AN ASSESSMENT OF THE ATTRACTIVENESS OF THREE BAIT TYPES TO THE CALIFORNIA GROUND SQUIRREL

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The California ground squirrel (*Spermophilus beecheyi*) is one of the most damaging vertebrate pests in the state of California. Rodenticides are often employed to control this pest given their ease of use, efficacy, and cost effectiveness. The carrier designed to deliver this toxicant is very important to ensure the greatest possible efficacy for these rodents. Typically, grain or pelletized baits are used for field rodents because of their palatability and ease of application. However, there is currently great concern about the spillage of such baits around bait stations, as such spilled bait can be responsible for mortality of non-target species. A highly palatable paste bait that is securely housed within a bait station could eliminate this concern and is worth investigating. Such a bait is currently available from Liphatech, Inc. to control commensal rodents but has never been tested on field rodents such as the California ground squirrel. Therefore, we compared the attractiveness of a nontoxic version of this paste bait to standard wheat and oat grains to provide initial information on the utility of this bait matrix for attracting the California ground squirrel to bait stations.

STUDY SITE

We tested the efficacy of the three proposed baits at a rangeland site in the foothills at the base of the Sierra Nevada Mountains in eastern Fresno County, California. This site consisted of open grassland in uneven terrain with a few pockets of oak trees present throughout the study site.

METHODS

We placed 15 T-shaped bait stations randomly throughout the study area, making sure to keep all bait stations at least 100 m apart. We then randomly assigned bait types to each bait station, for a total of 5 bait stations of each bait type. To monitor activity at each bait station, we placed 2 passive infrared remote-triggered cameras (combination of Scoutguard SG550V, Reconyx RC55, and Reconyx PC800 Hyperfire) at each bait station; one camera was placed at each of the entrances to the bait station. This ensured that we would capture all activity events at each bait station. We recorded each 5-minute interval where a photo of at least one ground squirrel was taken and tabulated them for each functional day of each bait station. We counted a functional day as 06:00 of one day to 05:59 the following day to reflect the diurnal nature of the ground squirrel. Because we were utilizing two cameras at each bait station, we occasionally recorded activity within the same 5-minute time period from both cameras at a bait station. To eliminate this bias, we compared photos from both paired cameras and removed any overlapping photos from our data set. We then developed a general index of activity by dividing the number of photos recorded at each bait station by the number of days the bait station was active, and compared the resultant index values across each bait type through one-way ANOVA.

We were also interested in the time that was required for the ground squirrels to acclimate to the bait stations. For this, we recorded the number of days it took for a ground squirrel to be

photographed at each bait station, and compared these values across the three bait types through one-way ANOVA.

We operated the bait stations from 11–28 July, 2011. For bait station operation, we initially applied two liters of wheat and oats to each of their respective bait stations. For the paste packets, we ran wire through both sides of the bait stations and attached 4 bait packets to each side for a total of 8 packets per station. We monitored each station every 1–2 days to refill if necessary, and recorded the total amount of bait applied to each bait station for comparison to our general index of activity. Unfortunately, we could not directly compare the amount of bait consumed at each of the three bait stations types, as two were grains, while one was a paste. However, we did test for differences in bait consumption between the two grain baits through a Student's *t*-test. Finally, we also tested the validity of our general index by relating the amount of bait consumed to the derived general index values for each bait station through the use of simple linear regression.

RESULTS

We observed 5,140 photos containing at least one California ground squirrel over the 18 day period of this study. Of these, 1,124 photos were at wheat bait stations, 3,099 were at oat bait stations, and 917 were at paste bait stations. This resulted in a mean index value of 12.5 photos per day for wheat bait stations, 34.4 photos per day for oat bait stations, and 10.2 photos per day for paste bait stations. The amount of activity at the three bait station types differed ($F_{2,13} = 14.9$, $P < 0.001$), with activity greater at oat bait stations than at either wheat or paste bait stations ($P < 0.001$). There was no difference between activity at wheat and paste bait stations ($P = 0.647$).

The mean number of days required before feeding commenced at each bait station differed (wheat = 5.2 days, oat = 3.4 days, paste = 6.2 days; $F_{2,13} = 3.7$, $P = 0.057$), with feeding occurring quicker at oat bait stations than at paste bait stations ($P = 0.020$). There was no difference between oat and wheat ($P = 0.111$) and wheat and paste bait stations ($P = 0.358$).

Oats were consumed at a greater rate than wheat at their respective bait stations (oats = 0.77 liters/day, wheat = 0.32 liters/day; $t = –3.7$, $P = 0.006$). Paste baits were also consumed at a fairly high rate (2.66 packets/day). We were able to use the mean number of photos taken per day to successfully predict the amount of bait consumed at each bait station (wheat: $F_{1,3} = 37.4$, $P = 0.009$, $R^2 = 0.93$ [$\beta = 0.017$, SE = 0.003]; oat: $F_{1,3} = 7.5$, $P = 0.071$, $R^2 = 0.71$ [$\beta = 0.018$, SE = 0.007]; paste: $F_{1,3} = 6.4$, $P = 0.086$, $R^2 = 0.68$ [$\beta = 0.127$, SE = 0.050]) indicating that our indexing method appropriately captured activity at the bait station sites.

DISCUSSION

Based on our findings, all three bait types should be effective as carriers for anticoagulant rodenticides for the California ground squirrel. Oats were clearly the preferred bait type in this investigation, as activity was greater, more bait was consumed, and shorter acclimation periods were observed for ground squirrels at these sites. Initially, there does not appear to be much difference in acceptability between the wheat and paste baits, as we observed similar numbers of photos at each site and a similar period of time before feeding commenced. However, this does not reflect the whole story, as once the ground squirrels became acclimated to the feeding sites,

they learned to rapidly remove the bait packets from the stations. Oftentimes within 2–3 hours, no bait packets remained, and the subsequent number of photos substantially dropped after this time-period. If the bait packets were not so easy to remove, more photos would likely have been recorded. In contrast, there was always a steady supply of wheat, so the number of photos obtained for this bait type was as high as possible. As such, the paste packets may be more highly preferred than wheat grains by the California ground squirrel, although neither are as attractive as the oats. Nonetheless, our results are promising if the primary impetus is to develop an attractive bait that can be securely housed within a bait station (i.e., eliminating non-target consumption).

FUTURE DIRECTION

Our findings indicate that a toxic paste packet might be a more effective carrier for California ground squirrel control programs than standard wheat grains. However, we do not currently have a bait station design that will successfully keep these bait packets housed inside without allowing the ground squirrels to remove them. The next step would be to design and test such a bait station. Upon completion, efficacy studies could be conducted to ensure the efficacy of this particular bait type.