March 1990

MYTHOLOGY OF VERTEBRATE PEST CONTROL

William D. Fitzwater
National Animal Damage Control Association

MYTHOLOGY OF VERTEBRATE PEST CONTROL

WILLIAM D. FITZWATER, National Animal Damage Control Association, 7104 Bellrose Avenue NE, Albuquerque, New Mexico. 87110.

ABSTRACT: Controlling vertebrate species obnoxious or even dangerous to them has been a concern of the human species through the evolutionary process. Early measures were often based on religious, superstitious, and biologic fantasies. While modern control measures are better biologically founded, there still remains an aura of mythology around many accepted by the public today. Examples are given of some of them: toxicants, electromagnetics, ultrasonics, and repellents for deer, moles, and raccoons.

Proc. 14th Vertebr. Pest Conf. (L.R. Davis and R.E. Marsh, Eds.)
Published at Univ. of Calif., Davis. 1990.

INTRODUCTION

At the start, primitive humans scribbled graffiti on cave walls in the belief that in some magical way this depiction of a prey animal bristling with arrows would make the hunt more successful (Dembeck 1961). There was a real problem in those days as some of their competitors for food were no pushovers, such as the cave bear and the saber-toothed tiger. Man rose to the head of the class over these fellow creatures by his ability to think and communicate. Starting with primitive pit traps and sharpened sticks, he eventually worked his way up to the ultimate control tool- the nuclear warhead.

MYTHOLOGY'S ROLE IN ANIMAL DAMAGE CONTROL

Human progress in effective animal damage control took some detours, however. As though they didn't have enough troubles with wolves, ravens, moles, rats, and other common animals we contend with today, they invented animals. The "lamia" was an interesting creature, a four-footed beast with a face like a woman, a body covered with scales, and "very large and comely shapes" on the breast. These appendages attracted men so the beast could catch and devour them when they came near (Topsell 1607) (Fig. 1).

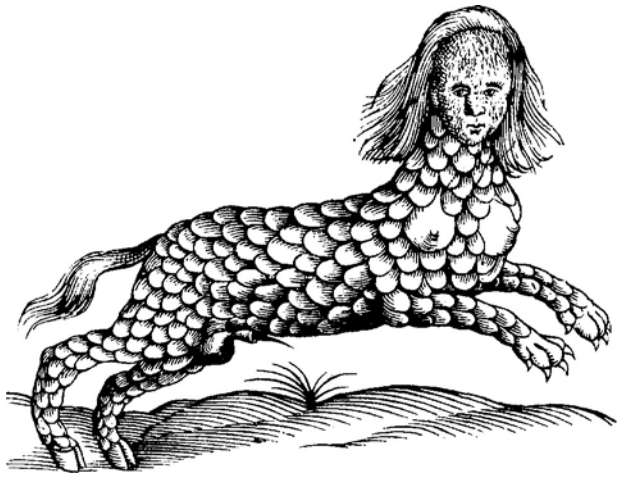

Figure 1. The Lamia.

In those days humans sometimes relied on verbal abuse as a means of getting rid of rats. The Irish, in particular, were supposed to rhyme them to death as Ben Jonson in 1601 is quoted: "Rime 'hem to death, as they do Irish Rats in drumming tunes" (Dannenfeldt 1982). Ancient Greeks apparently felt their field rodents had a better education because they wrote notes:

> "I adjure you, ye mice here present, they ye neither injure nor suffer another mouse to do so. I give you yonder field (usually the neighbor's) but if ever I catch you here again, by the mother of God I will rend you in seven pieces."

This paper would be placed under a stone in the field making certain the written side was up (Frazer 1959). But before we think too harshly of these superstitious folk, the practice of writing "rat letters" has persisted to modern times. This message, written May 9, 1845, was found stuffed behind a brick in the cellar wall of a house in Sandwich, New Hampshire, some 40 years later (Botkin 1947):

> "I have bourn with you till my patience is gone. I cannot find words bad enough to express what I feel, you black devils...now, spirits of the bottomless pit, depart from this place with all speed! Look not back! Begone, or you are ruined!... We are preparing water (to) drown you; fire to roast you; cats to catch you; and clubs to maul you. Unless you want your detested garments dyed in fire and brimstone, you satans quit here and go to Ike Nute's! This is for cellar rats. Please give notice to these in the chamber. There are many of us plotting against you..."

It was also felt these other animals were subject to civil law (Evans 1987). A 16th century French lawyer, Bartholomew Chassenee, made his reputation (and became the patron saint of the modern Animal Rightist movement) on a defense of rodents who were blamed for destroying the peasants' fields. The rodents were summoned to appear before the court in Autun. Chassenee argued that inasmuch as the defendants were scattered over a wide area, a single summons was insufficient to notify them all so the notice had to be published from the pulpits of all parishes involved. After this delaying action was accomplished, he argued his clients be excused on the ground the length of the journey and the serious perils from cats threatened their lives if they responded to the summons. He even went so far as to try to get all cats bonded. The case was dropped.

People in desperation sometimes resorted to a higher authority, the church. Egbert, Bishop of Trier, excommunicated swallows who were disturbing the faithful by their chirping and sacrilegious defiling his head and vestments with their droppings. He forbade them to enter the sacred edifice on threat of death, and it is still a popular superstition that if a swallow flies into the cathedral, it will fall dead (Evans 1987).

An unusual control measure against rats/mice that frequently appears is "the survival of the fittest" (Topsell 1607). Several mice were put in a cage to kill and eat each other. The sole survivor was then turned loose to hunt down and eat its own kind. Disfiguring and hurting an individual rodent so it scares others out of a colony is equally ludicrous but variations on this theme appear often in the annals of rat and mouse control. Painting, singeing the hair, tarring, belling, castrating, flaying the skin off the head, putting red pepper in incisions on the back, stuffing mongo beans up the rectum and sewing it shut, etc., made for some unhappy individuals, but they did not have much influence on their kin.

Around the turn of the century, Rodier claimed to have cleared rabbits from 64,000 acres in Australia in 20 years. His "system" consisted of live-trapping rabbits, killing the females, and releasing the males to harass the remaining females (Hovell 1924). Jennison (1927) claimed to have cut the rat population in the Manchester (UK) Zoo in half within 5 years by this method. However, his mathematics are a little difficult to understand by current standards as he caught 263 rats in 1916 and 216 rats in 1920. This is half?

The ancients used many biological substances for poisons (Dannenfeldt 1982). Most of these were complicated exotic formulations for rats and mice such as "...a paste made of honey, copperas, and ground glass...." or "...sweet butter, oatmeal, pulp of a roasted apple, a quantity of wheat flour, and sugar. Add powdered Argentum sublimatum..." (mercuric chloride). A general purpose toxicant for rats, mice, wolves, or foxes was finely powdered wolfsbane roots (Aconitum napellus). Besides those mentioned above, ratsbane (arsenic), black and white hellebore (Helleborus spp.), hemlock (Conium spp.), and oleander (Nerium spp.) were popular vertebrate pesticides. Of these only arsenic has survived to the present, possibly due to its reputation for settling questions of inheritance. It was known as the poudre de succession (inheritance powder) (Anon. 1966). Squill was discovered by early Egyptians but it was not used extensively as a rat poison until the last century. Strychnine was isolated first in the Philippine Islands about 1818 but was not used as a rat poison in Europe until 1840 (Fitzwater 1972a).

MODERN ADC MYTHOLOGY

This brings us to the present day vertebrate pest controller-very handicapped! He has no Pied Piper to blow his pipes nor bishop to excommunicate pesky wildlife. Further he is faced with an urban majority whose concept of wildlife is rooted in the belief that Bambi lives. Thus we have damage control recommendations based on testimonials with little or no scientific support. It is often easier to outwit smart humans than it is to outwit some dumb animals. Also researchers seem obsessed with testing exotic chemicals rather than substantiating or debunking the efficacy of "rat letter" types of control. Once established, these are perpetuated, particularly in extension leaflets. Here are some recommended but questionable animals damage control measures encountered in the field:

Plaster/Cement and Rats

Boelter (1909) states that plaster of paris (calcium sulfate) mixed with sugar has long been recommended as a rat poison. This bait is placed near water. When the thirsty rat drinks, the plaster hardens in his intestinal tract and "literally stiffens him." Fitzwater (1990) fed caged rats (Rattus norvegicus) plaster of paris mixed 50% with their dry feed. He also fed a mixture of portland cement in the same ratio to a second set of rats. After 14 days on these diets, there was no mortality in either test and the animals appeared perfectly healthy except for sore rectums due to their large bowel movements. It is probably safe to assume the digestive fluids in the alimentary tract prevent these substances from hardening. Other suggestions along this line, such as dehydrated potatoes and bath sponge or cork pieces soaked in butter or bacon fat, can be presumed to be equally ineffective.

Carbonated Soft Drinks and Mice

Ingestion of carbonated drinks is supposed to cause mice to bloat up to the point of exploding. A university laboratory fed mice (Mus musculus) a liquid diet of a commercial cola for 8 days without any mortality. Once a bottle is opened it goes flat rapidly.

Electromagnetics

Devices claiming to put out an electromagnetic force capable of driving pest animals out of an area received great publicity a few years back (Fitzwater 1978). They supposedly drove out pest species, from aphids and cockroaches to coyotes and pocket gophers, with no effect on humans or domestic animals. While electromagnetic forces can change the behavior of animals, experimental support data are based on confined animals and higher intensities than is possible in the field units. The devices in use generate no more electromagnetic impulses than what is put out by a household refrigerator.

Ultrasonics

Sounds above the range of human hearing (over 20,000 Hz), as they can't be checked without special equipment, are difficult to evaluate. One such device is SAV-A-LIFE® which, when mounted on the front bumper of an automobile going 45 mph or more, is supposed to send out a high-frequency sound alerting deer crossing the highway. Russell Reidinger (DWRC, pers. comm.) had this checked by A. L. Kolz. Using compressed air at different pressures, they concluded the device is no more complex than a whistle. The frequency was determined to be about 3,400 Hz, with no significant ultrasonic frequencies present. The amplitude was 65 dB at a distance of 6 feet, which is little better than a shout.

There are also "ultrasonic" devices that reportedly repel birds. The author observed an unperturbed pigeon resting on a rafter within 3 feet of a commercial ultrasonic unit in an open barn. This is not exactly surprising as studies have shown the range of pigeon hearing to be between 200 and 7,500 Hz (Brand and Kellogg 1939). In a more specific test Woronecki (1988) was unable to repel pigeons from a vacant building after 20 days' treatment with a commercial ultrasonic device.

Some mammals we do know hear ultrasonic frequencies are bats and commensal rodents. Hill (1970) with high-frequency dog whistles (4,000 to 18,000 Hz) drove bats out of a building with 48 hours continuous play. Peterson (1974)

found bats were initially disoriented and agitated when a commercial sonic device was turned on. However, by the end of the studies, counts showed no appreciable loss in numbers. There is considerable literature available on the use of ultrasonics to repel commensal rodents. While they may work under certain conditions, the cost/benefit ratio is questionable.

Mothball Repellency

Mothballs (naphthalene) are registered repellents for bats, cats, dogs, house sparrows, pigeons, rabbits, starlings, and tree squirrels. Indoor use recommendations are 5 pounds per 2,000 cubic feet for attics, etc. (Fitzwater 1972b). Similarly PDB flakes (paradichlorobenzene) are registered as repellents for cats, dogs, ground squirrels, moles, pocket gophers, and Norway rats. The dog and cat registrations usually are combined with other chemicals and carry instructions that they need to be used with disciplinary action to reinforce the repellent effect. The efficacy data on these chemicals, despite a long history of use, are questionable. In test conditions naphthalene showed no repellency against (1) penned deer (Payne and Palmer 1985), (2) starlings in a nest box, though the naphthalene was well above the recommended concentrations for enclosed spaces (Dolbeer et al. 1988), or (3) bats exposed to direct sprays of 7% naphthalene or PDB (Sterner et al. 1980).

The following chemicals and organic materials have been recommended for use as deer repellents: ammonium soaps of higher fatty acids, asafetida, blood meal, bonetar oils, creosote, feather meal (chicken feathers), hot sauce extract (Capsaicin), human hair, lime sulfur, moth balls (naphthalene), pheromone extracts, predator feces, putrefied egg solids, tankage (meat meal), thiram, ZAC, and ZIP.

The effective repellents ZAC and ZIP have lost their EPA registrations because the market would not support the cost of further study for reregistration.

It is practically impossible to compare efficacy of these materials because there are so many variable factors, such as the proximity and availability of native food supplies, deer pressure, weather severity, size of areas being protected, feeding patterns of the herd, longevity of the treatment period, experimental design of the study, interactions between plant species and chemicals, method of application, etc.

For example, Payne and Palmer (1985) placed hair twelfth in a test of 14 repellents and considered it useless. Their test was done on caged deer (Odocoileus hemionus) with a corn bait. Conover and Kania (1988) testing free-ranging deer (Odocoileus virginianus) in an apple orchard with hair balls strung in the trees found a "statistically significant difference" over the control trees. These same two studies also tested putrescent egg solids (BGR®). Palmer and Payne (1985) rated it the only consistent repellent in the 11 tested, whereas Conover and Kania (1988) rated it below human hair in repellency. Conover (1984) found BGR reduced deer damage to Japanese yews (Taxus cuspidate) 46% compared to hair which reduced it only 35%.

Spray applications of mixtures of predator feces have shown some effectiveness. Sullivan et al. (1988) in a study with spray solutions of fox (Vulpes vulpes) and ferret (Mustela furo) feces found they depressed vole (Microtus montanus) populations over a 3-year study. It was suggested the odors drew more predators into the area, increasing predation and possibly induced a behavioral-physiological stress on the prey population. Melchiors and Leslie (1985) found native predator feces significantly repressed feeding patterns of deer (O. hemionus).

A summation of deer repellents is they are not completely effective (about the best that can be expected is a 50% reduction in damage), can have a negative cost/benefit ratio, are extremely variable in their efficacy, are generally short-lived because of weathering or animal adaptation, and due to EPA registration restrictions have a poor future. Of the biological products which require no EPA registration, the consensus seems to go with tankage, human hair, and predator feces, with the last being difficult to procure in sufficient quantity. For the chemicals that need EPA registration, putrefied egg solids, thiram, and ammonium salts of higher fatty acids seem to give the best results.

Mole Myths

Moles (Talpidae) have been a problem since the start of the cultivation of crops in Europe. Their subterranean lifestyle discourages objective investigation. Thus most control recommendations are of the testimonial type. Poisonous plants, such as "gopher purge" (Euphorbia lathyris) and the castor bean (Ricinus communis), are supposed to be mole repellents. But even as far back as the 16th century the castor plant was shown ineffective in a rare field experiment (Dannenfeldt 1982).

"Repellent" substances such as lye, paradichlorobenzene, naphthalene, wood ashes, bleaches, castor beans, marigolds, barbed wire, broken glass, razor blades, and human hair in mole runways have been recommended in older extension bulletins (Silver and Moore 1933, Bieberdorf 1953). These merely cause the moles to burrow around them causing more damage (Marsh and Howard 1978). The noisemakers and "vibrators," like windmills, bottles buried up to their necks so the wind blows across the open mouth, and mole wheels are equally ineffective (Kuhn 1979).

One exotic mole control measure the author has not checked out yet is the use of chewing gum. Gardeners (Anon. 1986) have been claiming that "Wrigley's Juicy Fruit" will plug up the digestive system causing death. Instructions are to take the gum out of the wrapper, roll it like a cigarette, and drop it in the mole runway through a small hole punched in the top. These are deposited at 4- to 6-inch intervals along the runs. The "secret" is the operation must be done with gloved hands to eliminate human odors. Despite the chance of selling a carload of gum, the Wrigley people are not too anxious to publicize a lethal use for their gum.

Raccoon Restraints

The following have been recommended for protecting backyard corn patches from raccoons (Procvon lotor): (1) lighted lanterns; (2) mothballs; (3) surrounding the patch with pumpkins, black plastic, newspaper and mothballs, blood meal, creosoted twine, kerosene-soaked rags, or predator feces like those of the African lion; (4) hard rock music; and (5) red pepper on ears of corn. None of these were effective for more than 3 days. Unfortunately, this evaluation is in the form of questionable testimonials (Logsdon 1983). The only method in this category that reportedly worked was chaining dogs at night around the field. The success of this depends upon the temperament of the dogs used.

As James Thurber said: "You can fool too many of the people too much of the time." And this is certainly true of the animal damage control beliefs held by a naive urban populace.

LITERATURE CITED

ANONYMOUS. 1966. Annals or arsenic. MD. 10(3):290-296.

ANONYMOUS. 1986. Soft-tech mole control. Harrow-smith Magazine. No. 2:26.

BIEBERDORF, G. A. 1953. The mole and its control Okla. Agric. Exp. Sta. Circ. C-136, Stillwater, OK. 8 pp.

BOELTER, W. R. 1909. The rat problem. J. Bale, Sons and Danielsson Ltd., London (UK). 165 pp.

BOTKIN, B. A. 1947. A treasury of New England folklore. Crown Publ. NY. 934 pp.

BRAND, A. R, and P. P. KELLOGG. 1939. Auditory responses of starlings, English sparrows, and domestic pigeon. Wilson Bull. 51:38-41.

CONOVER, M. R. 1984. Effectiveness of repellents in reducing deer damage in nurseries. Wildl. Soc. Bull. 12(4):400-404.

CONOVER, M. R., and G. S. KANIA. 1988. Effectiveness of human hair, BGR, and a mixture of blood meal and peppercorns in reducing deer damage to young apple trees. Proc. Third East. Wildl. Damage Conf. pp. 97-107.

DANNENFELDT, K. H. 1982. The control of vertebrate pests in renaissance agriculture. Agric. Hist. 56(3):542-559.

DEMBECK, H. 1961. Animals and men. Nat. Hist. Press, Garden City, NY. 390 pp.

DOLBEER, R. A., M. L. LINK, and P. P. WORONECKI. 1988. Naphthalene shows no repellency for starlings. Wildl. Soc. Bull. 16:62-64.

EVANS, E. P. 1987. The criminal prosecution and capital punishment of animals. Farber and Farber Ltd., London (UK). 336 pp.

FITZWATER, W. D. 1972a. 31,972 years of pest control. Pest Control 40(4):30-32.

FITZWATER, W. D. 1972b. EPA compendium of pesticides. Vol IV, Rodenticides and mammal, bird, and fish toxicants. USEPA, Wash., DC. pp. 38-39.

FITZWATER, W. D. 1978. Electromagnetic repellers – fact or fiction? Proc. Vertebr. Pest Conf. 8:88-92, Univ. Calif., Davis.

FITZWATER, W. D. 1990. Believe it or not! Pest Control (in press).

FRAZER, J. G. 1959. The new golden bough. S. G. Phillips, Inc., NY. 738 pp.

HILL, E. P. III. 1970. Bat control with high frequency sound. Pest Control 38(9):18.

HOVELL, M. 1924. Rats and how to destroy them. J. Bale, Sons and Danielsson Ltd., London (UK). 465 pp.

JENNISON, G. 1927. Natural history: Animals. Macmillan Co., NY. 344 pp.

KUHN, L. W. 1979. Mole control. OSU Ext. Circ. 987. Corvallis, OR. 4 pp.

LOGSDON, G. 1983. Wildlife in your garden. Rodale Press, Emmaus, PA. 268 pp.

MARSH, R. E., and W. E. HOWARD. 1978. Vertebrate pest control manual: Moles. Pest Control 46(4):24-27.

MELCHIORS, M. A, and C. A. LESLIE. 1985. Effectiveness of predator fecal odors as black-tailed deer repellents. J. Wildl. Manage. 49(2):358-362.

PAYNE, J. M., and W. L. PALMER. 1985. Deer damage prevention efforts in Pennsylvania. Proc. Seventh Great Plains Wildlife Damage Control Workshop, pp. 119-130.

PETERSON, J. W. 1974. Evaluation of the effectiveness of commercial sonic device. Memo to NE Bat Res. Advisory Group. 11/22/74. 5 pp.

SILVER, J., and A. W. MOORE. 1933. Mole control. USDA, Farmers' Bull. No. 1716. 17 pp.

STERNER, R. T., S. A. SHUMAKE, S. E. GADDIS, E. R. LADD, and J. W. PETERSON. 1980. Note on preliminary laboratory and field tests of select chemicals as bat repellents. Proc. Fifth Int. Bat Res. Conf., Texas Tech Press, Lubbock, TX. pp. 225-230.

SULLIVAN, T. P., D. S. SULLIVAN, D. R. CRUMP, H. WEISER, and E. A. DIXON. 1988. Predator odors and their potential role in managing pest rodents and rabbits. Vertebr. Pest Conf. 13:145-150. Univ. Calif., Davis.

TOPSELL, E. 1607. The historie of four-footed beasts. Topsell's histories of beasts (Malcolm South, ed., 1981). Nelson-Hall, Chicago, IL. 185 pp.

WORONECKI, P. P. 1988. Effect of ultrasonic, visual, and sonic devices on pigeon numbers in a vacant building. Vertebr. Pest Conf. 13:266-272. Univ. Calif., Davis.