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Appendix I: Symbiont list identifying potentially deleterious symbionts of concern for clean stock and commercial bumble bee rearing

The list has been sorted into two groupings based on the concern of the symbiont's presence in rearing operations: Priority/Of Concern and High Uncertainty but Potential, with select evidence presented in the main text summarized here. It is important to note that this is likely not a fully inclusive list, given current unknowns, and new symbionts of concern are likely to arise. Any clean stock program should visually monitor for problematic symptoms in individuals and colonies and verify causative agents.

Priority/Of Concern

Symbiont	Evidence
Protozoa	
Apicystis bombi Liu, MacFarlane, and Pengelly; Ophrocystidae	High virulence (Jones & Brown 2014; Rutrecht & Brown 2008); Potential for spillover (Graystock et al. 2013b); Possibly introduced with non-native *Bombus* (Arbetman et al. 2013)
Crithidia bombi Lipa and Triggiani; Trypanosomatidae	Virulence context dependent, but may be high (Sadd & Barribeau 2013); Easily transmitted and has been common in commercial colonies (Graystock et al. 2013b; Murray et al. 2013); High spillover potential (Colla et al. 2006)
Crithidia expoeki Schmid-Hempel and Tognazzo; Trypanosomatidae	Limited study, but assumed like *C. bombi*
Fungi	
Vairimorpha (Nosema) bombi Fantham and Porter; Microsporidia: Nosematidae	High virulence (Otti & Schmid-Hempel 2007; Otti & Schmid-Hempel 2008); Found in commercial distributed colonies (Graystock et al. 2013b; Murray et al. 2013)
Vairimorpha (Nosema) ceranae Fries et al.; Microsporidia: Nosematidae	Bumble bees susceptible, increases mortality (Graystock et al. 2013a)
Viruses (Li et al. 2011)	
Deformed wing virus (DWV); Iflaviridae	Replication in bumble bees (Levitt et al. 2013; Li et al. 2011); Pathology in commercially reared bumble bees (Genersch et al. 2006)
AKI-complex: Kashmir bee virus(KBV); *Acute Bee Paralysis Virus*(ABPV), *Kashmir Bee Virus* (KBV), *Israeli Acute Paralysis Virus* (IAPV) Dicistroviridae	Infective to bumble bees, long-lasting infectivity (Bailey & Gibbs 1964); Can be common in bumble bees (McMahon et al. 2015); Virulence may be dose- and transmission route-dependent, but can be high (Meeus et al. 2014; Niu et al. 2016; Wang et al. 2018)

High Uncertainty but Potential

Symbiont	**Evidence**
Bacteria	
Spiroplasma apis Mouches et al.; Mollicutes: Spiroplasmataceae	Disease association in honey bees and presence of bacteria in bumble bees indicates pathogenic potential, but not verified (Clark et al. 1985; Meeus et al. 2012)
Spiroplasma melliferum Clark et al.; Mollicutes: Spiroplamataceae	Associated with disease in honey bees and presence of bacteria in bumble bees indicates pathogenic potential, but not verified (Clark et al. 1985; Meeus et al. 2012)
Viruses	
Black queen cell virus (BQCV); *Chronic Bee Paralysis Virus* (CBPV); *Cloudy Wing Virus* (CWV); *Sacbrood virus* (SBV); *Slow Bee Paralysis Virus* (SBPV); Other "honey bee" RNA viruses	Found in bumble bees, including in commercial colonies (Choi et al. 2010; McMahon et al. 2015; Peng et al. 2011; Sachman-Ruiz et al. 2015; Singh et al. 2010); Need study to understand further occurrence and virulence in bumble bees (Tehel et al. 2016)
Fungi	
Tubulinosema pampeana Plischuk et al.; Microsporidia; Tubulinosematidae	Detected in bumble bees, affecting adipose tissue (Plischuk et al. 2017; Plischuk et al. 2015); Currently further pathology and effects unknown.

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