulgaris</i>	Wild	Adult	U.S.A.	2005	IAPV ⁴ BQCV ^{4,5}	41.7% 66.7%	[38] [38]
				2008	BQCV	2.10%	[128]
				2005	SBV ⁴	33.3%	[38]
				2008	SBV	2.10%	[128]
				2005	DWV ^{4,5}	91.7%	[38]
				2008	DWV	29.2%	[128]
			New Zealand	2019	DWV* KBV*	 -	[91]
		Larvae		2016	KBV	100%	[95]
	Artificial Infection				KBV	100%	
	Wild	Adult		2019	Moku virus*	-	[91]
		Larvae		2016	Moku virus	100%	[95]
	Artificial Infection				Moku virus	100%	
	Wild	Adult	U.S.A.	2008	Microsporidia <i>Wolbachia</i> spp. <i>Ascospaera</i> spp.	15.5% 35.4% 54.2%	[128]
<u>Scolidae</u>							
<i>Scolia flavifrons</i>	Wild	Adult	France	2021	ABPV ⁶ BQCV ⁶ SBV ⁶ DWV ⁶	50.0% 100% 50.0% 50.0%	[100]
ANT							
<u>Formicidae</u>							
<i>Anoplolepis gracilipes</i>	Wild	Adult	Australia	2016	BQCV	-	[51]
			Japan	2019	DWV	3.40%	[230]
			Solomon Island		DWV	100%	
			Vanatu		DWV	50.0%	

<i>Camponotus</i> spp.	Wild	Adult	U.S.A.	2011	IAPV BQCV SBV DWV	6.00% 24.0% 24.0% 6.00%	[93]
<i>Camponotus vagus</i>	Wild	Adult	France	2008	CBPV* CBPV*	100% 10.0%	[118]
<i>Formica rufa</i>	Wild	Adult	France	2008	CBPV*	10.0%	[118]
<i>Linepithema humile</i>	Wild	Adult	New Zealand	2015	ABPV IAPV	- -	[49]
				2013	DWV*	7.00%	[50]
				2019	DWV*	-	[91]
					KBV*	-	[91]
				2015	KBV	-	[49]
				2019	Moku virus*	-	[91]
<i>Paratrechina longicornis</i>	Wild	Adult	Japan	2019	DWV	15.4%	[230]
			Taiwan		DWV	4.60%	
			Malaysia		DWV	13.6%	
			China		DWV	26.7%	
			Fiji		DWV	33.3%	
<i>Pheidole megacephala</i>	Wild	Adult	Hawaii	2012	DWV	-	[130]
<i>Tapinoma melanocephalum</i>	Wild	Adult	Hawaii	2012	DWV	-	[130]
<u>Myrmicinae</u>							
<i>Myrmica rubra</i>	Artificial Infection	Adult	Switzerland	2019	DWV	-	[231]

Legend: Bold and underlined taxon indicates the taxonomic group; Underlined taxon indicates the family; -: no calculated; *: replicative virus; superscript “A”-“Z” and “1”-“6”: indicate the coinfection reported in the same study; ABPV: Acute Bee Paralysis Virus; IAPV: Israeli Acute Paralysis Virus; BQCV: Black Queen Cell Virus; SBV: Sacbrood Virus; DWV: Deforming Wing Virus; LSV: Lake Sani Virus; AmFV: *Apis mellifera* Filamentous Virus; KBV: Kashmir Bee Virus; SBPV: Slow Bee Paralysis Virus; CBPV: Chronic Bee Paralysis Virus; VdMLV: *Varroa destructor* Macula-like Virus.

Table S2. Bee pathogen spillover and prevalence identified in arthropod hosts, of which are reported condition, stage, geographical are and year.

Host			Geographic area	Year	Pathogen	Prevalence (%)	Reference	
Taxon	Condition	Stage						
FLY								
<u>Calliphoridae</u>								
Undetermined Calliphoridae	Wild	Adult	U.S.A.	2011	DWV	25.0%	[93]	
<u>Muscidae</u>								
<i>Musca</i> spp.	Wild	Adult	U.S.A.	2011	DWV	50.0%	[93]	
<u>Syrphidae</u>								
<i>Episyrphus balteatus</i>	Wild	Adult	U.S.A.	2008	<i>Wolbachia</i> spp. <i>Ascosphaera</i> spp.	76.9% 69.2%	[128]	
<i>Eristalis arbustorum</i>	Wild	Adult	United Kingdom	2016	BQCV SBV DWV	10.0% 5.00% 5.00%	[129]	
			U.S.A.	2008	<i>Wolbachia</i> spp. <i>Ascosphaera</i> spp.	72.7% 90.9%		
			United Kingdom	2016	BQCV SBV	10.0% 20.0%		
<i>Eristalis tenax</i>	Wild	Adult	U.S.A.	2008	Microsporidia <i>Wolbachia</i> spp. <i>Ascosphaera</i> spp.	9.10% 45.5% 36.42%	[128]	
			United Kingdom	2016	BQCV SBV	10.0% 20.0%		
			U.S.A.	2008	Microsporidia <i>Wolbachia</i> spp. <i>Ascosphaera</i> spp.	9.10% 45.5% 36.42%		
<i>Rhingia campestris</i>	Wild	Adult	U.S.A.	2008	<i>Wolbachia</i> spp. <i>Ascosphaera</i> spp.	41.7% 16.7%	[128]	
<u>Tipulidae</u>								
<i>Leptotarus</i> spp.	Wild	Adult	New Zealand	2019	DWV	-	[91]	
BEETLE								
<u>Coccinellidae</u>								
<i>Harmonia axyridis</i>	Wild	Adult	U.S.A.	2011	DWV	100%	[93]	
<u>Curculionidae</u>								
<i>Scolopterus penicillatus</i>	Wild	Adult	New Zealand	2019	DWV	100%	[91]	
<u>Nitidulidae</u>								
<i>Aethina tumida</i>	Wild	Adult	U.S.A.	2011	IAPV BQCV	78.0% 5.00%	[93]	
			Hawaii	2012	BQCV	-		[130]
			U.S.A.	2008	SBV	33.4%		[82]
			U.S.A.	2011	SBV	11.0%		[93]
			Hawaii	2012	SBV	-		[130]
			U.S.A.	2017	DWV* ⁷	70.0%		[164]
			U.S.A.	2011	DWV	72.0%		[93]
			Hawaii	2012	DWV	-		[130]
			U.S.A.	2007	DWV*	97.0%		[232]
			U.S.A.	2019	DWV			[86]
	Artificial Infection	Adult	U.S.A.	2007	DWV*	97.0%	[232]	
			U.S.A.	2019	DWV		[86]	
			U.S.A.	2017	KBV* ⁷	20.0%	[164]	
			U.S.A.	2011	KBV	44.0%	[93]	
			Mexico	2018	<i>AmFV</i> ^{8,9}	100%	[148]	
			U.S.A.	2017	<i>N. ceranae</i>	70.0%	[164]	
			Mexico	2018	<i>N. ceranae</i> ⁹	25.0%	[148]	
			U.S.A.	2017	<i>L. passim</i> ⁷	40.0%	[164]	
			Mexico	2018	<i>L. passim</i> ^{8,9}	83.4%	[148]	
			U.S.A.	2017	<i>C. mellificae</i> ⁷	30.0%	[164]	
	Wild	Adult	U.S.A.	2017	<i>C. bombi</i> ⁸	50.0%	[148]	
			Mexico	2018	<i>C. bombi</i> ⁸	50.0%	[148]	
			U.S.A.	2017	<i>C. mellificae</i> ⁷	30.0%	[164]	
			Mexico	2018	<i>C. mellificae</i> ⁷	30.0%	[164]	
			U.S.A.	2017	<i>C. mellificae</i> ⁷	30.0%	[164]	
			Mexico	2018	<i>C. mellificae</i> ⁷	30.0%	[164]	
			U.S.A.	2017	<i>C. mellificae</i> ⁷	30.0%	[164]	
			Mexico	2018	<i>C. mellificae</i> ⁷	30.0%	[164]	
			U.S.A.	2017	<i>C. mellificae</i> ⁷	30.0%	[164]	
			Mexico	2018	<i>C. mellificae</i> ⁷	30.0%	[164]	
	<i>Ascosphaera</i> spp. ⁸ 16.7%							
<u>Tenebrionidae</u>								
Undetermined Tenebrionidae	Wild	Adult	U.S.A.	2011	DWV	100%	[93]	
ROACH								
<u>Blattidea</u>								
<i>Celatoblatta</i> spp.	Wild	Adult	New Zealand	2019	DWV*	-	[91]	
					KBV	-		
					Moku virus	-		
<i>Maoriblatta</i> spp.	Wild	Adult	New Zealand	2019	DWV	-	[91]	
					Moku virus	-		
<u>Ectobiidae</u>								
<i>Blattella germanica</i>	Wild	Adult	U.S.A.	2011	BQCV	50.0%	[93]	
					SBV	75.0%		
					DWV	100%		

<u>EARWIG</u>							
<u>Forficulidae</u>							
<i>Forficula auricularia</i>	Wild	Adult	U.S.A.	2011	IAPV	40.0%	[93]
					BQCV	60.0%	
					SBV	50.0%	
					DWV	100%	
			New Zealand	2019	DWV	-	[91]
			U.S.A.	2011	KBV	20.0%	[93]
			New Zealand	2019	KBV	-	[91]
<u>BUG</u>							
<u>Pentatomidae</u>							
<i>Halymorpha halys</i>	Wild	Adult	U.S.A.	2011	DWV	100%	[93]
<u>CRICKET</u>							
<u>Trigonidiidae</u>							
<i>Bobilla</i> spp.	Wild	Adult	New Zealand	2019	DWV	-	[91]
					KBV*	-	
<u>BUTTERFLY</u>							
Undetermined Lepidoptera	Wild	Adult	U.S.A.	2011	IAPV	9.00%	[93]
					BQCV	9.00%	
					SBV	9.00%	
					DWV	27.0%	
<u>Papilionidae</u>							
Undetermined Papilionoidae	Wild	Adult	U.S.A.	2011	DWV	100%	[93]
<u>MOTH</u>							
<u>Pyralidae</u>							
<i>Galleria melonella</i>	Wild	Larvae	U.S.A.	2011	IAPV	14.0%	[93]
					BQCV	33.0%	
					SBV	29.0%	
					DWV	71.0%	
					KBV	10.0%	
<u>SPIDER</u>							
Undetermined Aranae	Wild	Adult	U.S.A.	2011	IAPV	10.0%	[93]
					BQCV	10.0%	
					SBV	10.0%	
					DWV	80.0%	
Undetermined Opiliones	Wild	Adult	U.S.A.	2011	IAPV	10.0%	[93]
					BQCV	10.0%	
					DWV	10.0%	
<u>Salticidae</u>							
<i>Helpis minitabunda</i>	Wild	Adult	New Zealand	2019	DWV	100%	[91]
					Moku virus	100%	
<u>Theridiidae</u>							
<i>Steatoda capensis</i>	Wild	Adult	New Zealand	2019	KBV	-	[91]
					Moku virus*	-	

Legend: Bold and underlined taxon indicates the taxonomic group; Underlined taxon indicates the family; -: no calculated; *: replicative virus; superscript “7”-“9”: indicate the coinfection reported in the same study -: no calculated; IAPV: Israeli Acute Paralysis Virus; BQCV: Black Queen Cell Virus; SBV: Sacbrood Virus; DWV: Deforming Wing Virus; LSV: Lake Sani Virus; AmFV: *Apis mellifera* Filamentous Virus; KBV: Kashmir Bee Virus.