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BAIT DEVELOPMENT FOR ORAL DELIVERY OF PHARMACEUTICALS TO RACCOONS (*PROCYON LOTOR*) AND STRIPED SKUNKS (*MEPHITIS MEPHITIS*)

Shylo R. Johnson,[1,3] Nikki J. Crider,[1] Grant A. Weyer,[2] Randall D. Tosh,[2] and Kurt C. VerCauteren[1]

[1] National Wildlife Research Center, Animal and Plant Health Inspection Service, Wildlife Services, USDA, 4101 LaPorte Ave., Fort Collins, Colorado 80521, USA
[2] SmartVet Holdings, Inc., 22201 W Innovation Dr., 170A, Olathe, Kansas 66061-1304, USA
[3] Corresponding author (email: shylo.r.johnson@aphis.usda.gov)

ABSTRACT: Oral vaccination is one tool used to control wildlife diseases. A challenge to oral vaccination is identifying baits specific to target species. The US has been conducting oral vaccination against rabies since the 1990s. Improvements in bait development will hasten disease elimination. In Colorado, we examined a novel bait for oral vaccination and offered two different flavors, sweet and fish, to captive raccoons (*Procyon lotor*) and striped skunks (*Mephitis mephitis*) to assess consumption and flavor preference and observed bait removal by target and nontarget species in the field. During captive trials, raccoons and skunks consumed 98% and 87% of offered baits, respectively. Baits contained a sachet to simulate a vaccine package. Raccoons and skunks consumed 98% and 94% of the sachets, respectively. All unconsumed sachets were punctured, suggesting that animals had oral exposure to the contents. Raccoons preferred fish-flavored bait, but skunks did not have a preference. In the field, raccoons consumed the most baits, followed by fox squirrels (*Sciurus niger*). Other rabies host species (striped skunks, red foxes [*Vulpes vulpes*], coyotes [*Canis latrans*]) had very low visitation and were never observed consuming baits. High consumption rates by raccoons and skunks in captivity and observance of raccoons consuming baits in the field suggest that these baits may be useful for oral delivery of pharmaceuticals. Further field research is warranted to determine how to best optimize bait delivery.
Key words: Bait, oral vaccination, raccoon, rabies, skunk.

INTRODUCTION

As human populations grow and expand, wildlife populations that thrive on anthropogenic resources are increasing. This increases the risk for pathogen transmission within wildlife populations and the probability of spillover into other species, including domestic animals and humans (Bradley and Altizer 2007). Disease management programs are developing better methods to prevent, control, and eliminate diseases in wildlife. Oral delivery of pharmaceuticals is showing measurable success in reducing zoonotic diseases (Cross et al. 2007).

Oral vaccination has advantages over other methods, including culling, at reducing disease. These advantages include public acceptability, economics, and practicality (Cross et al. 2007; Sterner et al. 2009). Oral vaccination also does not have the negative consequences of culling, such as dispersal of survivors (Donnelly et al. 2006). Research into oral vaccination involves multiple species (e.g., raccoons [*Procyon lotor*], striped skunks [*Mephitis mephitis*], foxes [*Vulpes vulpes*, *Vulpes lagopus*, *Urocyon cinereoargenteus*], coyotes [*Canis latrans*], mongooses [*Herpestes javanicus*], European badgers [*Meles meles*], ferrets [*Mustela furo*], feral pigs [*Sus scrofa*], white-tailed deer [*Odocoileus virginianus*]) and several diseases (e.g., rabies, tuberculosis, brucellosis, pseudorabies, and plague [Qureshi et al. 1999; Blanton et al. 2006; Cross et al. 2007]). For some disease-species combinations, such as rabies in red foxes (*V. vulpes*), international-scale implementation of oral vaccination began as early as the 1980s (Freuling et al. 2013), whereas for others, such as raccoon roundworm (*Baylisascaris procyonis*) in raccoons, initial efficacy is still being determined (Smyser et al. 2015).

Oral vaccination has challenges such as developing an efficacious vaccine, packaging so vaccine quantity and quality are maintained, and creating a species-specific bait matrix (Ballesteros et al. 2007; Cross et al. 2007). When these challenges are overcome, diseases may be eliminated. For example, red fox rabies has been eliminated in western Europe (Freuling et al. 2013), and canine rabies is no longer present in the US (Velasco-Villa et al. 2008). Where these challenges have not been overcome, rabies remains enzootic. The first vaccine-laden bait release to target raccoons in the US was in 1990 (Hanlon et al. 1998). Today, oral rabies vaccination (ORV) efforts consist of >8 million baits distributed annually. The use of these vaccine baits helps prevent new areas from becoming enzootic, but enzootic areas are not decreasing (Anderson et al. 2014). New tools are needed to improve success.

Most oral rabies vaccine baits consist of a liquid vaccine, a packet containing the vaccine, and a food-based coating or matrix that encloses the packet, to attract target animals and encourage consumption. Color, texture, flavor, and scent of the bait matrix influence attractiveness and consumption. By changing these features, vaccination rates may change according to how the animals respond. One area to improve is the exterior bait matrix, which is directly related to an animal discovering and consuming a bait.

Research into flavor preferences of raccoons (Linhart et al. 1991, 2002), skunks (Bachmann et al. 1990; Jojola et al. 2007), coyotes (Farry et al. 1998; Linhart et al. 2002), and red foxes (Saunders and Harris 2000) has indicated wide variation among species and regions. In an effort to contact the most target species in multiple regions, fishmeal crumbles and fishmeal polymers have become the standard bait matrix for ORV in the US. However, average vaccination rates indicate that approximately 30% of the raccoon population is consuming these baits (Slate et al. 2009), a number that is below the threshold (50–70%) thought necessary to eliminate the disease (Thulke and Eisinger 2008). In a study measuring bait uptake (confirmed by biomarkers) and vaccination rates by raccoons, the highest rates measured were 45% and 21%, respectively (T. DeLiberto pers. comm.), still below the recommended threshold. In Canada, research supported the use of sweet-flavored baits (Rosatte et al. 1998) and resulted in bait consumption and vaccination rates as high as 87% and 84% (Rosatte et al. 2009). Besides flavor, Canadian baits had other differences (i.e., matrix, vaccine brand, and distribution bait density) that affected vaccination and uptake.

The ORV program in the US has been managing carnivore rabies with fewer tools than are being used in Europe, even though there are more target species in North America (e.g., raccoons, multiple fox and skunk species, coyotes, and mongooses). Greater overall progress may occur if alternative baits are identified that will be consumed by target species, particularly raccoons and skunks. Increasing the variety of baits available would provide managers with more tools and options, whether it is delivering a vaccine for disease control, an immunocontraceptive drug for population management, or some other pharmaceutical. We evaluated a novel bait by comparing two flavors and including captive and field components. In captivity, we examined consumption and preference for sweet- and fish-flavored baits by raccoons and skunks. In the field, we monitored baits for visitation and consumption by target and nontarget species.

MATERIALS AND METHODS

Baits

Baits consisted of food-grade products covering a 1.5-mL distilled water–filled sachet to simulate a vaccine-filled sachet. The baits were white- to cream-colored spheres, 27 mm in diameter. The thickness of the bait matrix varied between 2 mm and 4 mm (Fig. 1). Both baits were made with the same proprietary ingredients and flavored by the addition of vanilla and sugar in the sweet-flavored baits and fish oil in the fish-flavored baits.

Captive raccoons and skunks

In June and July 2013, we collected 21 adult (11 males and 10 females) raccoons from Weld and Larimer counties, Colorado, by using live traps (Tomahawk, Hazelhurst, Wisconsin, USA) baited

FIGURE 1. Novel baits offered to raccoons (*Procyon lotor*) and striped skunks (*Mephitis mephitis*) in captivity and placed at camera-monitored stations in the field. Captive observations were conducted from June 2013 to February 2014 and field observations were conducted from October 2013 to November 2013 in Larimer and Weld counties, Colorado, USA.

with commercial cat food or sardines. We anesthetized captured animals with an intramuscular injection of ketamine/xylazine (10 mg/kg ketamine and 2 mg/kg xylazine [Fowler 2008]). We recorded sex, relative age, lactation status, and weight. Along with nontargets, raccoons <5 kg or actively lactating were released at capture. In September 2013, we acquired 20 adult (10 males and 10 females), captive-born striped skunks (Ruby Fur Farm, New Sharon, Iowa, USA). All animals were housed in individual pens (3×3×2.5 m) with a den box and enrichment structures in outdoor facilities at the National Wildlife Research Center (NWRC), Fort Collins, Colorado. We used individual housing for identification and marked each animal with a passive integrated transponder tag (Avid Identification System, Inc., Norco, California, USA) injected subcutaneously between the shoulder blades. They were housed in the same individual pens throughout the study, except that one female raccoon that gave birth to two male and two female cubs was housed with her cubs until they weaned. The female with young was presented baits on the same schedule as the other adult raccoons.

All animals were maintained on daily rations of omnivore diet (Mazuri Omnivore-Zoo Feed "A", Richmond, Indiana, USA). Individual raccoons received 200 g, whereas the lactating female received 400 g. Skunks received 100 g of maintenance diet. Water was available ad libitum. Work was approved by the NWRC Institutional Animal Care and Use Committee (QA-2111 and QA-2204).

Consumption trials

For skunks and adult raccoons, the procedure was the same. We divided the animals into two groups by generating random numbers for each individual and then grouping the five lowest numbers for each sex into group 1 and remaining individuals into group 2. Group 1 received the sweet-flavored baits first and group 2 received the fish-flavored baits first. Each group was offered their first flavor for six consecutive trials, and then each group received the alternate flavor for six consecutive trials (12 trials total). We started a trial by removing any maintenance food 16 h before offering baits. A bait was offered in the food bowl for 24 h starting at 0800 hours. At least 2 d separated the start of a trial, and we had a 10-d break without any trials between switching flavors. The adult raccoon trials were conducted from 29 June to 14 September 2013. The skunk trials were from 2 December 2013 to 25 January 2014. The raccoon cubs only had six trials (three with each bait flavor) without an extended break between changing flavors, and each group only consisted of two individuals. The raccoon cub trials were conducted from 6 January 2014 to 25 January 2014.

We monitored bait uptake by continuous video and motion-activated cameras. For continuous video, we mounted video cameras (Supercircuits model PC161IR, Supercircuits, Inc., Austin, Texas, USA; Zodiac model CAMZ836IR, Zodiac Light Waves Inc., Ontario, Canada; Polaris model EZ-380VF, Polaris USA, Norcross, Georgia, USA) on tripods so bowls and most of each pen were in the field of view. Cameras were connected to a digital video recorder (BLACK, Supercircuits) for recording. We attached motion-activated cameras (Reconyx Silent Image, Holmen, Wisconsin, USA) to adjacent cages and focused only on bowls. We conducted physical checks at 4, 8, and 24 h after offering baits to observe evidence of bait consumption directly. If the bait was no longer in a bowl, we searched the cage and den box for the bait matrix and sachet. Animals that consumed a bait before 8 h were fed at that check. Any animals not fed at the 8-h check were fed after 24 h.

We summarized which baits were gone at each bait check for each trial. Imagery from the motion-activated cameras was examined to identify interactions and consumption of baits. If we were unable to determine interaction and consumption from motion-activated camera imagery, we examined video data. We compared portions of baits and sachets consumed by raccoons and skunks by using prop.test in R (R Core Team 2014).

Two-choice preference trials

Preference trials with adult raccoons were conducted from 1 October 2013 to 4 October

2013. The preference trials for the raccoon cubs and skunks were conducted from 18 February 2014 to 21 February 2014. Using the same camera setups as described for bait uptake monitoring, we offered captive raccoons and skunks sweet- and fish-flavored baits simultaneously with their daily food ration. The baits were in separate spinout bowls attached to the wall of the enclosure. The food was in a bowl on the floor between the two bait bowls. We determined by coin flip which flavor was offered in which bowl location for the first of four trials. In each subsequent trial, flavored bait locations (north or south) were switched. Each trial lasted 24 h without any break between trials, and we used the same time schedule for bait checks that was used for the consumption trials. We discarded any bait and food remains after 24 h and started with fresh baits, food, and bowls in the next trial. We viewed imagery from motion-activated cameras to determine the order of interaction and consumption. If we could not determine order from the images, we reviewed video. Consecutive interactions with the same item were treated as one interaction. If an animal moved an item out of the field of view and interaction or consumption could not be determined based on the checks, the data were excluded from analysis.

Initially, we evaluated data with generalized linear mixed models using the package lme4 (Bates et al. 2013) in R to assess whether day or bait location was a predictor of consumption for either raccoons or skunks. Neither day nor location was significant for either species, so we grouped data across trials for each species and used a Wilcoxon signed-rank test for comparisons.

Field trials

We established bait stations in Larimer and Weld counties from 30 September 2013 to 1 November 2013. Temperatures ranged from –3 C to 25 C, total precipitation was 4.3 cm, and snowfall was 8.4 cm based on local sources (Western Regional Climate Center 2014). Elevation of the bait stations was between 1,350 m and 2,800 m. Locations ranged from urban to rural, including city natural areas, backyards, gardens, farms, and nurseries. Field trials were approved by the NWRC Institutional Animal Care and Use Committee (QA-2189).

We monitored bait stations up to 5 d with 26–34 stations operating at a time. We conducted station checks after 48 h. If a bait was gone, we collected the equipment. Otherwise, the station remained for 96 h. A station consisted of one motion-activated trail camera (Bushnell Trophy-Cam, Overland Park, Kansas, USA), and one bait that was either sweet or fish flavored. We attached cameras to available features (e.g., fence posts, tree trunks) such that lenses were 2 m from the bait. Our first bait flavor was determined by coin flip, and we alternated flavors at each subsequent bait station. Stations were separated by $\geq$750 m. We programed cameras to collect three images per triggered event and three images once every hour. We examined the imagery to determine which species visited the station, interacted with the bait, and consumed the bait (when these events occurred).

RESULTS

Consumption trials

Raccoons consumed 98% of 276 baits offered; adult raccoons consumed 100% (252), whereas cubs consumed 71% (17/24). After 4 h, 213 of 276 (77.2%) of the baits were consumed: 102 of 138 (73.9%) sweet and 111 of 138 (80.4%) fish flavored (Fig. 2). We located five sachets: four from adults and one from cubs. The outer coating was missing from all sachets, and all had been punctured. In the first trial, when all animals were naïve to the bait, adult raccoons consumed 14 of 21 (67%) baits, 5 of 10 (50%) sweet and 9 of 11 (82%) fish flavored, within 4 h. We excluded the cubs from this analysis because they were not naïve to the bait when it was offered in individual housing.

Of 240 baits offered to skunks, they consumed 87%. They consumed 106 of 240 (44.1%) of the baits within 4 h, evenly split between the sweet- and fish-flavored baits (Fig. 2). We located 12 sachets, all punctured and without coating. In the first trial, skunks consumed 17 of 20 (85%) baits, and 13 of these 20 (65%) baits were consumed within 4 h. In this trial, more fish-flavored baits (9 of 10) were consumed overall, but skunks consumed more sweet-flavored baits (seven sweet vs six fish) in the first 4 h. Raccoons consumed more baits (χ^2=19.9, P<0.001) and more sachets (χ^2=4.14, P=0.042) than skunks.

Two-choice preference trials

Adult raccoons consumed all baits offered within 24 h; raccoon cubs consumed 26, 13 sweet- and 13 fish-flavored baits, of the 32 baits offered. Skunks consumed 55 fish- and 54 sweet-flavored baits from 160 baits offered.

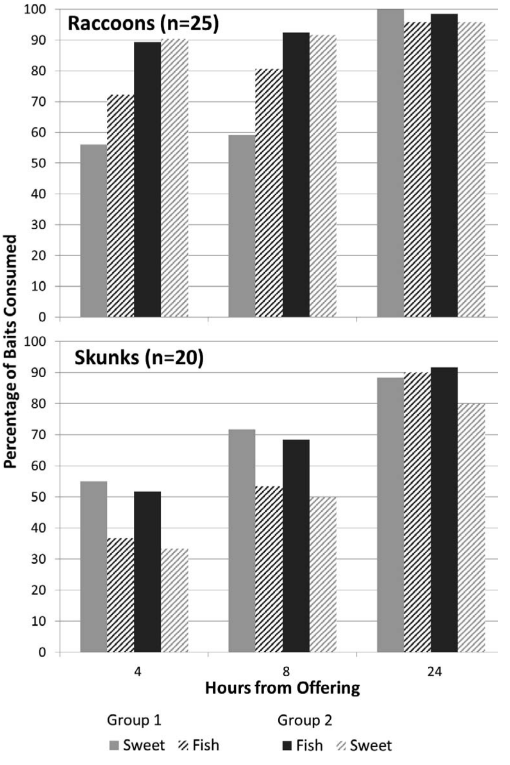

FIGURE 2. Consumption of sweet- and fish-flavored baits by raccoons (*Procyon lotor*) and striped skunks (*Mephitis mephitis*) at different intervals, summarized over multiple trials. Adult raccoons and skunks had six consecutive trials with one flavor before being switched to the other flavor for six consecutive trials. Raccoon cubs, which were combined with adult raccoons, had three consecutive trials before being switched to the other flavor for three consecutive trials. Animals in group 1 were offered the sweet-flavored bait first, whereas group 2 was offered the fish-flavored bait first. Baits were offered for up to 24 h in each trial before removal.

Because of the presence of multiple individuals in one cage, we excluded the female raccoon with cubs from preference trial analysis.

For our first analysis, we examined consumption between baits only. Because of camera failures with adult raccoons, bait preference was examined for only 17 individuals. Overall, adult raccoons consumed fish- and sweet-flavored baits first in 63% and 37% of the offerings, respectively. Nine raccoons consumed sweet- and fish-flavored baits first equally, and the remaining eight raccoons significantly consumed fish-flavored baits first more often ($Z=-2.52$, $W=0$, $P<0.05$). Overall, raccoon cubs consumed fish-flavored baits first in 56% of the bait offerings, sweet-flavored baits first in 31% of the bait offerings, and no bait in 13% of the bait offerings. One raccoon cub consumed sweet- and fish-flavored baits first equally, two consumed fish first more often, and one consumed sweet first more often. Combining adults and cubs, fish flavor was again consumed first more often ($Z=-2.49$, $W=5$, $P=0.013$). Of 80 total offerings, skunks consumed fish- and sweet- flavored baits first in 28% and 42% of offerings, respectively. They consumed one bait or less in 30% of the offerings. Four skunks never consumed baits. Eight skunks consumed sweet- and fish-flavored baits first equally. Six skunks consumed sweet-flavored baits first more often and two consumed fish-flavored baits first more often. No significant preference was indicated ($W=6$, $P>0.05$).

For our second analysis, we examined how bait consumption compared with food consumption by examining if a bait (any flavor) or food was consumed first significantly more often and which was consumed last significantly more often. Because of the amount of food offered, an individual could consume food first and last. Being unable to identify consumption order for some raccoons, we had data from 21 individuals for first consumption and 18 for final consumption comparisons. Food was consumed first for 45 of 89 (54%) of the offerings, and a bait was consumed first for 39 of 84 (46%) of the offerings. We did not detect a difference between a bait or food being consumed first ($Z=-0.71$, $W=47.5$, $P=0.48$). Food was consumed last for 58 of 72 (81%) of the offerings, and a bait was consumed last for 14 of 72 (19%) of the offerings. Food was most often consumed last ($Z=-2.53$, $W=19$, $P=0.011$). We were able to include all offerings for skunks. From the 80 offerings, skunks consumed food first 56% of the time, a bait first 41% of the time, and nothing was consumed in 3% of the offerings. Bait or food was equally likely to be consumed first ($Z=-1.089$, $W=53.5$, $P=0.28$). If a skunk

TABLE 1. List of animals documented removing a bait from camera-monitored stations from 30 September 2013 to 1 November 2013. Each station had one bait, either sweet or fish flavored.

Species	Sweet	Fish	Total
Raccoon (*Procyon lotor*)	9	10	19
Fox squirrel (*Sciurus niger*)	10	3	13
Other rodents	2	3	5
Birds	1	2	3
Dog (*Canis lupus familiaris*)	1	2	3

consumed a bait, they significantly consumed both baits before consuming any remaining food (Z=–3.039, W=6.5, P=0.002). However, when including individuals that did not consume any bait, no preference emerged between consuming baits before or after all food was gone (Z=–1.1067, W=67.5, P=0.27).

Field trials

Baits were offered at 121 locations: 61 sweet- and 60 fish-flavored baits. Baits were removed at 65 of 121 (53.7%) of the locations. We were able to determine the species that removed baits for 43 of 65 (66%) of the bait disappearances (Table 1). Raccoons consumed 19 of 30 (63%) of baits at visited locations where a bait was still available. We documented skunks, coyotes, and red foxes visiting the bait locations, but not bait consumption (Table 2). We had 24 baits removed on the first day, 21 on day 2, 6 on the day 3, and 14 on day 4.

DISCUSSION

Our findings suggest these novel baits have potential for oral delivery of pharmaceuticals to raccoons and skunks. Identifying an ideal bait for a particular species requires understanding food habits, eating behaviors, and the effect of timing on selection. These factors affected both the similarities and differences between the captive raccoons and skunks in our trials.

Overall consumption by the raccoons and skunks was equal to or higher than that for other oral vaccine baits. When Rosatte et al. (1998) compared bait flavors in single-choice and two-choice trials with captive raccoons, the highest consumption rate was 68% for a single flavor. The greatest consumption by captive raccoons observed by Linhart et al. (1991) was 90%. Highest consumption achieved in a captive skunk trial with various bait shapes and flavors was near, but less than 75% (Jojola et al. 2007). Consumption of our bait was 98% and 87% for raccoons and skunks, respectively. However, these studies often varied in the methods used, such as duration and frequency. When we added restrictions (4 h on the naive offering), bait consumption decreased to 67% and 65% for raccoons and skunks, respectively, but rates were still comparable to raccoon and skunk bait consumption from similar studies.

Time of day may also have influenced results. Both skunks and raccoons are nocturnal and are not typically active after sunrise and in early afternoon. Because our bait

TABLE 2. Visitation to bait stations with either a sweet- or fish-flavored bait by species from 30 September 2013 to 1 November 2013. The types of visitation consisted of no interaction, moving within ≤0.5 m of the bait and orienting to or touching the bait (interaction), and visiting after the bait was removed by a different species (bait gone). Unknown visitation occurred when we were unable to determine whether the animal interacted with the bait from camera images. Based on subsequent imagery, these unknown visitations did not result in bait removal.

	No interaction		Interaction		Bait gone		Unknown	
Species	Sweet	Fish	Sweet	Fish	Sweet	Fish	Sweet	Fish
Raccoon (*Procyon lotor*)	4	3	1	3	2	1	1	1
Skunk (*Mephitis mephitis*)	0	0	0	1	0	1	0	0
Coyote (*Canis latrans*)	3	2	0	0	0	2	0	1
Red fox (*Vulpes vulpes*)	0	0	1	0	1	1	1	0

offering started in the morning, some animals did not interact with the bait during the first few hours, possibly due to an innate preference of being more active at night. In field trials, almost all visitations occurred at night.

Time of year may also have influenced consumption. Both raccoons and skunks are superficial hibernators, sleeping more in winter, but they are still active to escape dangers, search for food, and find a mate (raccoons: Armstrong et al. 2011; skunks: Storm 1972; Sunquist 1974). Depending on intrinsic drives, a raccoon or skunk may consume any edible item, select for specific nutrients, or ignore food. Furthermore, although both raccoons and skunks are omnivores, raccoons consume a higher diversity of foods than skunks within the same environment (Llewellyn and Uhler 1952). These different drives may have affected the results of our consumption and preference trials with captive raccoons and skunks.

The captive trial for the adult raccoons was conducted in summer and early fall, and the field trial was in the fall. This coincided with the time when wild raccoons acquire fat stores for winter (Gehrt 2004; Armstrong et al. 2011) and may be more willing to consume any edible item. This is a possible reason why no flavor preference was observed in the field. Also, the raccoon cubs occasionally did not consume bait offered in winter.

Bait trials with the captive skunks occurred in winter. Skunks may have had decreased or more selective appetites during winter, resulting in the lower consumption rates than adult raccoons. Winter may have also affected the palatability of the baits. Colder temperatures may have frozen the water inside or increased hardness of the coating, thereby affecting bait and sachet consumption. A decreased or selective appetite may be related more to an individual than a group, as a few individual skunks never ate baits.

Sachet consumption seems to be species related as sachets were found with different individuals. The size of a bait or food item can affect consumption behaviors. For example, reindeer change their bite size and rate based upon food type (Trudell and White 1981). Size and strength of the jaw also influence what or how an animal eats. We observed raccoons, which are larger than skunks, to chew the entire bait and hold the bait between the paws when eating. In contrast, typically skunks pinned the bait on the ground. Jojola et al. (2007) observed similar behaviors with skunks. Because skunks are smaller, they may need to chew more than a raccoon before swallowing the bait. Both factors, less bait in the mouth and having to chew more, increase the chance of a sachet not being in the mouth when punctured, decreasing the probability of the animal receiving the pharmaceutical. Because all sachets located were punctured and animals chewed baits instead of swallowing them whole, sachet contents were likely released before swallowing.

Both the sweet and the fish flavors tested elicited high consumption rates in captive animals, and only the captive raccoons preferred fish-flavored baits. Neither skunk data nor field trial data indicated a flavor preference. By comparison, Rosatte et al. (1998) did not find a significant preference among cheese, sugar-vanilla, or fish baits in captive raccoons, but Jojola et al. (2007) observed a significant preference for fish baits over sugar, chicken, cherry, and apple in captive skunks.

Differing results and limited preference in omnivores is not surprising. Instead, we should consider whether any new bait has a competitive advantage over regularly available alternatives in nature. Once an animal locates a bait, alternative food choices, varying nutritional requirements, and fluctuating satiation levels may affect bait consumption. In preference trials, we attempted to represent some of this variation by providing an entire daily food ration simultaneously with the baits. At the beginning of the preference trials, when baits and food were available, animals were least satiated and we found no difference between a bait or food being consumed first for raccoons and skunks. However, as items were consumed, animals ate both baits before depleting food, suggesting that baits were preferred. Future research should examine how consumption varies when animals have excessive baits and food to consume.

In addition to the factors already mentioned that influence consumption, scent, location relative to home range, and population density can influence bait visitation rates and whether a bait will be consumed in the field. We had low field visitation by skunks, foxes, and coyotes, all of which likely have low population densities in our study area. In an attractant study in a similar area, Andelt and Woolley (1996) documented skunk visitation at 17 stations over 3 yr, but they did not mention whether foxes or coyotes visited the stations. We may also have had low skunk numbers due to a skunk rabies epizootic (Dyer et al. 2014). For raccoons, our total visitation (35) was above the average visitation rate (20) observed by Andelt and Woolley (1996) over 3 yr. Future researchers should focus on which of the two flavors, or other flavors, are better for attracting animals from a distance.

New baits, such those described here that can reach the requisite proportion of the target population, are needed for management of wildlife diseases, including rabies. Research should focus on multiple factors and how their interactions may influence bait consumption. Key factors that should be evaluated more comprehensively include flavor and scent preference, species ecology, nontarget uptake, seasonality and eating habits, and mouth size and food preferences.

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