

Stress and Parasitism
Glenn A. Noble
California State Polytechnic College
Project Number 103

Major attention was given to a study of stress and ameba. The host animal was the Uinta ground squirrel, Citellus armatus, and the ameba was Entamoeba muris, which lives in the cecum. The procedures of last summer were followed. Parasites were counted in field animals, in caged controls, and in stressed squirrels. The stressor for most of the experiments was cold temperature during the night produced by placing ice in a cage. This procedure reduced the night-time temperature to about 6° C, as compared to 20°-35° C in the warm cage containing the control animals. The entire cecal contents were thoroughly mixed with a measured amount of saline solution and amebas were counted using a standard hemacytometer.

It was found that after three nights of stress, the ameba count rose to about twice that in the field animals. Calculations were made on the basis of numbers of amebas per cu ml of cecal contents and also on the basis of numbers of amebas per cu ml per 100 grams of squirrel body weight. Cold stress for additional nights (up to 12) resulted in a drop in the numbers of amebas to a level lower than in field animals. In the caged control squirrels the numbers of amebas increased to a level intermediate between the count in field animals and that in stressed animals.

Commercial rabbit pellets were used in the above experiments. Another group of stressed squirrels was fed grass seed and dandelions. Amebas doubled in this group also, indicating that the rabbit pellets did not play a major role in producing the previous results.

A preliminary investigation of stress by means of cortisone was started at the end of the season. Injections of 1.5 mg of a saline suspension of cortisone acetate in each of 20 squirrels once a day for three days resulted in an ameba count which was 36% higher than in 20 animals which received injections of saline solution without the cortisone. When calculated on the basis of average number of amebas per cu ml per 100 grams of body weight the figure was 21% higher than in the controls. The total ameba count in cortisone-injected animals, however, was essentially the same as in field animals. The explanation for this unexpected outcome may be associated with the fact that the injection experiments were carried on one to two weeks after all field animals had gone into hibernation. Cortisone experiments will have to be made early in the season to clarify this point.

The numbers of cecal Trichomonas in both cortisone and saline-injected animals doubled that in field animals. This result supported my reports of 1961 and 1962 which described an increase in numbers of Trichomonas in squirrels subjected to crowding and to fighting. The numbers of these flagellates in the cold-stressed animals, however, dropped considerably below the field count. Further study of these parasites is required.

The following table summarizes the results.

	Number of squirrels	Amebas per cu ml of cecal fluid	Amebas per cu ml per 100 g body weight	<u>Trichomonas</u> per cu ml of cecal fluid
Field animals	40	3637	1133	1,312,823
3-day cold stressed Fed rabbit pellets	70	7021	2162	935,240
3-day caged controls Fed rabbit pellets	10	5063	1278	1,107,950
3-day cold stressed Fed seeds and plants	10	6350	2405	438,530
3-day stressed with cortisone acetate	20	4638	1578	2,867,500
3-day controls with saline injections	20	3405	1308	2,750,000

The increase in numbers of ameba in the cold-stressed squirrels was highly significant. It indicates promising results from further work on amebas using different stressors and modified techniques. Studies of non-lumen-dwelling parasites, such as Trypanosoma and ectoparasites should be made.

The adrenal glands were weighed as a part of the injection experiments but there was no essential difference between the cortisone-stressed squirrels and the saline-injected controls. This result was expected because three days is too short to permit appreciable growth of the glands.

In addition to the program described above, last year's experiments on the effect of reduced night-time temperature on the cecal pinworm, Syphacia citelli were repeated with a group of 10 stressed squirrels and 10 controls. At the end of two weeks the stressed animals contained an average of 55 worms each, whereas the control squirrels contained an average of 20.8 worms each. This pronounced increase in worm numbers was even greater than that obtained in 1964.

My research this summer was aided greatly by the careful and diligent work of my assistant, Mr. Joseph M. Choi, California State Polytechnic College.

Supported by grant from National Science Foundation.