

## Bee viruses

<b>Source</b>	Apimondia, IZSLT - Istituto Zooprofilattico Sperimentale del Lazio e della Toscana “Mariano Aleandri”
<b>Keywords</b>	Beekeeping, bee larvae, virus diseases
<b>Country of first practice</b>	General
<b>ID and publishing year</b>	8419 and 2010
<b>Sustainable Development Goals</b>	No poverty and life on land

### 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. 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.

Seasonal factors and the region where the apiary is located strongly influence the onset of honey bee viruses. To date, there are many identified and classified bee viruses but there is not enough information about their worldwide distribution.

### Description

#### 1. Main bee viruses

Table 1 illustrates the main bee viruses affecting the apiaries. Some viruses cause characteristic symptoms. In particular:

- the sacbrood virus (SBV) causes saccular larvae (Figure 5);
- the black queen cell virus (BQCV) causes blackened queen cells (Figure 9); and
- the chronic bee paralysis virus (CBPV) causes small black bees (Figure 1).

Table 1. 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

Source: FAO 2010

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



# Beekeeping

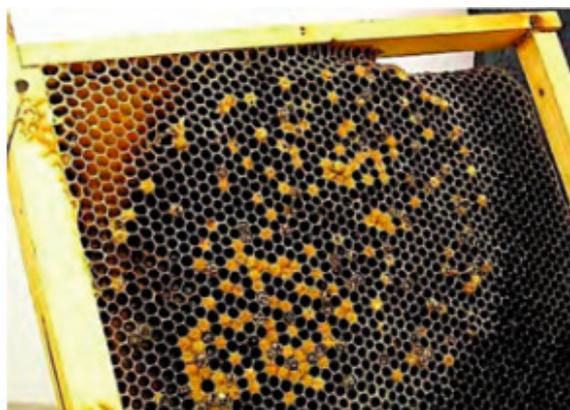
An exact diagnosis of the virus can be made through PCR technique (polymerase chain reaction) in specialized analysis laboratory (except for the sacbrood virus and the black queen cell virus).

Figure 1. Small black bees



© FAO/ Giovanni Formato

Figure 2. Comb affected by virus: uneven brood pattern with high mortality and cells with perforated capping



© FAO/ Giovanni Formato

## 1.1 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 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 (Figure 3).

Figure 3. Wobbly and flightless bees in the upper part of the honeycomb



© FAO/ Giovanni Formato

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

Figure 4. Paralysed bee with wings spread out in “K” form



© FAO/ Giovanni Formato

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 (Figure 5). Subsequently, the infected larvae dry taking the form of blackish mummified flakes (Figure 6). Normally no smell is present even if, sometimes, the brood may have a mild sour smell.

Figure 5. Saccular larva typical of sacbrood virus



© FAO/Giovanni Formato

Figure 6. The infected larvae dry taking the form of blackish mummified flakes



© FAO/Giovanni Formato

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).

### 1.2 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.

### 1.3 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 (Figure 7).

### 1.4 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 to 65 °C and resists six days to direct sunlight; in honey it loses its virulence after five to six weeks). SBV infects the young bee larvae orally. The symptoms are evident in larvae in capped cells (Figure 8), while the adults



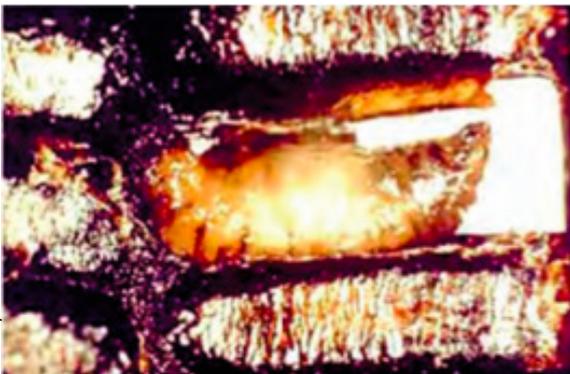
are asymptomatic. The capped cells are hollow inside and the larvae first become yellowish-brownish, then the internal organs become fluid while the integument remains intact assuming the typical “saccular” aspect (Figure 5).

Figure 7. Healthy honey bee with normal wings (left). Parasitised honey bee with deformed wings (right)



© FAO/ Giovanni Formato

Figure 8. Sacbrood virus (SBV)



© FAO/ FERA

### 1.5 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 (Figure 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.

Figure 9. Black queen cell virus (BQCV)



© FAO/ Giovanni Formato

## 2. 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).

### 3. 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.

### 4. Related/associated technologies

- Good beekeeping practices: 8409.
- Main diseases of honey bees: 8412.
- Nosemosis: 8413.
- Varroa mites (varroaosis or varroosis): 8416.
- AFB (american foulbrood): 8417.
- EFB (european foulbrood): 8418.

### 5. Objectives fulfilled by the project

- Women-friendly
- Resource use efficiency
- Pro-poor technology