Black Queen Cell Virus

Comprehensive Findings Review

Synthesised from the abstracts and full texts of the most-cited and representative papers within a harvested corpus of 717 records (611 open access). A curated review of landmark findings, not an exhaustive catalogue. Generated 2026-06-12.

Executive Summary

Black queen cell virus (BQCV) is a positive-sense, single-stranded RNA virus of the family **Dicistroviridae**. It takes its name from its signature pathology: infected queen larvae and prepupae die, and the walls of their queen cells darken to a characteristic black or brown. BQCV is one of the most prevalent honey bee viruses worldwide — typically second only to deformed wing virus in survey after survey — yet it usually causes little overt harm to adult worker bees. Its classic and best-documented association is with the gut microsporidian *Nosema* (especially *Nosema apis*), and it forms part of the multi-stressor synergies (with parasites and pesticides) that contribute to colony losses. This document synthesises the findings by theme and catalogues the landmark studies.

Family	Dicistroviridae; positive-sense ssRNA (~8.5 kb)
Signature	Kills queen larvae/prepupae; queen-cell walls turn dark/black (the namesake symptom)
Prevalence	Among the most prevalent bee viruses — ~86% of French apiaries (Tentcheva 2004)
Key association	Strongly linked to the gut microsporidian Nosema (esp. N. apis)
Synergies	Pesticide (thiacloprid) elevates BQCV load; synergises with Nosema on mortality (Doublet 2015)
Adult impact	Usually low/covert in adult workers; main damage is to queen brood
Transmission	Faecal–oral, food/pollen-borne, and vertical (queen→offspring) (Chen 2006; Singh 2010)

Taxonomy and Signature Pathology

BQCV is a member of the family **Dicistroviridae** with a positive-sense RNA genome of roughly 8.5 kb. It is named for its effect on developing queens: infected queen larvae and prepupae die, and the walls of the affected queen cells darken to a characteristic black-brown — a readily recognisable field symptom. In contrast to this clear impact on queen brood, BQCV generally causes little or no overt disease in adult worker bees, in which it usually persists as a covert infection. Phylogenetic analyses place BQCV in a lineage distinct from the iflaviruses DWV and SBV (Chen 2004).

Prevalence and Distribution

BQCV is one of the most prevalent and widely distributed honey bee viruses globally. In a large French survey it was found in 86% of apiaries in adult bees — second only to DWV and SBV — though only 23% in pupae (Tentcheva 2004). Across reviews of global virus distribution, BQCV consistently ranks among the most prevalent viruses alongside DWV, SBV and the acute paralysis complex (Beaurepaire 2020). Despite this ubiquity, infections are frequently asymptomatic, with colony-level disease appearing mainly when co-factors are present.

The Nosema Association and Multi-Stressor Synergies

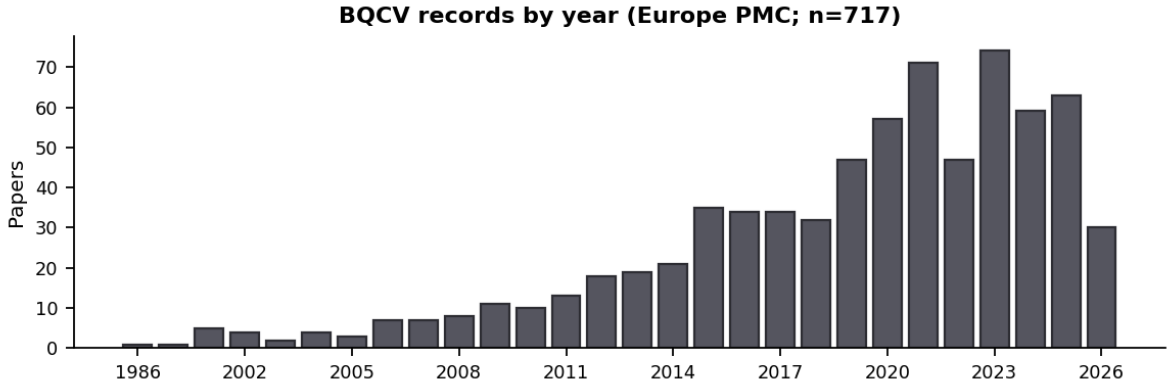
BQCV's most distinctive feature is its strong, long-recognised association with the gut microsporidian *Nosema* (classically *Nosema apis*): the parasite's disruption of the gut appears to facilitate BQCV infection, and the two frequently co-occur. This places BQCV firmly within the multi-stressor framework of bee decline. Experimentally, the neonicotinoid thiacloprid significantly elevated BQCV

loads and produced an additive interaction with BQCV that reduced larval survival, while *Nosema ceranae* combined with BQCV synergistically increased adult mortality (Doublet 2015). BQCV has also been shown to non-randomly co-occur with the Lake Sinai virus complex (Ravoet 2013), underscoring its role as one node in a web of interacting pathogens.

Transmission Routes

BQCV spreads by the routes typical of bee viruses. It is transmitted faecal–orally and via contaminated food — picorna-like viruses including BQCV occur in pollen pellets and are infective (Singh 2010) — and vertically from queens to offspring through eggs and reproductive tissues (Chen 2006). Unlike DWV, BQCV does not show a strong, direct dependence on *Varroa* mite infestation: in acaricide-treatment experiments its titres bore no clear relationship to mite load, in contrast to DWV (Locke/Pisa 2021). Its epidemiology is instead shaped more by gut-parasite co-infection and seasonal brood-rearing cycles.

Research Activity



Landmark Study Catalogue

Selected by citation impact and thematic importance. Core studies:

Tentcheva 2004 — Prevalence and seasonal variations of six bee viruses in France (2004, Applied & Environmental Microbiology; cited 285)

Large-scale PCR survey of six viruses across 36 French apiaries.

- BQCV found in 86% of apiaries (adult bees) — among the most prevalent viruses surveyed.
- Lower in pupae (23%); persistent infection without clinical signs.
- Establishes BQCV as a near-ubiquitous, typically covert honey bee virus.

PMC535170 · doi:10.1128/aem.70.12.7185-7191.2004

Doublet 2015 — Bees under stress: sublethal pesticide and pathogen interactions (Nosema, BQCV, thiacloprid) (2015, Environmental Microbiology; cited 249)

Tested combined effects of thiacloprid, Nosema ceranae and BQCV on larvae and adults.

- Thiacloprid significantly elevated BQCV viral loads.
- An additive interaction between BQCV and thiacloprid reduced larval survival.
- In adults, N. ceranae + BQCV and N. ceranae + thiacloprid synergistically increased mortality.
- Demonstrates BQCV's role in multi-stressor (pathogen × pesticide) colony health effects.

None · doi:10.1111/1462-2920.12426

Chen 2004 — Multiple virus infections in the honey bee and genome divergence of honey bee viruses (2004, J. Invertebrate Pathology; cited 118)

Screened colonies for mixed infections and analysed viral phylogeny.

- Individual bees can harbour four viruses (incl. BQCV) simultaneously — first such report.
- Phylogenetically, KBV and BQCV form a lineage distinct from the DWV/SBV iflavirus clade.
- Developed a multiplex RT-PCR for simultaneous detection of multiple bee viruses including BQCV.

None · doi:10.1016/j.jip.2004.07.005

Chen 2006 — Prevalence and transmission of honeybee viruses (2006, Applied & Environmental Microbiology; cited 165)

Examined queen tissues and offspring for six viruses including BQCV.

- BQCV detected in queen feces and reproductive tissues including ovaries.
- BQCV present in queens was detected in their eggs, larvae and adult workers — vertical transmission.
- BQCV was one of the two viruses (with DWV) most consistently transmitted to offspring.

PMC1352288 · doi:10.1128/aem.72.1.606-611.2006

Supporting studies:

Ravoet 2013 — Comprehensive bee pathogen screening in Belgium (2013, PLoS ONE; cited 167)

Screened 363 Belgian colonies for 18 pathogens vs winter mortality.

- Viruses of the Lake Sinai complex and BQCV tended to non-randomly co-occur.
- Number of pathogen species correlated with colony losses — BQCV part of the co-infection web.

PMC3753275 · doi:10.1371/journal.pone.0072443

Singh 2010 — RNA viruses in hymenopteran pollinators: inter-taxa transmission via pollen (2010, PLoS ONE; cited 283)

Surveyed viruses in bees, pollen and non-Apis pollinators.

- First detection of BQCV (with DWV, SBV) in pollen pellets; contaminated food was infective.
- BQCV detected across multiple non-Apis hymenopteran species.

PMC3008715 · doi:10.1371/journal.pone.0014357

Beaurepaire 2020 — Diversity and Global Distribution of Viruses of the Western Honey Bee (review) (2020, Insects; cited 132)

Synthesised global diversity and distribution of A. mellifera viruses.

- BQCV is among the most prevalent and most widely distributed bee viruses.
- Often a multi-host pathogen; global trade contributes to its dissemination.

PMC7240362 · doi:10.3390/insects11040239

Pisa 2021 — Acaricide treatment affects viral dynamics in Varroa-infested colonies (2021, Environ. Sci. Pollution Research; cited 114)

Tracked DWV/SBV/BQCV dynamics during acaricide treatment.

- BQCV titres showed no direct relationship with Varroa mite infestation (unlike DWV).
- Confirms BQCV epidemiology is largely Varroa-independent, shaped by other factors.

PMC7921077 · doi:10.1007/s11356-017-0341-3

Scope note: studies excluded as off-topic

- **Vanengelsdorp 2009 / Cornman 2012 / Nazzi 2012**: CCD/collapse studies — BQCV is one of many pathogens measured, not the focus.
- **Lanzi 2006 / Highfield 2009 / Di Prisco 2016 / McMahon 2016**: DWV-specific papers surfaced via shared multi-virus surveys.
- **Runckel 2011 / Adams 2016**: Microbiome/ICTV-taxonomy papers — contextual, not BQCV-specific findings.
- **Sandrock 2014**: Neonicotinoid colony-performance study — pesticide focus, BQCV peripheral.

References

Chen 2004. *Multiple virus infections in the honey bee and genome divergence of honey bee viruses.* J. Invertebrate Pathology (2004). doi:10.1016/j.jip.2004.07.005

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Doublet 2015. *Bees under stress: sublethal pesticide and pathogen interactions (Nosema, BQCV, thiacloprid).* Environmental Microbiology (2015). doi:10.1111/1462-2920.12426

Beaurepaire 2020. *Diversity and Global Distribution of Viruses of the Western Honey Bee (review).* Insects (2020). doi:10.3390/insects11040239 · PMC7240362

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