

were packed with innumerable little tubercles, which could only be seen clearly under the stereoscopic microscope. The lungs, kidneys, and bone marrow appeared to be normal. The liver and spleen contained innumerable acid-fast bacilli, and a few were found in the lungs and marrow; none could be seen in a preparation from the kidney.

A rabbit was injected with 5 milligrammes of bacilli and died thirteen days later. There was a caseous tumour in the abdominal wall at the seat of inoculation. The omentum was drawn up and thickened, and contained some early caseous patches. Tubercles were present on the diaphragm and falciform ligament. The spleen was large, pale, and soft, but without visible tubercles. Lungs and kidneys were apparently normal. The post-sternal and vertebral glands were caseous.

The tuberculosis appeared to be progressive, but was in an early stage. So early a termination without obvious disease of lungs or kidneys raised the suspicion that the animal might have died from some cause other than tuberculosis, but there were no circumstances or appearances to support this view.

A guinea-pig injected intraperitoneally with 50 milligrammes of culture lived for 120 days. Death was found to be due to a compound fracture of the humerus. There was a large abscess about the broken bone. No trace of tuberculosis could be found in the abdominal cavity or elsewhere, and no acid-fast bacilli were seen in a preparation from the contents of the abscess.

These experiments, together with the cultural characters of the strain of the bacilli, leave no room for doubt that the Rabbit B, from which the strain was obtained in culture, was suffering from an injection with a pure strain of avian tubercle bacilli.

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## THE PSOROPTES COMMUNIS OVIS: SOME OBSERVATIONS ON OVA AND OVIPOSITING.

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THE writers of this article carried on a considerable number of observations in relation to the ova of the psoroptes communis, some of which have already been published (*Annual Report of the Chief Veterinary Officer, Board of Agriculture and Fisheries*, 1911, and *Journal of Comparative Pathology and Therapeutics*, 1910).

Some of these observations have been repeated and extended, using other methods, and the object of this article is to describe a few of the more important results obtained.

*Method.*—Eggs of ovigerous females were collected from affected sheep. Some of these were submitted to microscopical examination, making use of the usual technique; others were submitted to observation *in vitro* at incubative and other temperatures. The conditions surrounding experiments *in vitro* must of course be considered somewhat artificial, and some of the practical objections to this method were pointed out in the previous article.

To make the observations approach more nearly to the natural the following method was adopted. The lids and bottoms were removed from pill boxes of about 1 inch in diameter and 1 inch in depth. The open ends were then closed by tightly stretching and fixing pieces of silk netting of a very fine mesh over the openings. Eggs obtained from ovigerous females or the ovigerous females themselves were placed inside these boxes, and the box was then tied tightly against the skin of the sheep by strands of the animal's wool. The females, by this method, were apparently able to feed through the meshes. It was found very difficult, however, to obtain silk with a fine enough mesh to prevent some of the larvæ passing through after they had hatched from the eggs.

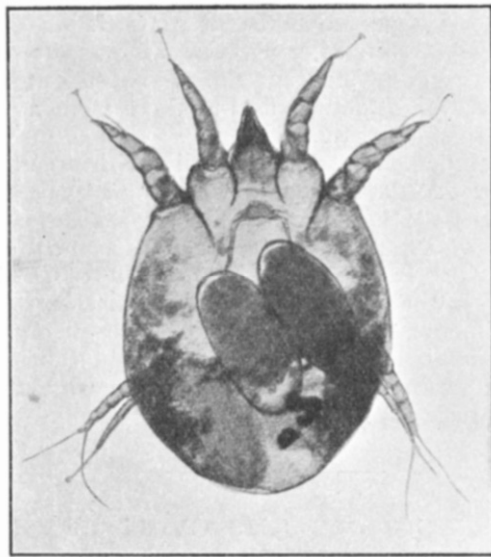


FIG. 1.

Adult female acarus containing three ova. (Photographed by Mr W. T. Cranston.)

*Number of Eggs laid by a Single Female.*—In order to properly observe the eggs inside the female it is usually necessary to treat the parasite with a clearing agent. The egg is very large in proportion to the acarus which contains it, being nearly half the length of the body of the female. It is exceptional to find two or more fully developed ova inside the body of an acarus at one time, but in one case a female acarus taken directly from a sheep was found to contain no less than three ova which appeared to be fully formed (see fig. 1).

The female acarus is generally admitted to be oviparous, and this we have found to be the rule. During the month of May 1911, however, and again in May 1912, an adult female acarus taken from a sheep was found to contain in its body an egg enclosing a larva which appeared to be fully developed (see figs. 2 and 3). When ovigerous

females are taken from a sheep, placed in a glass dish or tube, and incubated, a considerable proportion of them will lay. It is exceptional, however, for a female to lay more than one egg after being removed from its host, unless it is returned to the sheep for further feeding. In the course of a very large number of observations on ovigerous females *in vitro* only one acarus has been observed to lay more than one egg (two ova laid). This took place after eighteen hours' incubation at 25° to 27° C. We are led to believe from these observations that statements which have been made regarding the number of eggs laid by a single female acarus, and which purport to be based on observations carried out on acari removed from their host, are open to question, as it is not possible to make such observa-

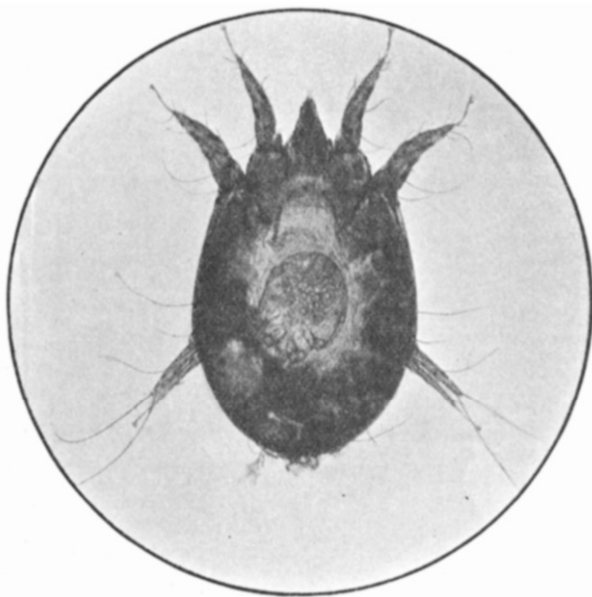


FIG. 2.

Adult female acarus containing a larval parasite within the body.  
(Photographed by Mr W. T. Cranston.)

tions *in vitro*. If incubation is continued without interruption after the eggs have been laid in the incubator the majority will hatch out. The average time occupied in hatching is about 100 hours (four days), but some of the eggs may not hatch out until the sixth or even the seventh day. Those which remain unhatched after the seventh day do not usually hatch at all. The ova will hatch out in a dry atmosphere, but a slight amount of moisture favours the process. It has also been found that they will hatch out under water.

So far as we are aware the number of eggs laid by a single acarus has only been arrived at by calculation, and it is usually stated, following upon the observations of Gerlach, that each female lays

fifteen eggs. For the purpose of acquiring more definite information regarding the number of eggs laid by a single acarus, ovigerous females and copulating pairs were removed from a scabby sheep, and placed upon healthy sheep either directly on the skin or in contact with the skin, but confined in one of the pill boxes above mentioned. Where the acari were placed directly on the skin only one female was used at a time for observation. The pill box is not really necessary for such observations, as the female and her progeny may not move any great distance from the part on which they are first put, unless the sheep disturbs the parasite by nibbling and rubbing.

By this method of observation it was found that distinct intervals elapse between the laying of the first egg and those which are laid

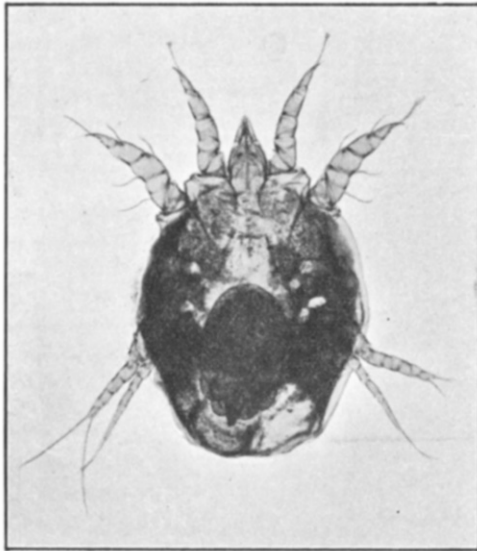


FIG. 3.

Adult female acarus containing a larval acarus within the body.  
(Photographed by Mr W. T. Cranston.)

afterwards. When a single female was put on the skin and observed daily over a number of days it was found that the laying period lasted much longer than the hatching period. In fact, adult acari could be found along with eggs from the same female. The only way, then, to arrive at the number of eggs laid by a single female is to count the eggs and individuals found to arise from one female which has the opportunity of feeding, taking care, of course, to make the count before the first individuals hatched out have proceeded to a second generation. By following this plan the greatest number which it has been possible to count from one female has been fifteen individuals, but it would appear from counts made of masses of eggs from a known number of females that the average per female was considerably above fifteen, the estimate reaching as high as thirty in

one observation, and we have reason to believe that the total number of eggs laid by a single female may even exceed that number. It is not impossible, of course, that in the counts from single females some eggs escaped observation and were not counted, but it would appear that the calculation of Gerlach is fairly accurate in so far as it applies to some females, though not to all. By observing the number of eggs laid on sheep by females over a period of twenty hours, it was found that a female may lay two eggs in that time. Having regard to the facts that a female usually lays at most three eggs in twenty-four hours, that adults can be found along with eggs from the same female, that eggs remain on the skin for four days or even more before hatching, and that the period required for the acarus to pass through its various stages is about twelve days, it would appear that eight days approximately represents the duration of the laying period. The females have not been actually seen to die on sheep after the egg-laying period, but it is usual to find many dead females away from the skin in the wool. When observed in the boxes many of the females are found dead and shrivelled up, and it would appear to be correct that with the end of the laying period the life of the female terminates. The observations show, however, that it must not be taken for granted that each female will lay approximately fifteen eggs, or that it will always begin to lay immediately it is placed on a sheep. Some of the females put under observation have for some unknown reason declined to produce eggs for a considerable time after being put on the sheep, and others have been observed to lay a much smaller number than fifteen. In some of the observations, particularly when a copulating pair was put on a sheep (the male drags the female about), the female could not be found at the next and subsequent examinations. In some of these cases the sheep were isolated, and were found after long intervals to be affected with scab in a visible form. Such observations furnish the proof of what always appeared to be theoretically possible, viz., that an outbreak of scab can be started by one fecundated ovigerous female. They also provide an additional explanation of the long intervals which frequently elapse in practice between contact with infection and the appearance of visible scab, to which attention was directed in previous papers (note, *loc. cit.*).

*Effects of Certain Dips on Ova Removed from Sheep.*—To obtain large numbers of ova for these observations several ovigerous females were placed in the above-mentioned boxes and attached to the skin of a sheep. The females laid eggs on the silk gauze, and this, along with the eggs, was immersed in the dipping fluids, made up according to the manufacturer's directions. Reference was made in a previous paper to the existing belief that recurrence of scab after one dipping is due to the eggs not being destroyed by the dips and hatching out afterwards. It was pointed out that the viable period for eggs was short, and that living larvæ were seldom found on sheep after dipping, even when our observations were continued far beyond the viable period.

Subsequent observations have shown that after dipping scabby sheep in arsenical dips a few larvæ may hatch out, but that these usually leave the dipped sheep. This was not found to be the case with dips of the creosote type, and it was on this account considered

advisable to carry out observations on the effects of different kinds of dips on eggs *in vitro*. It is obvious that such observations will not comply with the conditions of dipping in practice, because the fleece of a sheep (not recently shorn) which has been immersed in a dipping fluid maintains the latter in contact with the eggs for a more or less considerable time. On the other hand, experiments *in vitro* permit different dips to be compared under identical conditions.

*Observation No. 1.*—About sixty eggs laid on silk gauze in the space of four days were immersed for one minute in an arsenical dip. The eggs were laid in contact with the skin, and it follows that some of them must have been on the point of hatching out. After immersion the eggs were transferred to the incubator ( $25^{\circ}$  to  $27^{\circ}$  C.). Several larvæ hatched out.

*Observation No. 2.*—About thirty ova laid on silk gauze in contact with the skin were immersed in an arsenical dip for one minute. The eggs were laid over a period of five days, and as in the previous case some of them were on the point of hatching. After being transferred to the incubator several larvæ hatched out.

*Observation No. 3.*—About 100 eggs laid on gauze in contact with the skin were immersed in a creosote dip for one minute. The eggs had been laid over a space of five days, so that the conditions in this respect were the same as in observation No. 2. The eggs were afterwards transferred to the incubator ( $25^{\circ}$  to  $27^{\circ}$  C.). No larvæ hatched out in this case.

*Observation No. 4.*—About eighty ova laid on gauze in contact with the skin were immersed in a creosote dip for half a minute. The eggs were afterwards transferred to the incubator ( $25^{\circ}$  to  $27^{\circ}$  C.). No larvæ hatched out in this case.

*Observation No. 5.*—This test was a repetition of observation No. 4, about 300 ova being immersed in the dip for half a minute. They were transferred to the incubator, and on the following day one larvæ was seen partly emerged from the shell, showing somewhat feeble movements of the limbs. Subsequent examinations did not reveal any signs of hatching or movement.

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## AN ABSCESS IN THE VENTRICULAR SEPTUM OF A COW'S HEART.

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IT is a matter for regret that I am unable to give any history of the specimen recorded in this note, save that the animal from which it was obtained "had been ill for some time before it died."

The specimen is the heart of a cow, which having died a natural death was disposed of for cat's meat. On cutting the heart right across it was found that there was a large abscess containing creamy pus, and measuring just over 4 inches in each direction in the thickness of the ventricular septum. It was not placed in the middle of