

A WHITETAIL'S SIGNATURE – THE TARSAL GLAND

Karl V. Miller
Warnell School of Forest Resources
University of Georgia

When human beings meet, we recognize each other on sight by identifying facial features, or perhaps by voice patterns. Not so with deer! Although deer likely learn to identify some others on sight, deer rely primarily on the sense of smell for personal recognition.

A variety of glands may be involved in recognition of other deer by scent, but clearly the tarsal gland is the most important. Any deer hunter who has harvested a buck during the rut is very familiar with the strong scent that is often associated with this gland. However, few hunters are fully aware of the role that this gland plays in deer communication. Deer often sniff the glands of other deer, particularly deer they are unfamiliar with. The frequency of tarsal gland sniffing appears to be greater at night than during the day, probably because of reduced visibility. By smelling the tarsal scent, deer can not only tell who the other deer is, but they likely can also learn something about the other deer's dominance status, sex, condition, and other socially important information.

Over the past decade, we have conducted a number of studies at the University of Georgia in an attempt to decipher the role of this gland in deer communication. Although we've made some tremendous strides in our understanding, we still haven't pieced together the entire puzzle. But what do we know at this point?

The tarsal gland consists of a tuft of elongated hairs on the inside of the deer's hind leg. Each of these hairs is associated with an enlarged secretory structure called a sebaceous gland. These sebaceous glands secrete a fatty material, called a lipid, that completely coats the hairs. The hairs themselves have specially modified scales to provide greater surface area for holding the fatty material. However, based on our research, it is not this material that gives the gland its strong musky odor. Rather, the smell comes from urine that is deposited on the tarsal gland during a behavior called rub-urination. Retaining the odor requires daily 'recharging' of the gland with urine.

In one of our studies, we investigated the activity of these secretory glands associated with the tarsal gland. We thought that since bucks urinate on to the tarsal gland more frequently during the breeding season than at other times, the fat-secreting structures would become more active as well. Instead, we were surprised to discover that the activity of these glands did not change during the year, and that there was no difference in the activity between males and females. These results indicate that it is not a change in the activity of the gland itself that causes a change in the smell of the tarsal gland. Instead, the change in smell (and color) comes from a change in the frequency in rub-urination, and perhaps from a change in some of the components of the deer's urine.

Although all hunters know that bucks urinate onto their tarsal glands during the breeding season, it is less widely known that this behavior occurs throughout the year (although less

frequently). In fact, bucks and does will urinate onto the tarsal gland about once per day throughout the year. Even day-old fawns have been observed urinating on their tarsal glands. Does apparently identify their fawns through the odors given off the the fawns' tarsal glands. Interestingly, bucks will often smell and lick the tarsal glands of an estrous doe as a prelude to mounting.

The skin underneath the tarsal tuft also has well-developed arrector pili muscles, which allow the deer to flare the tarsal gland to release a burst of scent. Deer often flare this gland in response to physical or social trauma – a painful injury or perhaps harassment from other deer.

Any observant hunter certainly has noticed that the tarsal gland smells nothing like the smell of fresh urine. So where does this stink come from? Well, the picture gets a little more complex here. The warm, moist, nutrient-rich tarsal glands provide a perfect environment for the growth of a number of species of bacteria. As the urine runs over the tarsal hairs, the fatty material on the hairs selects out some of the fat-soluble compounds from the urine and holds them on the hair. The bacteria on the gland then change these materials to produce the gland's characteristic smell.

Recently, two of my graduate students, Jon Gassett and Karen Alexy, conducted a study of the types of bacteria on the tarsal gland. Their results revealed that there were dozens of different species of bacteria commonly inhabiting the tarsal gland, and that the types of bacteria present often differed among different animals. It's these different populations of bacteria that ultimately provide each deer with its own unique scent. Therefore, the mechanism by which the tarsal scent is produced is somewhat similar to how human underarm odor is produced, although we don't urinate in our underarms!

(As a side note, the types of bacteria on the tarsal included some well-known species that are potential human pathogens, such as Staph, Strep, Listeria, among others. So, be sure to wash your hands after handling a deer's tarsal gland!)

In a recent study, we identified 103 volatile compounds emanating from the tarsal tuft of male deer. Of these, 12 occurred in greater concentrations on dominant animals than on subordinates. Many of the compounds that we found on the tarsal gland were not observed in fresh urine, which further verifies that bacteria are important in the conversion of urinary compounds into socially-important odors.

Can a fresh tarsal from a buck be useful in a hunting situation? Certainly, but be careful how you use it. By placing a tarsal in a scrape site, or using it as a drag, you may signal a challenge to another buck. If he thinks someone is trying to invade his 'turf', he may return to the scrape more often, or follow the scent trail of the drag. However, timing of use is critical. Use of a tarsal scent likely would be most effective during the 2 to 3 weeks preceding the peak of the rut when scraping activity is at a peak. In contrast, it may be less effective during the peak of the rut when most bucks will be tending does. A buck tending a doe will be less likely to investigate the scent of a possible unknown intruder. He may actually try to direct the doe to another area to avoid a confrontation and the possibility of losing his prize!