

## Moose and pizza: a matter of taste?

by Ed Berg

Two weeks ago in this column I told the story of those strange green “roses” growing on willow bushes. The willow roses, the reader may recall, are actually growth deformities called “galls,” which are induced by a small fly (midge) larva. The midge larva eats the stem’s growing center and prevents the stem from elongating, so that the leaves emerge on top of each other to form a “rose.”

Now here is the puzzle: why do moose dislike eating willow roses? Observant moose watchers will notice that about mid-winter there are still a lot of willow roses (now dry brown leaves) on the willow bushes, whereas the ungalled branches are heavily browsed.

My attention was first drawn to this phenomenon when I discovered an old 1982 report in the Refuge files by former Refuge biologist Ed Bangs. (Ed has since moved into the public eye as the director of wolf reintroduction in Yellowstone Park.) Ed tagged stems on fifteen willow bushes, and found that the moose ate about three times as many ungalled as galled branches. This is probably about the same degree of preference that one would find in teenagers for, say, pepperoni pizza over plain cheese pizza.

To convince myself that this browsing preference was real, I repeated Ed’s study in more detail in the winter of 1994-95. I tagged sixty-five Barclay willow bushes along the roads near my place in Funny River, and carefully matched the tagged branches (with galls and without galls) so that they were about the same height above ground and same stem diameter. In the fall I labeled the branches with twine (which would be harmless if eaten) - one turn of twine if ungalled and two turns if galled. When I checked the bushes in April, I found that the moose had eaten 78% of the ungalled stems and only 52% of the galled stems. This wasn’t as strong a preference as Ed found, but it looked real enough.

During this same winter (1994-95) Nikiski High School senior Ethan Ford came into our office in search of a science project. We hatched the idea of doing some feeding experiments with live moose at the Moose Research Center (MRC), and soon enlisted the assistance of Curt Shuey the MRC caretaker, Refuge biologist Richard “Mac” McAvinchey, and former ADF&G

moose biologist Chuck Schwartz. (Chuck too has moved onto grander experiments, and is now working on brown bears in Montana).

We did two experiments with “tame” moose at the MRC. In the first experiment we offered to the moose five gallon buckets with willow branches frozen in snow: some buckets had only galled stems and others had only ungalled stems. Each (of five) moose was offered a pair of buckets (galled and ungalled) for ten minutes, and we computed the amount eaten by weighing the buckets before and after the feeding. Ten minutes was plenty of time because these moose were hungry, and willow is like candy to a moose. The preference was clear: they ate almost three times as much ungalled as galled stem (by weight). This result confirmed with tame moose what we had seen along the roadsides with wild moose, and it wasn’t too surprising.

The second experiment was more interesting, to my way of thinking. When teenagers prefer pepperoni over plain cheese pizza, the preference is based primarily on taste and not texture. So, do galled stems taste bad to moose? One extreme possibility is that the tiny (4 mm long) midge larva has a powerful bad taste. We couldn’t see any easy way to test this, although we could have collected a bunch of larvae and spiked the moose pellet rations with them. But the larva seemed so small that we decided to assume that it was flavorless. A more interesting possibility is that the larva stimulates the plant to produce a bad tasting chemical that would help protect both the insect and the plant from being eaten.

Many plants have elaborate chemical defenses that either poison their would-be consumers or else greatly reduce palatability. Have you ever noticed the powdery white scale on birch bushes around here? These scales are papyrific acid, which the plant secretes when it has been damaged by browsing. These scales make birch very unpalatable to hares, and to moose to a lesser extent, and hares will starve rather than eat heavily scaled birch.

To test for a taste effect, we prepared more buckets of galled and ungalled willows, but this time we clipped off the galls from the galled branches and also

clipped off the current year's growth on the ungalled branches. The branches in each bucket now looked exactly the same, and had the same texture. If the moose preferred one bucket over another, it would have to be a matter of taste, we reasoned. (This is like taking the pepperoni off of a cooked pizza, and telling someone that this is just a plain cheese pizza. Can they tell the difference?)

The moment of truth came: we presented each moose with the two identical-looking buckets, and lo! they ate the same amount from each bucket. Hypothesis rejected! Taste was irrelevant!

It appears, then, that texture is the key thing: the moose simply don't like eating a mouthful of dry leaves. In any case the larva has evolved a pretty good defense against being eaten by moose. We observed that the tame moose would sometimes bite off the willow rose and drop it, before continuing to eat the rest of the branch. In this case the larva still has its winter home in the rose, and maybe some extra snow

overhead for added protection. Texture seems to be a pretty good defense for the larva, and a bad taste might not add that much more.

Ethan Ford wrote a nice paper on this study and won a prize at the Alaska Statewide High School Science Symposium in Fairbanks. He is now a senior at [UAF](#) studying wildlife biology and is planning to continue for a Master's Degree, reports his mother Carol Ford. We hope that Ethan will consider our two million acre laboratory at the Kenai National Wildlife Refuge when it comes time to pick a thesis research topic.

Refuge Notebook columns are available on the Web at <http://www.fws.gov/refuge/kenai/>.

*Ed Berg has been the ecologist at the [Kenai National Wildlife Refuge](#) since 1993. He also teaches geology at the Homer and Soldotna branches of the [Kenai Peninsula College](#), and serves on the [Kenai Peninsula Borough Trails Commission](#).*