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A Survey of Invertebrates of Jackson Hole
Donald C. Lowrie
Los Angeles State College
Project Number 91

The summer was spent making collections of insects and spiders in the area.

Molting in Mammals
Norman C. Negus
Tulane
Project Number 93

Weasels, Mustela erminea, were live-trapped and brought to the laboratory at Tulane University to study the effect of photoperiod and sexual hormones on hair growth and molting.

Water shrews, Sorex palustris, were also taken alive and taken to Tulane in order to investigate the sensory mechanisms involved in their avoidance of obstacles.

Assisted by Edwin Gould, Tulane University.

Stress as a Factor in Parasitism
Glenn A. Noble
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Project Number 103

A study was made of stress factors in ground squirrels and the effect of these factors on the parasites of the squirrels. The relationship between stress and bacterial or virus diseases has received some study, but very little attention has been given to the effect of stress factors on animal parasites. Evidence points to the general assumption that when an animal, or man, is under stress, its resistance to infection decreases. With bacterial infection this reaction seems to be due, in part, to the production of adrenocorticotrophic hormones from the pituitary gland and consequent release of adrenal glucorticoids which diminish normal inflammatory responses.

The Uinta ground squirrel, Citellus armatus, was selected as the animal for study because it was readily available in the area of the Research Station, was easily maintained in captivity, and was 100 percent infected with parasites of one kind or another. The parasite chosen for especial attention was a caecal protozoan, Trichomonas sp. The term parasite is used in its broad sense, for the pathogenicity of these flagellates in the squirrels has not been determined. The

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protozoa are probably commensals. The caecum of every ground squirrel examined contained many thousands of protozoa of several varieties, but Trichomonas sp. were almost always present in the greatest numbers. Most of the squirrels harbored flagellates, amebas and the oxyuroid worm Syphacia sp. in the caecum. A few other roundworms and one tape-worm were also found. Very few squirrels had any ectoparasites.

One hundred four ground squirrels were captured. Thirty-three of these were live-trapped and examined immediately as controls. Seventy-one were caged and subjected to various stress factors, and four of these underwent surgical removal of caecal samples and recovered normally from the operations. These four animals were taken to California for further study.

Stress factors used were light and heat, noxious stimulants, fear, crowding, darkness, hunger, annoyance and extreme confinement. Also, ten animals were caged without stress. All animals were fed daily with fresh dandelion plants, their natural food, and occasionally with a few commercial dog pellets and small pieces of melon rind. Fresh water was present at all times. Almost every day at least one stressed squirrel and one newly trapped animal, a control, were sacrificed and examined for parasites.

A record was made of the sex and weight of each animal sacrificed. A fresh blood sample was examined for motile trypanosomes and microfilariae. Blood smears were taken and stained with Wright's blood stain. A hemacytometer was used for blood cell counts. The surface of the body of each animal was examined for parasites and the body cavities were opened and examined for internal parasites. Counts of Trichomonas were made of caecal contents.

Thirty-three squirrels, used as controls, were live-trapped during the study period and examined as soon as possible, usually within two hours. These control animals began to hibernate about August 10 and by August 15 no more could be found. None of the caged animals hibernated and thus could be studied throughout the period of research.

Results

The blood picture was variable but, in general, in both controls and in stressed animals, when the number of caecal protozoa was high the number of white blood cells was low, and vice versa.

Over the entire period of the study the average number of Trichomonas, per field of view in the microscope, after dilution, in the newly trapped 33 control animals was 92. The average number of these caecal protozoa in the stressed animals, throughout the summer, was 154--a significant increase. The average number of Trichomonas in the ten "comfortably" caged animals with no other stress factors was 155. In all animals there was a decrease in

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numbers of protozoa towards the end of the summer, but in some of the stressed animals the numbers tended to rise again. In three of the stressed squirrels and in one of the controls there were practically no Trichomonas. These animals were not included in the summaries, since it was assumed that other factors other than stress were operative.

Stress factors and numbers of Trichomonas are summarized as follows:

<u>Stress</u>	Average Number of Protozoa
Crowding	177
Extreme confinement	160
Light and heat	155
Fear	151
Annoyance	147
Noxious stimulants	139
Darkness	116
Hunger	86

Conclusions

The stress factors used in this experiment apparently increased the number of caecal Trichomonas for about two weeks. After that period Trichomonas decreased in numbers either because the squirrels became adjusted to stress, or because in preparation for hibernation the animals normally show a reduction in protozoa numbers. In some animals the protozoa number subsequently increased.

Since the animals in a cage which was not subjected to special stress factors showed an increase in numbers of Trichomonas the same or even higher than in specially stressed squirrels, it may be assumed that capturing and caging, even under what appears to be optimum conditions, produces sufficient stress to be reflected on the parasite population. Additional stress has little or no additional effect.

The total number of squirrels examined and the number for each phase of the research were not large enough for truly significant results. It was indicated, however, that stress is a factor in parasitism, at least temporarily for Trichomonas. The results show considerable promise for future research.

Assisted by Robert Tesh, who was at the Station under the Student Conservation Program.

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