

coats and liberate the parasites, which enter the cells lining the stomach. There they grow and multiply rapidly, and finally produce numerous spores, which pass through the bee and can infect a fresh host. These spores are thus the means *Nosema* has of perpetuating itself, as otherwise when the bee died *Nosema* would die also.

Field bees become weakened by the enormous number of parasites in their stomachs and are unable to return to the hives when out foraging. In badly-diseased hives all the adult bees may show some degree of infection. Queens are attacked, but brood is immune. The disease reaches its height in spring, though it may persist throughout the year.

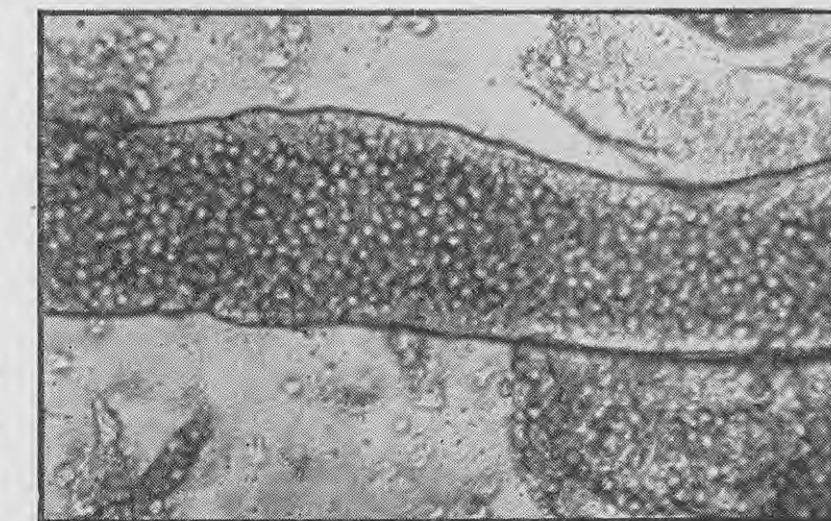
Symptoms

A loss in hive strength without apparent cause is usually the first sign of infection, other symptoms often being difficult to detect. In very bad cases the bees may be seen crawling from the hives, being unable to fly, and there may be dysentery. Microscopic examination is necessary for diagnosis of the disease. Bees, preferably living, should be sent to Wallaceville for diagnosis after consultation with the local Apiary Instructor.

Economic Importance

Nosema has been reported in Australia, Brazil, Canada, England, Germany, Switzerland, and the U.S.A. It would be surprising if it were not present in New Zealand, as it was reported in Australia in 1910. It was probably introduced to New Zealand in the early days of beekeeping, as it must be one of the commonest and most widely-distributed of bee diseases.

Nosema is a far less serious disease than American foul-brood. Strong colonies with a mild infection soon throw it off and recover, as was the case at Wallaceville. A weak colony with a heavy infection may die out, and occasionally a group of hives, perhaps with lowered resistance, becomes a total loss, but usually the economic loss to the industry is small. If the



The encysted stage of *Malpighamoeba mellifica prell* in the malpighian tubule, 430 times natural size.

queen becomes infected with *Nosema*, the hive will decline rapidly and the bees may attempt supersedure. From past accounts of spring dwindling or reduction of hive strength in New Zealand there is little doubt that *Nosema* has been present for many years.

Control Methods

Isolation of infected colonies is not recommended. In the case of such a widespread outbreak as that which occurred in New Zealand in 1946-47 isolation and disinfection of individual hives would be impracticable. Where dysentery occurs, hive mats should be burnt to prevent risk of their transfer to uninfected hives. Badly-infected hives should not be moved to clean

apiaries. Contamination of drinking water and robbing of diseased hives probably cause the disease to spread.

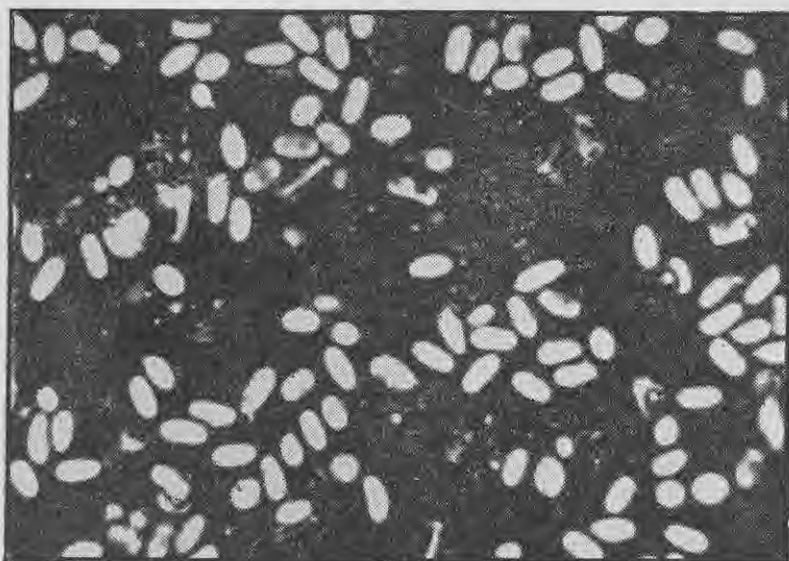
Requeening a hive in which the queen is infected or combining it with the queen and bees of a nucleus hive is a step which is often successful. Treatment with drugs has not been found of use so far. One of the difficulties in assessing the value of drugs is that many hives recover naturally from *Nosema*, so control hives—that is hives not fed the drug—must be used. Treated hives and the untreated controls should all have the same degree of infection if the drug is to be tested accurately. The danger of any drug used reaching extracted honey which may be sold to the public and its possible adverse effect on the bees are important factors in such trials.

In the U.S.A. gentian violet, emetine HC1, chinoformin, tryparsamide, chlorosan, and sulphathiazole have been tested. None appeared to be effective.

In Russia *b. naphthol*, xerophorm, picric acid, urotropin, phenol, collargol, salol, and gramicidin were tried. None was satisfactory.

Dr. Butler, at Rothamsted, England, is trying the effect of stovarsol, propamide, and tryparsamide. Trials have not been completed.

D. S. Robinson, Apiary Instructor, Department of Agriculture, Hastings, and the author have been carrying out trials of drugs against *Nosema* for several seasons. Drugs selected are known to be useful against organisms resembling *Nosema*. They are fed to hives in gradually-increasing doses, mixed in sugar syrup, so that tolerance of bees for them is first established. Finally, a group of hives is fed the drugs and samples from these and a control group are examined at intervals in the laboratory so that the course of the disease can be followed. Drugs already tested, with the weights fed in a single dose to a colony given in parentheses, are atebirin (3 grammes),



Nosema apis spores, 600 times natural size.