sprays with Penetrol as a spreader caused severe leaf injury.

Following this first attempt it seemed advisable to try a series of sprays with less colloidal sulphur. Four strengths were used: 0.5, 1.0, 2.0, and 4.0 pounds. Four applications of these sprays were made on the following dates: April 11, 20, 27 and May 4. These sprays had no harmful effect on the plants. The 4–100 and 2–100 gave excellent commercial control of spider. Less satisfactory results were obtained with the 1–100 and the 0.5–100 gave very little control. By this time mildew had made its appearance and the plants sprayed with a 1–100 spray or stronger were free of the disease.

On May 4 the manager of the greenhouse became interested and wanted to try some of the colloidal sulphur spray. Accordingly, a complete house, the one with the most severe infestation of red spider, was sprayed using 1.5 pounds of the colloidal sulphur to 100 gallons of water. This spray was very effective and in a week was followed by another using 1.75 pounds of sulphur to 100 gallons of water. No injury resulted and four more sprays were applied at weekly intervals using a 2–100 spray.

After the second and third sprays spiders were scarce and mildew was almost absent. In the adjoining houses spiders were serious and mildew quite prevalent. This one season's experience indicates that red spider and powdery mildew on greenhouse cucumbers can be successfully controlled with hydrophilic colloidal sulphur spray. The strength of spray suggested for greenhouse cucumbers is 2 pounds of the sulphur paste to 100 gallons of water. This gave excellent control and has a wide margin of safety.

This is not the first use of hydrophilic colloidal sulphur spray as an acaricide. DeOng,[2] 1924, found it to be very effective against the red spider *Bryobia pratiosa*. He prepared his sulphur in the laboratory according to Young.[3] His results showed excellent control but he concludes hydrophilic colloidal sulphur would not replace lime sulphur, at least until a cheap method of manufacturing it was devised. The strength of sulphur suggested will cost about the same as lime sulphur and considerably less than nicotine sulphate.

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[2] E. R. DeOng, "The preparation and use of colloidal sulphur as a control for red spider," *Jour. Econ. Ent.* 17: 533–538, 1924.

[3] H. C. Young, "The toxic property of sulphur," *Ann. Mo. Bot. Gard.* 9: 403–435, 1922.

PHAGOCYTOSIS OF BRUCELLA, AN INDEX OF IMMUNITY TO UNDULANT FEVER IN MAN

STUDIES of the phagocytic activity of the polymorphonuclear cells in the blood of man toward the genus *Brucella* have revealed an important relation between this phenomenon and susceptibility and immunity toward undulant fever.

It has been found that the cells of individuals who have never knowingly been in contact with *Brucella* infective materials or who have not had undulant fever, possess little if any phagocytic activity for the organism when mixed with it *in vitro*. The polymorphonuclear cells of those who have handled infective materials, such as cultures or infective tissues, and of those who have recovered from undulant fever have marked phagocytic activity. It has been found from the study of many such cases that from 80 to 100 per cent. of these particular cells will ingest *Brucella* to a marked degree.

During the course of the infection in man the phagocytic activity of the cells will vary. As a rule only slight, if any, phagocytosis will be seen. As recovery takes place, the phagocytic activity of the cells increases rapidly.

There appears to be no relationship between the agglutination titer of the serum and the phagocytic activity of the cells in the same individual. Phagocytosis may be negative when the serum shows a titer of 1 to 2,000, or 100 per cent. of the cells may show a marked phagocytosis when serum agglutinins cannot be demonstrated in a dilution of 1 to 25 or higher.

The phagocytic activity of the polymorphonuclear cells in individuals who have recovered from undulant fever appears to persist for a considerable period of time. These cells of one individual three years after recovery and several one year after recovery show a phagocytosis of 100 per cent.

The technic which we are using in this study is as follows: Blood is collected and mixed with sterile, two per cent. sodium citrate physiological salt solution. The blood cell suspension is added to a suspension of a strain of *Brucella* (turbidity 3 McFarland nephelometer) in the proportion of 1 to 1 and mixed well. The mixture is then placed in a 37° C. incubator for 30 minutes. At the end of this period, the cells are smeared on slides and stained with Hastings blood stain. On microscopic examination, 50 to 100 polymorphonuclear cells are examined. The cells are grouped according to whether they show a marked, moderate, slight or no ingestion of the bacteria.

A more detailed report of this study will appear in the *Journal of Infectious Diseases*.

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THE EFFECT OF TEMPERATURE ON THE NUMBER OF SCALES IN TROUT

IT has long been known that fish from southern localities usually have a smaller number of scales than those of the same species from farther north, and it has been assumed that the decrease in the number of scales is due to the higher temperature under which the individuals develop. While some writers postulate a theory of selection of those individuals which are best constituted to meet the temperature conditions of the environment, others have proposed a direct effect on the integumentary system. As far as the writer is aware, no one has previously demonstrated from the experimental side that the number of scales can be directly modified by temperature. During the past summer an experiment was conducted on the eggs and alevins of Kamloops trout (Salmo kamloops) to determine the effect of temperature in this respect. The index chosen to specify the number of scales was a count of the number of oblique, parallel rows running in a downward and backward direction from the dorsum to the lateral line. The series begins just behind the head and ends at the termination of the vertebral column. Kamloops trout of Kootenay Lake were selected for the experiment. These trout have an average index of 145 rows with a standard deviation of about 6 rows; the total range is 130–160 rows. Eggs were obtained for the experiment on May 23 from fish at the end of the spawning run. Six pairs of trout were selected and the eggs of each pair were kept separate. The alevins and fry produced from these were reared in the hatchery at Nelson, B. C., under the ordinary hatchery temperatures. The water temperature in the hatchery begins to rise from the stationary winter level (1°–2° C.) at the end of February. It rises continuously until the end of July or the first week in August when it is 12°–13° C. The eggs from the end of the spawning run thus develop under warmer temperatures than the eggs from the earlier part of the run. The average index for each of the six lots of fry was in every case below the lower limit of the standard deviation for the normal population (below 139 rows). In each case the index of the offspring was significantly below the counts for their own parents. This part of the experiment indicated that the individuals having a low scale count in the normal population are probably produced from eggs which have been deposited at the end of the spawning run and have, consequently, developed at a higher temperature. In order to check this theory a random sample of eggs spawned during the middle of the run was removed from the hatchery on June 24 at the eyed-egg stage. These were reared at a temperature approximately 5 Centigrade degrees above that occurring in the hatchery until August 10, when the warmer temperature was discontinued. In these fry the average number of scale rows was reduced by 10 from the normal average for the population. A corroborative experiment was carried out with the eggs from one of the six pairs mentioned above. The eggs were divided into two lots:

Lot 1 was reared at ordinary temperatures. The resulting fry had a scale count of 132 rows on the average and were 13 rows below the normal population—16 rows below the female parent and 17 rows below the male.

Lot 2 was reared at the higher temperature, namely, 5 Centigrade degrees above normal. The resulting fry had an average scale count of 127 rows or 18 below the normal average and 21 and 22 rows below the female and male parent respectively.

From these experiments it seems evident that in Kamloops trout the number of scales is directly modified in an inverse manner by temperature, the higher the temperature, the fewer the scales. The data will be more fully presented and discussed in a forthcoming paper.

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BROWN, LAWRASON and FRED H. HEISE. *The Lungs and the Early Stages of Tuberculosis.* Pp. 151. Appleton. $1.50.

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