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# The Effect of Heavy Rains on the Orthoptera (Grasshopper) Population of the Prairie

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Hence,

$$B.\ V. = P.\ V. + (P.\ V. \times \frac{X}{Y})\ ;\ \text{when:} —$$

B. V. equals blood volume in liters (× 1,000 for cc.).
P. V. equals plasma volume in liters.
$\frac{X}{Y}$ equals ratio of cells to plasma in the blood.

In the accompanying table the plasma volume and blood volume measurements are given for both single and parabiotic rats. The weights of each member of a parabiotic pair could not be conveniently determined, so the combined weight is given, and equal amounts of dye were injected into each animal. The table indicates that there may possibly be a slightly higher percentage of blood in female than in male rats. The results as a whole show that about one-tenth of body weight is blood, which is slightly higher than given by other investigators.

## LITERATURE CITED

SMITH, H. P. 1930: Studies on vital staining. II. The removal of Brilliant Vital Red from the blood stream. Distribution of dye between blood stream and body tissues. J. of Expt. Med. 51: 379.

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# THE EFFECT OF HEAVY RAINS ON THE ORTHOPTERA (GRASSHOPPER) POPULATION OF THE PRAIRIE

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The general interest created by destructive grasshoppers in the past few years incited the author to some studies on populations of Orthoptera, particularly on prairie patches in Iowa. Correlations of the data with climatic information will be made at times to yield possibly valuable results. This article will point out that following several heavy rains in August, 1932, the number of grasshoppers had markedly decreased on a one acre plot of *Stipa spartea* — *Andropogon scoparius* association of prairie located 5 miles south of Stanhope and 22 miles northwest of Ames. As the grass had not been grazed, mowed or burned for several years the tract presented a thick cover of protective material. Corn bordered on two sides and Sudan grass grew at the other two sides of the plot.

The first collection dealt with in this paper was made on August 8, 1932 at 10:30 A.M., with a light wind, nearly clear sky, and an air temperature of near 90° Fahrenheit. The grasshoppers were collected with 200 sweeps of a net over an area of 100 sq. m.

During the ten succeeding days, chiefly on August 12 and August 17, a rainfall of 5.95 inches was measured at the Agronomy Farm of Iowa State College. On August 19, at the same hour of the day as the first survey and with climatic conditions as favorable for grasshopper movement as those of the 8th, a second collection of grasshoppers was made in a manner as before.

The species, with numbers of adults and nymphs counted together, that were taken are shown in the following table.

| Species Collected | August 8 | August 19 |
|---|---|---|
| *Diapheromera velcii* | 4 | 1 |
| *Erotettix simplex* | 4 | 5 |
| *Orphulella speciosa* | 12 | 9 |
| *Chortophaga viridifasciata* | 1 | 0 |
| *Melanoplus dawsoni* | 4 | 0 |
| *M. femur-rubrum* | 0 | 4 |
| *M. differentialis* | 1 | 0 |
| *Phoetaliotes nebrascencis* | 2 | 3 |
| *Scudderia texensis* | 1 | 1 |
| *Conocephalus strictus* | 11 | 4 |
| *C. saltans* | 24 | 17 |
| *Nemobius fasciatus* | 1 | 2 |
| *Oecanthus nigricornis quadripunctatus* | 2 | 1 |
| Total | 67 | 47 |

It is suggested that the heavy rainfall was the major factor responsible for the approximately 30 per cent decrease in population during the ten day period.

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## REINFECTION OF RATS WITH *EIMERIA MIYAIRII* AFTER IMMUNIZATION

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It was shown in previous paper (1932) that rats which had not previously been infected became immune to *Eimeria miyairii* after recovery from an infection produced by ingesting 1500 oocysts daily for five days. It was also stated that in the passing of the weeks some of the immunity was lost. The latter statement was based upon an experiment with four rats which showed the last coccidia on September 25, 1931, and which could not be reinfected immediately, but which again became infected after ingesting large numbers of oocysts on December 12, 1931, — about 78 days after the last oocysts of the first infection were eliminated. Three of these rats passed oocysts "in moderate numbers" for three days, but only one oocyst was recovered from the fourth rat. It seemed desirable to repeat the experiment making quantitative counts of the oocysts. The technique for making the counts was the same as that previously described.

Ten white rats (Nos. 135 to 144 of the previously published records) each eliminated from 21,560,000 to 103,000,000 oocysts during the first infection, the mean being 53,777,000 oocysts. The date of the first infective feeding was February 22, 1932, and the last oocysts were eliminated on March 7, 1932.

Five of these rats were fed 1,500 sporulated oocysts of the same parasite daily for five days, beginning May 23, 1932. The droppings of these rats were saved for the period from the seventh to the fifteeenth day after the first infective dose. This eight day interval, as experiments with 600 rats have shown, is the period during which the oocysts will be eliminated by this mode of infection if the animals become infected. Of the five rats, three did not become reinfected, one eliminated 192,590 oocysts, and the other 185,184 oocysts.

Three of the remaining rats were infected on July 15, 1932. One of these could not be reinfected. By the use of the sugar-flotation method, one oocyst was recovered from one of the other two, while three oocysts were recovered by sugar flotation from the remaining rat.

The experiment shows that, in certain cases at least, a rat immunized to the coccidium *Eimeria miyairii* may lose little or none of its immunity within a period of from 77 to 130 days after its recovery from the immunizing infection. Although quantitative counts were not made upon the rats used in the previously reported experiments, the writers had the impression from the numbers observed in the fields of the microscope that three of the four reinfections were heavier than those here reported.

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