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GO TO  
TECA

**Technologies and practices for small agricultural producers**

[Home](#) > [Technologies](#) > [Bee viruses](#) >

## Bee viruses

### Summary

Virus diseases of bees are spread throughout the world. They are usually undervalued by beekeepers: they can cause serious economic losses if associated with other bee diseases.

Varroa destructor has greatly contributed to increase the incidence of viral diseases. Varroa, in fact, is a passive carrier of bee viruses that are transmitted to the bees through the mite's saliva. In addition, varroa weakens the immune system of the bees, which can allow the reactivation of latent viral infections already present in the body of the bees.

Other bee diseases that set the conditions for the onset of viral diseases are Nosemiasis, European Foulbrood and Amebiasis.

The transmission of the viruses usually occurs horizontally (e.g. through the bee feces, royal jelly, varroa saliva, the beekeeper), but the transmission of the main bee viruses occurs vertically (from the queen to the brood).

This practice describes the causes and symptoms of bee viruses, how these diseases spread, and how to address and prevent them.

### Description

Seasonal factors and the region where the apiary is located strongly influence the onset of honey bee viruses.

All viruses are virtually present in apiaries in latent or asymptomatic form (i.e. no symptoms are visible in the hive). Triggering events, such as other hive diseases or stressful factors, can lead to the development of the infection and the death of bees or the destruction of colonies and/or the affected combs.

The Sacbrood Virus (SBV), the Black Queen Cell Virus (BQCV) and Chronic Bee Paralysis Virus (CBPV) causing characteristic symptoms, respectively: saccular larvae (Fig. 5), blackened queen cells (Fig. 9) and small black bees (Fig. 1).



**Fig. 1: Small black bees**

For other viruses, however, the symptoms are usually more general and common: presence of bees with deformed wings (Fig.4), uneven brood pattern with high mortality and cells with perforated cappings (Fig. 2).



**Fig. 2: Comb affected by virus: uneven brood pattern with high mortality and cells with perforated cappings**

An exact diagnosis of the virus can be made through PCR technique (polymerase chain reaction) in specialized analysis laboratory (except for the Sacbrood Virus and the Black Queen Cell Virus).

To date, there are many identified and classified bee viruses but there is not enough information about their worldwide distribution.

Main bee viruses
Chronic Bee Paralysis Virus (CBPV)
Sacbrood Virus (SBV)
Acute Bee Paralysis Virus (ABPV)
Deformed Wing Virus (DWV)
Black Queen Cell Virus (BQCV)
Cloudy Wing Virus (CWV)
Slow Paralysis Virus (SPV)
Bee Virus X (BVX)
Bee Virus Y (BVY)
Filamentous Virus (FV)
Apis Iridescent Virus (AIV)
Israeli Acute Paralysis Virus (IAPV)
Arkansas Bee Virus (ABV)
Berkley Bee Picornavirus (BBPV)
Kashmir Bee Virus (KBV)
Egypt Bee Virus (EBV)
Tobacco ringspot virus
Kakugo Virus

GO TO  
BOTTOM

#### **CHRONIC BEE PARALYSIS VIRUS (CBPV or CPV)**

This is an infectious and contagious disease of adult honeybees caused by a virus (CBPV). The infection has no seasonal pattern, often remains latent and is present in many countries. The CBPV is found more frequently found in colonies infested with varroa.

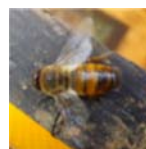
The CBPV is the only common viral disease of adult bees that has well-described symptoms, for this it has been given a variety of names, such as "hairless black syndrome" and "little blacks".

Affected bees become almost hairless, dark in appearance and suffer nibbling attacks from healthy bees of their colony. They become wobbly and flightless in the upper part of the honeycomb, crawling on the ground and on the stems of grass, where they die (Fig. 3).



**Fig. 3: Wobbly and flightless bees in the upper part of the honeycomb**

Some bees present enlarged abdomen due to accumulation of liquid in the honey sac and wings spread out in "K" form (Fig. 4). Sick individuals die within a few days of the onset of symptoms.



**Fig. 4: Paralysed bee with wings spread out in "K" form**

Thousands of paralysed bees from each colony die throughout the year and severely affected colonies can suddenly collapse.

The cells are hollow inside and the larvae become yellowish-brownish. Their internal organs become fluid while the integument remains intact, assuming the typical "saccular" larvae aspect when they die (Fig. 5). Subsequently, the infected larvae dry taking the form of blackish mummified flakes (Fig.6). Normally no smell is present even if, sometimes, the brood may have a mild sour smell.





GO TO  
BOTTOM

**Fig. 5: Saccular larva typical of Sacbrood virus**



**Fig.6: The infected larvae dry taking the form of blackish mummified flakes**

The infection has a typical seasonal pattern with higher incidence in spring and early summer, and normally disappearing by the autumn.

However, associated to varroa, these viruses can cause devastating effects and take epidemic form. The virus is transmitted to the larvae by the royal jelly and to the bees when they go to clean up the infected cells from dead larvae. Recently it has also been demonstrated that the virus is passed on from the queen to the brood (i.e. vertical transmission).

#### **ACUTE BEE PARALYSIS VIRUS (ABPV)**

This virus can normally be found in the fatty tissue of the bee and does not cause symptoms. Combined with varroa, the infection becomes particularly serious, causing mortality both in brood and adult bees. This virus is usually combined with the chronic paralysis virus (CBPV), however in case of massive varroa infestation ABPV prevails on CBPV because of its rapid replication activity.

#### **DEFORMED WING VIRUS (DWV)**

This virus is relatively widespread in apiaries, although often present in subclinical form if not associated with varroa (no symptoms are visible). However, in combination with varroa this virus can cause the death of the brood and of adult bees. This virus affects immature bees during their development in the cells. Unlike the ABPV, it is characterised by a very slow replication cycle, generally allowing the bees to fly despite the serious wings deformations, the reduced body size and very short life expectancy (Fig. 7).



**Fig. 7: Healthy honey bee with normal wings (left) - Parasitised honey bee with deformed wings (right)**

#### **SACBROOD VIRUS (SBV)**

This is a Picorna-like virus not very resistant to chemical, physical and environmental agents (it dies in 10 minutes at 55-65 °C and resists six days to direct sunlight; in honey it loses its virulence after 5-6 weeks). SBV infects the young bee larvae orally. The symptoms are evident in larvae in capped cells (Fig. 8), while the adults are asymptomatic. The capped cells are hollow inside and the larvae first become yellowish-brownish, then the internal organs become fluid while the integument remains intact assuming the typical "saccular" aspect (Fig. 5).



GO TO  
BOTTOM

**Fig. 8: Sacbrood Virus (SBV)**

#### **BLACK QUEEN CELL VIRUS (BQCV)**

This virus only affects the cells of queen bees and is one of the most frequent causes of mortality among the queen larvae. The name of the virus comes from the blackish colour of larval forms and the cell walls (Fig. 9). Although worker bee and drone brood can be infected by BQCV, generally these do not develop any kind of symptoms. The infection is more common when colonies are affected by nosemosis as the lesions of the small intestine facilitate the passage of the virus in the hemolymph.



**Fig. 9: Black Queen Cell Virus (BQCV)**

#### **VIRUSES PREVENTION AND CONTROL**

There are not still specific and effective therapeutic remedies for the viral diseases of bees. In the case of particularly severe symptoms, the only remedy is the destruction of affected colonies. In other cases where the symptoms are less severe you can try to replace the queen and the infected honeycombs, which will be destroyed.

The infected hives must be properly cleaned and disinfected before being used (disinfection can be carried out with bleach and then passing a blue flame on the hives).

Because of the demonstrated transovarian transmissibility for some viruses (an infected queen bee can produce infected eggs and brood), when introducing new queens in the apiary it is recommended to observe a quarantine period and monitoring of the health of the brood.

Good beekeeping practices are essential to prevent diseases and the stress factors should be kept to a minimum level, in fact they may serve as predisposing factors for the viruses, such as: chemical (e.g. drug treatments), physical (e.g. frequent visits in winter), metabolic and infectious (it is fundamental to keep varroa and nosema infestation under control).

See related technologies published on TECA by Apimondia and IZSLT on bee diseases:

1. [Good beekeeping practices](#)
2. [Main diseases of honey bees](#)
3. [Nosemosis](#)
4. [Varroa mites \(Varroatosis or Varroosis\)](#)
5. [AFB \(American Foulbrood\)](#)
6. [EFB \(European foulbrood\)](#)
7. [Bee viruses](#)

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## Further reading

Formato G., Cardeti G., Le virosi delle api. In "Aspetti igienico-sanitari in apicoltura" published by Istituto Zooprofilattico Sperimentale del Lazio e della Toscana "M. Aleandri", Italy, August 2007, 34-39

GO TO  
BOTTOM

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## Category

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## Created date

Wed, 17/06/2015 - 12:11

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### Apimondia

**Apimondia, the International Federation of Beekeepers' Associations**, is the world organisation representing the interests of apiculture and aims to facilitate links between beekeepers, scientists and all involved with apiculture. Apimondia stems from the International Committee of Apicultural Congresses created in 1893 holding the first congress in 1897 in Belgium. Apimondia in its current institutional form was founded in the Netherlands in 1949 and its core business is the organisation of international apicultural congresses and symposia. Today Apimondia work remains truly international: Apimondia is run on a basis of co-operation between beekeepers and scientists from many countries as well as international organisations. A special feature of Apimondia is the wide range of working languages used in publications and at meetings.



You can also visit **Apimondia** linked websites to find out more:

[www.apimondia.org](http://www.apimondia.org)

[www.apimondia2013.com](http://www.apimondia2013.com)

[www.apimondia2015.com](http://www.apimondia2015.com)

[www.beethecampaign.org](http://www.beethecampaign.org)

**Apimondia, la Federación Internacional de las Asociaciones de Apicultores**, es la organización mundial que representa los intereses de la apicultura y su objetivo es facilitar los vínculos entre los apicultores, los científicos y todos los involucrados con la apicultura. Apimondia deriva del Comité Internacional de los Congresos Apícolas creado en 1893 y con la celebración del primer congreso en 1897 en Bélgica. Apimondia, en su forma institucional actual, fue fundada en los Países Bajos en 1949 y su actividad principal es la organización de congresos y simposios apícolas internacionales. Hoy el trabajo de Apimondia permanece verdaderamente internacional: Apimondia realiza su programa sobre la base de la cooperación entre los apicultores y los científicos de muchos países, así como organizaciones internacionales. Una característica especial de Apimondia es la amplia gama de idiomas utilizados en las publicaciones y en las reuniones de trabajo.

Para más informes puede visitar los sitios web de Apimondia:

[www.apimondia.org](http://www.apimondia.org)

[www.apimondia2013.com](http://www.apimondia2013.com)

[www.apimondia2015.com](http://www.apimondia2015.com)

[www.beethecampaign.org](http://www.beethecampaign.org)

GO TO  
BOTTOM

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## IZSLT - Istituto Zooprofilattico Sperimentale del Lazio e della Toscana "Mariano Aleandri"

The Istituto Zooprofilattico Sperimentale del Lazio e della Toscana "Mariano Aleandri" (IZSLT) is a public body operating in the frame of the National Health Service with duties related to animal health and welfare and food safety. In such areas it provides services in the diagnosis of animal diseases and zoonoses, microbiological, chemical and physical controls over safety of foods, food production chains and animal feed. In the same areas it performs research, epidemiological surveillance, continuous training and international cooperation activities.

IZSLT's mission is to ensure that animal health and welfare, hygiene of farms, primary productions, safety of foods and animal feed comply with the relevant legislation.



To effectively fulfill its mission, the Institute carries out:

- diagnostic service over animal diseases and zoonoses;
- scientific and technical support to veterinary and public health services for controls on animals, food and feed;
- laboratory tests to verify the health status of animals;
- technical and scientific support to monitor veterinary medicines;
- research on animal health and welfare, food safety and hygiene of farming and livestock products;
- studies on animal welfare and development of alternatives to the use of animals in experiments;
- studies to monitor the safety of food of animal origin and feed;
- scientific and technological cooperation with other research institutes;
- epidemiological surveillance on animal health and food safety, on livestock products and on environmental factors affecting the above;
- studies on the health risks for humans linked to animals and animal products;
- support, technical assistance and hygiene information to manufacturers of food of animal origin;
- production of vaccines and laboratory diagnostics for the improvement of animal health.

In the frame of IZSLT activities, the Apiculture Unit's mission (<http://www.izslt.it/apicoltura/>) is to certify and guarantee the health and welfare of bees, and the hygiene and safety of the hive products, through: diagnosis of bee diseases and analyses on hive products, support to Governmental Institutions in drawing up legislation, research activity, collaboration with other laboratories or institutions, technical support and training for operators, pollution environmental monitoring using honey bees and protection of honey bee biodiversity.

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[GO TO  
BOTTOM](#)