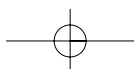
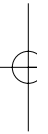
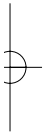


## Sacbrood



Pupa with sacbrood

© J.-P. Faucon

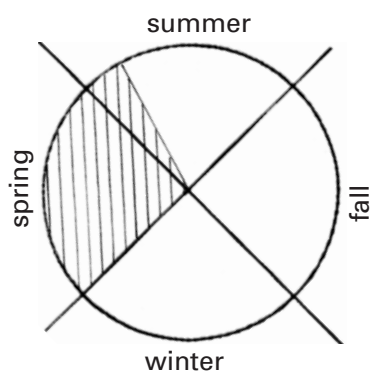




### DISTRIBUTION

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Bibliography: 96, 102, 311, 881



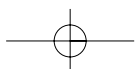
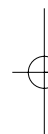
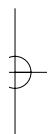
#### PERIOD MOST PREVALENT.

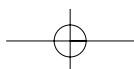
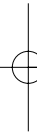
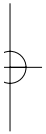
Spring and early summer.

#### BEE HOST SPECIES

*Apis mellifera*, *Apis cerana*

Bibliography: 124





## ● FIELD DIAGNOSIS

### ***Before opening the hive***

- colonies showing little activity.

### ***After opening the hive***

- pepperbox brood pattern;
- capped brood comb with larvae resembling small sacs of liquid;
- capped brood comb with discolored larvae (not creamy white);
- pells contain dead pre-pupae that are starting to change color beginning with the thorax and head;
- pells contain dead pre-pupae of varying degrees of brown;
- pells contain pupae reduced to flat brown boat-shaped scales.

#### **KEEP IN MIND**



This disease can go undetected.

When a brood comb appears patchy (pepperbox) check to see if larvae or pre-pupa in capped cells present the symptoms above.

## ● ETIOLOGY (36, 83, 105, 124, 262, 794, 795, 796, 797)

Sacbrood virus (SBV) can multiply in adult bees without giving any outward signs of the disease.

Young workers whose task it is to clean cells are often contaminated when removing larvae that have died from the virus.

Within days of infecting a worker bee, high concentrations of the virus are found in the bee's hypopharyngeal glands (Fig. 93) (83).

Nurse bees can also be infected and transmit the virus to larvae when their gland secretions are added to the food.

In the brood nest, there will be a mix of healthy larvae and larvae that appear to be healthy but that are, in fact, infected. In the first case development rolls out normally. But in infected larvae, the virus multiplies quickly in several types of body tissues, including fat body, muscles and tracheal terminal cells (794, 796).

Two-day old larvae are the most susceptible to the disease, older larvae are less so and manage to reach adulthood (36).

Millions of virus particles infest the exuvial fluid, the liquid between the larva's body and tegument. The dead larva is stretched out in the cell with its head toward the capping, the body resembling a liquid-filled sac (Fig. p. 315).

The viral infection affects the dermal glands, probably inhibiting the formation of the enzyme chitinase that the bee needs to dissolve the endocuticle in order to molt. Each dead larva contains a milligram of virus particles, enough to infect 1,000 colonies (96).

Once the cells have been capped, normal larvae are pearly white and transform into pupae a few days later. Infected larvae turn pale yellow and die in the prepupa stage, having been unable to molt for lack of chitinase.

The dead larva dries up and turns dark brown, beginning with the thorax and head, eventually transforming into a flattened, boat-shaped scale (96).

#### ● **INFECTION OF WORKER BEES** (80, 83)

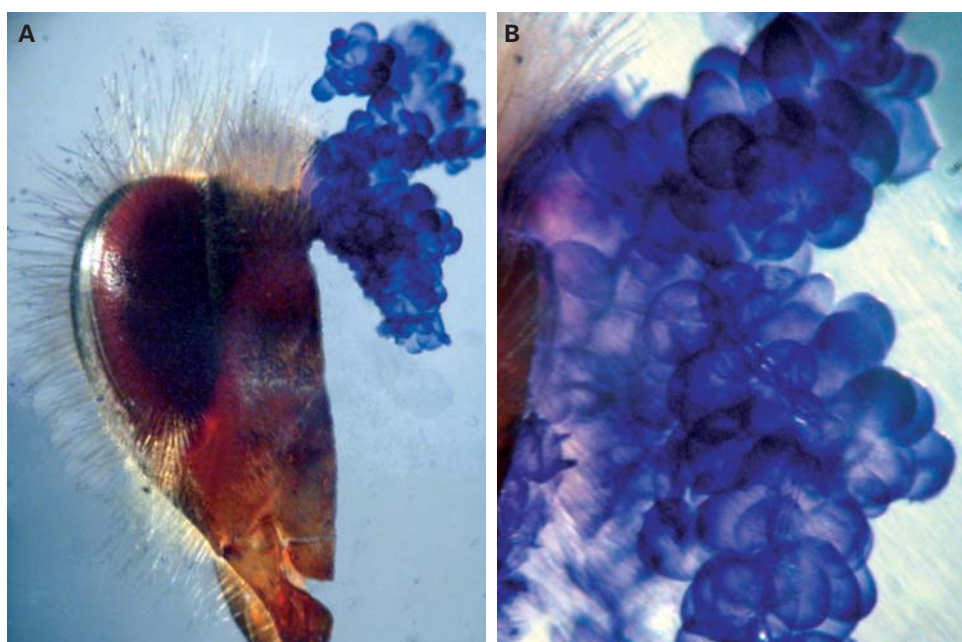
The young worker bee charged with cleaning cells removes the dead larvae in which the exuvial liquid has accumulated and contains large amounts of viral particles. Exposed workers are contaminated by the infected liquid seeping from punctures resulting from the cleaning activity (80).

A day later the hypopharyngeal glands of the worker already contain important quantities of the virus (83). When the cleaning bees become nurses they will transmit the virus through food mixed with their contaminated gland secretions.

Fresh pollen, collected by contaminated foragers and fed to larvae can be a source of infection too, since their glandular secretions also contain large quantities of the virus and are incorporated into the food.

#### ● **THE VIRUS IN THE ADULT BEE** (96, 105, 385)

Although adult bees do not exhibit obvious symptoms, changes nevertheless take place. When adult worker bees are infected by the virus, they stop eating pollen and collect less of it than healthy bees. Their normal sequence of tasks is accelerated and their lifespan shortened (105). Their hypopharyngeal glands degenerate (385) and they stop taking care of larvae (96).

*Diseases and Pests of Both Adults and Brood / Sacbrood***Fig. 93. Sacbrood.**

A. Left half of worker head with right hypopharyngeal gland attached – B. Detail of hypopharyngeal gland stained with black chlorazol after bleaching and dilating with lactic acid.

Nectar contaminated with the virus by adult bees appears to be a less important source of infection than pollen (96).

Infected drone adults do not exhibit obvious symptoms either, although the virus multiplies actively in their brain.

In winter, adult bees constitute a holding tank for the virus which will begin infecting again with the coming of spring. Some of the infected bees will die prematurely. If no new infestation occurs, there will be less infection the following season.

### ● **BEST PRACTICE**

Measures against viral disease are generally well known.

Never use brood combs with a pepperbox pattern in other colonies.

Colonies used to create new colonies should, of course, be free of the virus.

Use bee strains that are less susceptible to viral infection.

Never leave combs with dead brood or scales for bees to clean. These combs should be burned (Fig. 57).

**SACBROOD VIRUS: CYCLE**

Fig. 94-Sacbrood

There are three parts to this figure:

-A, B, C, D how infection occurs.

-E, F, G, H development of a healthy larva

-I, J, K, L development of a larva with symptoms of sacbrood

A cleaning bee is attempting to remove a larva (A) that was killed by the virus. The dead larva resembles a thin-walled sac in which its remains float in molting fluid infested with sacbrood viral particles.

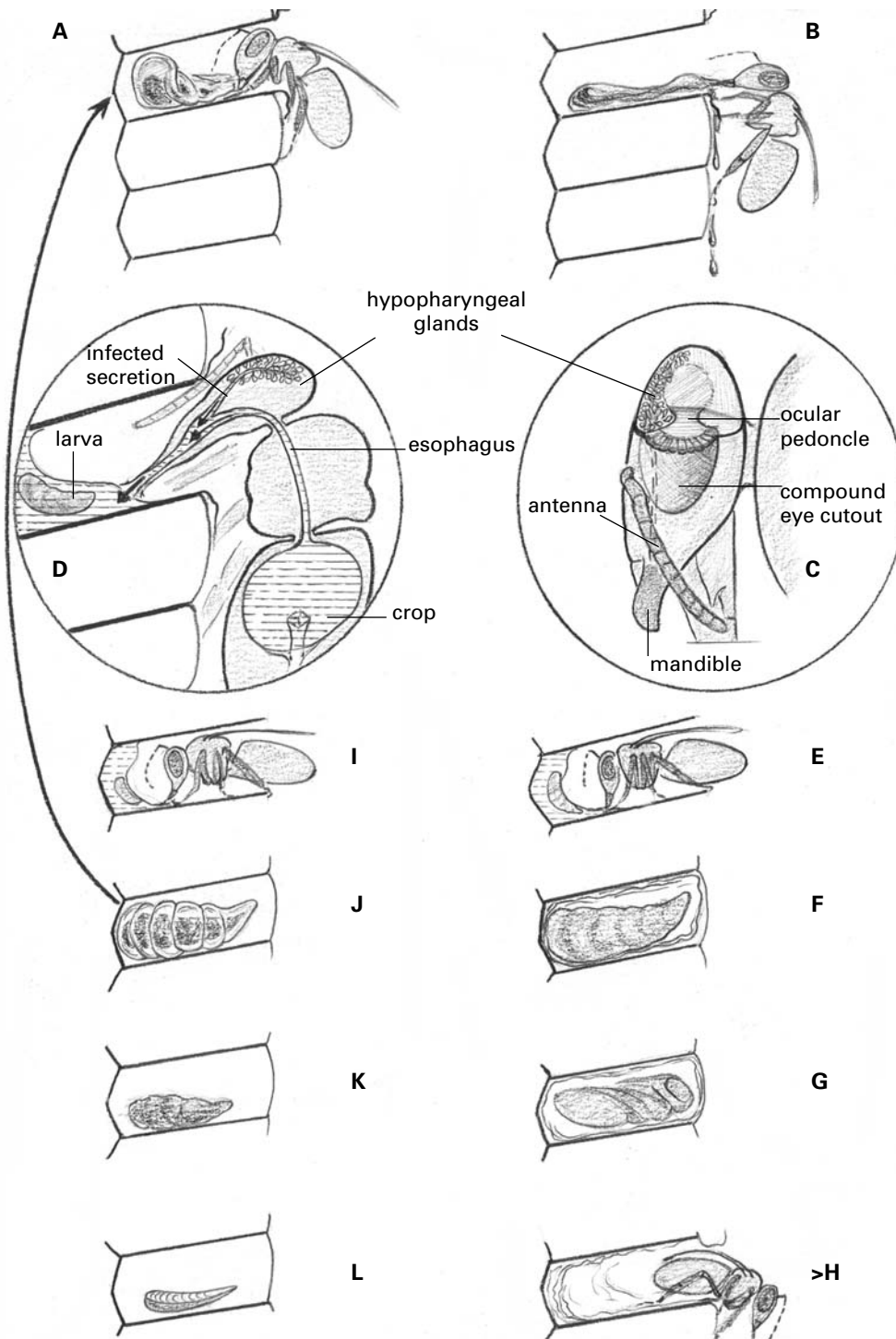
During handling (B), the fragile wall is punctured, releasing the virulent liquid (+), which contaminates the mouthparts of the worker. The virus (C) quickly finds its way to the bee's hypopharyngeal glands located dorsally in the head near the compound eyes (Fig. 93). The secretions of these glands are added to the larva's food (D). Indeed, the regurgitated content of the crop is mixed with a number of secretions, of which those of the infected hypopharyngeal glands.

A larva over two days of age (E) is less susceptible to the disease and manage to mature into adults (F, G, H).

A larva under two days is infected by a nurse bee carrier of the virus (I). Once infected, larval development is blocked, and it dies in the pre-pupal stage. The characteristic appearance of the dead pre-pupa is due to that fact its body mass floats in exuvial fluid inside its carapace (J) unlike the normal larva that fills its carapace. The healthy larva is pearly white, the diseased larva pale yellow.

The dead larva may be removed by a cleaning bee and the cycle begins again as above (J, A, B), or it may dry out (K) to become a boat-shaped scale (L).

*Diseases and Pests of Both Adults and Brood / Sacbrood*



**Fig. 94. Sacbrood**

**KEEP IN MIND**

There is another illness called BSD (Brazilian Sacbrood-like Disease) (919, 920, 1089) that presents the characteristic symptoms of sacbrood in Africanized bees. BSD, however, is not caused by a virus, but by toxic pollen.

A variety of virus extraction and purification techniques have not revealed an associated virus (1089), even when examined under electron microscope.

On the other hand, experiments with pollen from *Stryphnodendron polyphyllum* (Fabaceae, Mimosoideae), commonly called *barbatimão* cause the same symptoms as sacbrood.

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