Sperm storage Honey bee sperm cells or spermatozoa are the male reproductive cells found in semen. Each drone honey bee produces about ten million sperm cells, about seven million per microlitre of semen.

Being in store is the normal state for honey bee spermatazoa: a queen stores them in her spermatheca from the time of her mating flights until her death, sometimes longer than three years.

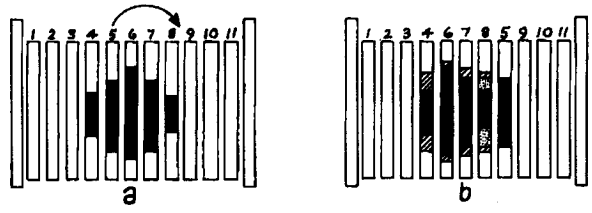
A practical method of artificial storage of honey bee sperm cells would be an important asset to bee breeding. It could be used for long-term storage of breeding stock, thereby eliminating the perpetual propagation of inbred lines and mutant markers. It could advance the management of breeding programmes by allowing the breeder to collect and store semen from breeding lines when drones are plentiful. The semen could be used whenever it was needed or even sent to other breeding stations. To use stored semen, of course, a breeder would need to employ INSTRUMENTAL INSEMINATION.

Honey bee sperm cells have survived many artificial storage conditions. Much experimental work has involved storage at 60°F (16°C), and at this temperature sperm cells have survived for as long as 8 months. Survival diminishes with time, and after 50 days the number of viable spermatozoa entering the spermatheca with instrumental insemination is about half the number expected if fresh semen is used. Bee sperm cells have also survived the extreme cold of storage in liquid nitrogen at -320°F (-190°C). However, rather than a gradual cell mortality with time, the major survival problems with liquid nitrogen storage occur during the harsh transitions into and out of extreme cold.

Progeny can be consistently produced from sperm stored in liquid nitrogen, but it is unsatisfactory since the queens inseminated with this semen are usually partial drone-layers. This problem needs to be solved before stored sperm can be used for anything but stock maintenance; it would be too unreliable for use on queens destined to head honey-production colonies.

The techniques of storing bee semen are still experimental and quite varied. At non-freezing temperatures the undiluted semen is usually stored with streptomycin sulphate. For storage in liquid nitrogen, the semen is usually diluted with various salines and dimethyl sulphoxide. In both cases, glass capillary tubes are used as containers for the semen. JRH

Spiders see **Pests and predators**



Spreading the brood Colonies and nuclei which are headed by a vigorous young queen and are free from nosema disease can be induced to build up more rapidly by a technique known as 'spreading the brood'. The technique can be explained as follows, referring to the two figures. In the one on the left, A represents a normal, average, brood nest in early spring in temperate countries. Comb 5 is found to contain the largest area of sealed brood, preferably just beginning to emerge. This comb is moved to the outside of comb 8, which up to now has been the last frame on that side containing brood, as shown in B. The warmth from the brood in combs 7 and 5 will warm up the empty dotted area in comb 8, and the queen will very soon lay eggs in this, making the brood nest symmetrical once more. This provides a gain of several hundred eggs which would not have occurred without the shift. Normal expansion will continue at the same time, as suggested by the hatched area.

This technique can be made more efficient by placing the brood nest to one side of the hive, as shown in C. In very cold seasons it is probably best to place a dummy frame between the brood (on frame 1 in the diagram) and the wall of the hive, or to leave a full frame of stores there to act as a buffer to temperature change. Spreading the brood can then proceed as shown in D-G, a shift being made every 7-10 days until the colony is fully built up. Providing the conditions set out in the first paragraph are rigorously adhered to, and brood is *never* spread over an empty comb, no problems will occur. It is a method of speeding up colony growth which does not entail the transfer of brood or bees from another colony.

A further advantage is that during the period between inspections the 'spread' comb will have emerged and the queen should have relaid this, as well as the induced extra laying. At the next inspection the laying capability of the queen, and the build-up rate of the colony, can usually be assessed by looking at the first one or two combs on the expansion side. If the brood is initially placed against the wall, expansion can only occur on one side and is more easily assessed.

See also SPRING NECTAR FLOW, MANAGEMENT OF.