

# An Observation of the Domestication of Aphids by Ants

By Tom Gentles, Regina.

Last summer I observed a particularly interesting colony of ants in Snake Bite Valley southeast of Beechy. This creek is actually a gorge from 150 to 200 feet deep, with very steep sides, draining into the South Saskatchewan River. Bear Paw shale outcrops along the valley walls from fifty feet below the top down to the bottom. In many places the Bear Paw shale is covered by a thin mantle of glacial debris which has probably slumped down from higher up on the escarpment. Wherever this thin layer of clay covers the Bear Paw shale, hoary sage-bush grows in profusion.

At one point I noticed that ants had apparently infested a considerable number of the hoary sage-bush plants. I thought this peculiar since it was doubtful that the ants would actually feed on that type of plant. On checking closer I noticed that the sage-bush was also infested with aphids. I remembered reading that ants sometimes domesticated aphids and lived on a liquid secreted by them. However, I had never realized that this might occur right here in Saskatchewan. It seemed a good opportunity to study the matter a bit more thoroughly so I spent a few hours observing the action of the ants.

The ants had their nest at the bottom of a slope about half way down the north side of the valley. Leading from the ant nest were five distinct trails or highways. Two of the trails led directly to live sage-bush plants on which aphids were pastured. Two led to dead sage-bush plants but continued past them to living sage-bush beyond. These latter bushes were also infested with aphids. The fifth trail led to a patch of snowberry bushes and apparently ended there. The trails themselves were one to two inches wide and had been cleared of all the usual debris of the prairie floor. Some of the trails were over 30 feet in length. They had been so well cleared of all rubble that the course of the path could be seen from a considerable distance. A check at several points along the

path showed that there were between 10 and 20 ants on each foot of the path. At first glance the movement of the ants appeared to be quite at random. However, after I had watched for a while it soon became evident that this movement had a definite purpose. Some of the ants were progressing away from the nest towards the sage-bush and others which had been at the sage-bush were going back to the nest.

Many of the ants found away from the nest were carrying smaller ants in their jaws. The smaller ants were folded almost double and appeared to be dead. However, I found out later that this was not so. When these outward bound ants were mildly disturbed with the point of a pencil they did not drop the ants they were carrying but left the trail and tried to hide in the grass and leaves beside it. The other ants on the pathway were definitely antagonistic toward the pencil and attacked it vigorously. They did this by rushing up to the pencil, bracing themselves with their four rear legs and lifting the front part of the thorax and head and trying to bite the pencil with their mandibles. I noticed that they did not do this when an unburdened ant was molested with a pencil, only when one of the carrying ants was disturbed. The ants which were being carried were apparently quite healthy because when they were forcibly removed from the mandibles of the bearers they would rush around just as rapidly as the others. I could see no particular reason for some of the ants being carried along the path. The ones being carried were definitely smaller than the ones doing the carrying so perhaps the big ones were carrying the smaller ones to conserve on total energy expended.

At many points along the pathway I could see small but recognizable insects and parts of insects being carried to the nest. There were beetles, grasshopper legs and small green worms among the many particles of succulent food being transported to the lair.



It was a simple matter to check the speed with which the particles of food were being moved. A great deal depended on the size of the object being carried, of course, but several checks indicated that the average speed was about four feet in ten minutes. Coming from the end of the longest trail would take an ant well over an hour. How long was spent in transporting the insect from where it was caught through the veritable jungle of foliage to the beginning of the trail, it was impossible to judge.

The sage-bush plants were two or three feet in diameter and the same in height. Each tip of the sage-bush was literally covered with aphids. The aphids themselves ranged in size from tiny new born ones which could barely be seen with the naked eye to ones larger than a pinhead. The ants were also on every single tip of the sage-bush. They were much less numerous than the aphids, of course, but there would still be 10 to 20 ants on every tip. The aphids would number about 500 on each tip. The ants appeared to be rushing around on the sage-bush without any definite purpose; however, every once in a while an ant would stop near an aphid, apparently checking on the production of food. I read up on this later. A considerable number of detailed studies have been made of this by some quite learned observers. The excrement of the aphids is very sweet and it is this sweet secretion that the ants feed on. Ordinarily the secretion is thrown off into the air in tiny droplets. However the aphids are domesticated by the ants, the secretion is retained by the aphids until an ant arrives. The ant strokes the body of the aphid until the aphid is induced to give up a tiny drop of sweet solution. The ant then drinks this and moves on.

From what could be observed, this secretion of the aphids and the insects the ants manage to catch were the only sources of food. It might be interesting to calculate just how many aphids are required to supply the food for a certain number of ants. It was possible to calculate the number of aphids by counting the ones on one tip, then multiplying by the number of tips on the bush and then again by the number of bushes



*Photo by R. W. Fyfe*

Ants and aphids on the hoary sage-bush.

on which the ants were raising the aphids. By this means it was estimated that there would be a minimum of 20,000 aphids being raised by the one nest of ants. This observation was made in June so it is quite likely that the number of aphids would greatly increase later on in the year. It was impossible to estimate the number of ants.

The aphids must give off a considerable volume of the sugary secretion used by the ants since it once was a source of food to savage peoples. Usually nomadic tribes were consistently short of a sugar supply and utilized every possible source. In some parts of the world aphids live in great numbers on trees. It is recorded that sometimes the secretion of these aphids could be felt as a fine mist on the face. For this reason, the secretion has been called honey dew. The savages would spread skins beneath a tree which was infested by aphids and then proceed to shake the tree vigorously. The secretion would then fall on the skins from which the honey dew could be scraped.

Since first noticing this phenomenon in June, I have made similar



observations in other places in the province. This phenomenon is quite prevalent south of Moose Jaw and also at Bateman. In these other places, though, the operation did not seem nearly as well organized. There were no trails leading from the nest to the bushes and there were fewer aphids in proportion to the ants. In these cases it is quite likely that the aphids serve only as a secondary source of food for the ants.

I also noticed aphids on the hoary sage-bush only when there were ants living in symbiosis with them. I was able to deduce from this that the aphids are kept over winter by the ants in their ant hills and

that in the spring when the sap starts to flow, the ants place them on the bushes. This phenomenon shows that ants have an ability almost equal to that of human beings for utilizing their environment to produce food. It is known, too, that many ants keep gardens of fungus growing in their nests as a dependable source of food, and that other ants raise slaves to help them secure food. It is interesting to think that the rather complex form of the ant community has been in existence for many years—indeed students of paleontology have fairly well established that ants and aphids lived in harmony sixty million years ago.

## MAMMALOGIST APPOINTED TO THE STAFF OF THE UNIVERSITY OF SASKATCHEWAN

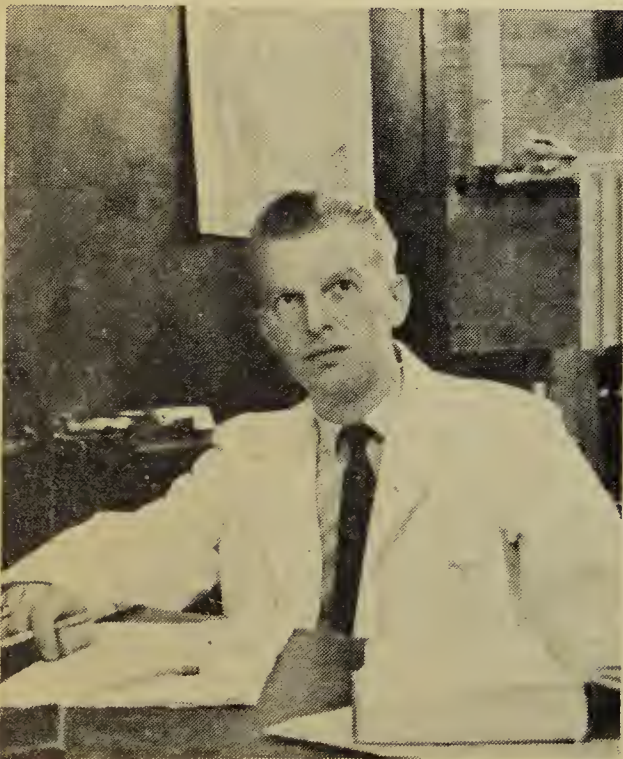
Members of the Saskatchewan Natural History Society who attended the annual meeting in Saskatoon had the pleasure of hearing a talk on animal populations by Dr. R. S. Miller, newly appointed Assistant Professor of Biology at the University of Saskatchewan. We hope that we may see him at many of our meetings and that we shall often see his name in the **Blue Jay**.

Dr. Miller was born in Cleveland, Ohio, and spent five years in the U. S. Air Force before attending university. He obtained his B.A. from the University of Colorado in 1949 and his Ph.D. from Oxford in 1951.

From 1952 to 1955, he instructed at Harvard in elementary zoology, general ecology and population ecology. From 1955 to 1958, he was associate biologist at Colorado State University doing research on small mammal populations, primarily on pocket gophers (*Geomyidae*).

Dr. Miller has published research papers on the activity rhythms, food habits, population changes and movements of the Field Mouse (*Apodemus sylvaticus*) and of the Bank Vole (*Clethrionomys glareolus*); he has also studied the rate of growth of incisors of pocket gophers and the effect of crowding on longevity of adult *Drosophila melanogaster*. He continues to be interested in population studies of small mammals with special emphasis on the theory of competition in population ecology. Dr. Miller has completed research which he hopes to publish soon on the competition between two closely related species of *Drosophila* and on the ecology and distribution of pocket gophers of Colorado.

In his speech at the annual meeting Dr. Miller made a strong plea for complete and careful scientific study of all the possible effects of any human attempt to control or limit the population of any animal. People who are interested in mammals will be glad to know that there is a mammalogist in the Biology Department of the University to give help and guidance to the amateur.



Richard S. Miller