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Journal
Proceedings of the Vertebrate Pest Conference, 18(18)

ISSN
0507-6773

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Publication Date
1998

DOI
10.5070/V418110049

THE EFFICACY OF GLUE TRAPS AGAINST WILD POPULATIONS OF HOUSE MICE, *MUS DOMESTICUS*, RUTTY

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ABSTRACT: Field research was conducted from Purdue University during 1991 to 1993 to examine some aspects of the efficaciousness of the various types of glue traps against wild populations of house mice. The research was conducted in agricultural and livestock buildings containing various infestation levels of mice. Tests compared the capture and escape rates of glue boards vs. trays, covered vs. uncovered glue traps, and glue traps vs. snap traps, and multiple catch curiosity traps. Observational work, via night vigils, was also conducted to note the behavioral response of mice to glue surfaces, including the behavioral aspects of mice neutralizing glue surfaces in well-used runways. These field tests indicate many mice, upon initial interactions with glue traps and surfaces, are repelled by them and either learn to avoid them or neutralized them in some manner. Results of comparison trials between glue traps and non-glue mouse traps also indicate strong differences in interaction and capture rates favoring non-glue traps. It is hypothesized that when glue traps are successful, it is likely due to mice traveling kinesthetically along frequently used runways in which traps are placed, or to factors associated with age class of mice. These studies have strong implications for rodent pest management programs in facilities which are restricted to non-chemical approaches (e.g., food handling establishments and sensitive accounts).

KEY WORDS: house mouse, *Mus domesticus*, glue traps, snap traps, multiple catch traps, investigative behavior, kinesthetics

Proc. 18th Vertebr. Pest Conf. (R.O. Baker & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. 1998.

INTRODUCTION

Glue traps are widely used by homeowners, food processors, and pest management professionals in attempts to control rodents; particularly mice. The impetus for this field study resulted from repeated calls for assistance from warehouses and food processing plants which had been relying on glue traps as their primary indoor mouse control tool, but yet mice were persisting. Visits to these sites confirmed that although some mice were being captured on the glue traps, other mice remained uncaptured and active for prolonged periods in areas where fresh traps were abundant and present in mouse runways and high mouse activity areas. Some mice, it seemed, were ignoring, avoiding, or repelled by the glue traps in their territories.

This led to a literature search in efforts to locate a study which addresses the efficacy of glue traps when used against wild populations of mice within structures. Not only is such data and discussion lacking, but efficacy testing procedure and standards for glue traps have never been developed by the pest control industry, nor does the EPA require the registration of glue trap products. Frantz and Padula (1983) also noted this during their review of glue traps.

Several publications address glue traps on an informal basis, (e.g., Anon. 1981; Fitzwater 1982; Marsh 1982; Frishman 1992) and on a more formal level, Frantz and Padula (1983) provide an laboratory study addressing the mode of action of glue entrapment on lab mice, and the behavior of confined lab mice around glue traps. Their results are important in that they provide insight into the interaction between mice and glue traps. Still, these researchers note the importance of the difference between a lab environment and a natural environment and stressed the need for testing glue traps in the field.

This paper reports the results of several different field tests which were conducted over a period of three years that measure the efficacy of glue *board* traps and glue *tray* traps used in various combinations and in comparative tests against various types of non-glue traps against naturally occurring, structural infestations of free-ranging wild populations of the house mouse, *Mus domesticus*.

MATERIALS AND METHODS

The field tests for this study were carried out during 1991 to 1993 in various livestock, agricultural, and warehouse buildings in central Indiana infested with populations of wild house mice, varying in population size. All buildings were relatively new (≤10 yr.), heated and insulated. Some sites contained livestock in pens or cages. Food (livestock feed) was readily available to the mouse populations at all sites. Thus, the sites resembled other commercial urban buildings in which mice become pests due to the availability of food, shelter, and warmth.

All buildings were screened prior to testing to ensure building or climatic factors would not negatively affect the glue traps or non-glue traps used in the study. Thus, only buildings, or those portions of building, where floor areas were not dusty, dirty, or wet prior to, or during, the test periods were used for tests. Additionally, all test areas remained at temperatures ranging between 18 to 30°C at night depending on the specific climatic conditions and building for each test.

For those tests where traps were in position for more than one night, the adhesiveness of each trap was checked daily using a clean metal spatula blade to ensure the trap was not affected by any dust or dirt. Glue traps containing any captures, or traps containing fur residues from previous mice where replaced with new traps. Successful metal repeating mouse traps were replaced with clean (hot water and ammoniated detergent/rinse) traps to avoid biasing traps due to pheromonal cueing.

All glue traps used in this study were, and are, available from popular manufacturers and supply distributors, and the basic make up of the traps in design and glue compositions remain, for the most part, the same today, although relatively minor changes have been made among some brands and models since these tests were conducted.

Glue *board* traps are constructed with thin levels of glue varying from 1 to 2 mm in thickness mechanically applied at the factory to thin cardboard platform. The platform can be placed out unfolded or folded to form a tent-like appearance. Glue *tray* traps are filled with glue to a thickness varying from 4 to 6 mm. Various types of plastic or cardboard covers are available for the glue tray traps. Both styles of traps are available in mouse-size traps and rat-size traps. The dimensions of the traps are listed with the specific test below. The variances in the composition and mixtures of the glue ingredients among models and brands were not considered. A discussion of the materials used as sticky adhesives for rodent and bird glue traps and repellents is provided by Fitzwater (1983).

All glue and non-glue traps used in this study were obtained either by purchasing the traps from pest control supply houses, or via the manufacturers directly.

Additional methods (specific trap dimensions, number of traps, trap spacing, etc.), are discussed with the specific test.

Test I. Glue Traps vs. Non-Glue Traps

Test IA—Cardboard glue traps vs. double sets of professional model mouse snap trap. Based on preliminary observations of glue traps failing to control mice in two large food manufacturing plants, this test was initiated to gather a cursory evaluation as to how the inexpensive cardboard glue board traps would perform against standard mouse snap traps on capture performance only.

Within three rooms, 12 Victor cardboard mouse size M320 glue traps folded into a "teepee" configuration, and 24 Victor M133 professional model (i.e., expanded trigger) mouse traps were installed along wall areas and various shelving areas exhibiting mouse activity (e.g., droppings, urine pillars). Because each glue trap is capable of capturing more than one mouse per trap setting, two snap traps per placement were made for every one glue trap. In this way, approximately the same amount of space occupied the mouse's runway, by the new objects, and the opportunity to capture more than one mouse was available at each trap station. The snap traps were placed with approximately 2.5 cm separating the traps.

The traps were installed in an alternating treatment pattern at about 1.5 to 2.0 m intervals, but various closets and shelving areas were also utilized according to mouse activity and space allowing for trap placements. All traps were installed in "runway" areas (corner placements were avoided). Because the glue traps available for this test contained a "peanut oil" attractant, applied by the trap manufacturer, the snap traps were baited with a tiny smudge of peanut butter on each of the trap triggers. All traps were installed between 1500 to 1700 hr. and checked the following morning between 0700 to 0900 hr. This test was run for one night only, and was conducted during the spring of 1991.

Results. The snap traps captured a total of 54 mice per 96 traps for a total capture rate of 56.2%. The glue traps captured a total of only four mice (8.3%) (Table 1). Escapes and non-committal interactions between the trap treatments were not measured in this test.

Test IB—Mechanical repeating multiple catch traps vs. glue traps. As a follow up to Test IA, it was desirable to evaluate the difference between commonly used mechanical multiple catch traps ("curiosity traps") and glue traps, as both types of traps are widely used in the food industry. The tests were run in various combinations and designs as described below.

Table 1. A comparison of the total mouse captures by professional model mouse snap traps and folded cardboard glue traps.

Building	Snap Trap (n=24)	Folded Cardboard Glue Trap (n=12)
GF 1	16	2
GF 2	13	1
Vestibule areas	9	0
GF 3	16	1
Totals	54	4

Test IB(1)—Comparison of a wind-up curiosity trap and folded cardboard glue trap. The objective of this test was to measure the difference between interaction rates and capture rates between a widely used multiple-catch mouse trap (The Ketch All®; Kness Manufacturing), and a folded cardboard "elongated" mouse glue trap (The Trapper® Bell Laboratories).

This test was conducted four to five weeks following the snap trap tests utilizing the same buildings, and in a similar fashion, although the Ketch All® trap replaced snap traps. The Trapper® Mouse Pro (Bell Laboratories) cardboard mouse trap forms a four-sided tunnel measuring 18 x 5.5 x 3.5 x 6.0 cm with a glue covering measuring 9 x 14 cm. The adhesive surface begins one centimeter from each end of the trap. Conceivably, the glue trap contains enough space to capture up to three mice. The Ketch All® trap, if wound completely could capture up to 15 mice. For this test, however, each trap was wound enough to allow for only three good revolutions of the trigger paddle. If any more than three mice were found within either trap, they were ignored. Twelve (12) traps of each treatment were installed into each room. For the purposes of this paper, only a summary of overall performance between trap treatments is presented. This test was run for one night only.

Results. The results of Test IB(1) are presented in Table 2. Similar to the results seen in the snap trap comparison tests, the glue traps captured only seven mice among 48 traps for a total of 13.0% of the total mice taken from all four areas. The Ketch All® trap captured a total of 47 mice among 48 traps (87% of all mice captured).

Test IB(2)—Comparison of a non wind-up multiple catch traps to covered and uncovered glue tray traps. This field evaluation compared the Tin Cat® (Woodstream Corporation) repeating mouse trap with uncovered J. T. Eaton's rat-sized glue tray traps and the same tray trap installed within an Eaton's glue trap cover. The Tin Cat® is a non-windup teeter totter ramp style repeating mouse trap measuring 16.5 x 27 x 6.5 cm. The entry openings to the trap measure 2.5 x 3.5 cm and are 0.7 cm off the floor. The glue tray trap measured approximately 12 x 28 cm and is filled with approximately 4 to 6 mm of glue. With the cover on the glue trap, a tunnel opening of 5.0 to 7.5 cm tall and 12.5 cm wide is created.

Tests were conducted in an poultry layer research facility containing 14 rooms and long hallways. The various hallways and storage areas throughout the building contained significant levels of mice. A total of 19 traps of each treatment were installed until the floor space was completely occupied throughout the facility. The traps were run for a period of six days, at which time various cleaning and operational activities of the facility caused the termination of the trapping program. Thus, a total of 114 trap nights per trap treatment were run. All traps were run each morning, and all captured mice were removed from the premises and euthanized. Any trap of any of the three treatments that had a successful capture or showed signs of mouse interaction (e.g., droppings or hair on a trap) was replaced with a new glue trap or a clean (i.e., thoroughly washed) Tin Cat®. Traps were installed in randomized fashion throughout the complex with approximately 2.5 m spacing between all traps.

Results. The results of Test IB(2) are shown in Table 3. The repeating Tin Cat® captured a total of 96 mice or 67.6% of all mice captured over the six nights of trappings. The uncovered glue tray traps captured a total of 30 mice (21.0%), while the fewest mice were captured on the covered glue traps with a total of only 16 mice (11.2%).

Table 2. A comparison of total mouse captures for the Ketch All®® repeating mouse traps and folded cardboard glue traps.

Room	Ketch All® Trap (n=12)	Folded Cardboard Glue Trap (n=12)
GF 1	11	1
GF 2	9	4
Vestibule areas	6	0
GF 3	21	2
Totals	47	7

Table 3. A comparison of total mice captured per day for the Tin Cat® repeating curiosity trap, a covered glue tray trap, and an uncovered glue tray trap.

Day	Tin Cat® Trap (n=19)	Uncovered Glue Tray (n=19)	Covered Glue Tray (n=19)
1	27	13	5
2	18	6	3
3	18	7	3
4	16	2	1
5	10	1	4
6	7	1	0
Total	96	30	16
Percent of Total Mice Captured	67.6	21.0	11.2

Test II. Glue Trap Model Comparisons

The objective of this field test was to measure any interaction and efficacy difference between the various types of glue traps. Open vs. folded boards were compared, as well as glue tray traps vs. glue boards. It was of interest to note the effects of a glue trap lying flat on a surface as compared to a folded trap which creates a tunnel to which the mouse must enter. Additionally, it was of interest to see whether or not the lip on a glue tray which raises the surface of the trap off the floor by approximately 5 to 7 mm might affect the interaction of exploring or running mice as compared to the surface of a cardboard trap lying relatively flat along the surface.

These tests were carried out in moderately to severely infested rooms among three grower-finisher confined hog buildings, as well as within the poultry research complex mentioned above. For test IIA, 21 traps of the Victor M 183 were alternated in placement, with spacing of approximately 2 to 3 m. The test was run for one night only.

For Test IIB, a total of 128 traps of each treatment was installed into the buildings. The Bells' mouse size (12.2 x 8.3 x 1.0 cm) Trapper® glue tray traps filled with approximately 4 to 6 mm of glue were used in this study. The glue board traps were the Victor M 183 mouse traps as described above. Trap treatments were alternated in placement, with spacing of approximately 2 to 3 m. The test was run for one night only.

Results. The results of Test IIa are shown in Table 4. Of the total number of 19 mice captured during the night, 14 (73.6 %) of the mice were captured on the open boards, as compared to 5 mice (26.3%) captured among the folded traps. Although, the overall number of mice captured between treatments and among the three rooms was very low, it is not necessarily an indication of a low population of mice, as it might be an aversion of mice to interact with these devices. Moreover, a total of 38 traps received interactions, but non-committal activity, and moved traps represented 30% of the total traps installed.

The results of the comparison for Test IIb are shown in Table 5. In this test, interactions with traps included either captures or indications on any activity on the trap surfaces (e.g., hairs, droppings). The interaction rates of the trays were less than half of the interactions with the boards (23.4% vs. 50.7%). The glue tray traps successfully captured a total of 22 mice that interacted with the tray trap compared to 31 mice captured with the glue boards. This is also reflected in the percentage of escapes or non-committal interactions with those traps receiving interactions. With the trays, escapes were much lower (16.6%) as compared to the open board traps which showed nearly half of all traps (47.6%) allowing escapes or repelling the mice from committing more to the trap surface.

DISCUSSION

Natural Aversions by Mice to Dangerous Surfaces

Many factors are likely to affect the efficacy and repellency of glue traps against rodents within real world biological and non-biological factors (Corrigan 1994). This paper, however, is primarily concerned with the possible biological and behavioral factors since all styles of glue traps were found in many cases to be avoided, and were significantly less effective in capturing mice than non-glue traps.

For many years, professionals and non professionals alike have visually witnessed mice jumping over and running around glue traps. But, aside from a reactive jump over a new object (as they do with other traps as well), it seems some mice are capable of detecting the danger of a sticky surface. In the field it is common to find evidence (droppings and/or hair) of mouse encounters, interactions, and "escapes" on glue traps. Moreover, pest management professionals often encounter tufts of hair on cockroach monitoring traps, as well as pieces and parts of cockroaches which have been consumed off of glue boards by mice. Such field observations combined with the data as shown in these

Table 4. Total number of captures and escapes of mice for folded and unfolded glue board traps.

Building	Open Glue Board (n-21)	Folded Glue Board (n=21)	Boards Moved Out of Runway	Glue Traps Indicating Escapes or Non-committal Activity
BG 1	7	3	2	8
BG 2	3	0	4	7
P1	4	2	7	10
Totals	14	5	13	25

Table 5. Interaction rates, captures, and escapes of mice between open cardboard glue traps and open plastic tray glue traps.

	Glue Trap	Trap Interaction (%)	Captures	Missing Traps	Traps Indicating Escapes or Noncommittal Activity
			n=30		n=30
N=128	Tray	30 (23.4%)	22 (73.3%)	3	5 (16.6%)
			n=65		n=65
N=128	Open board	65 (50.7%)	31 (47.6%)	3	31 (47.6%)

studies clearly indicate that many mice are able to determine and avoid the danger of sticky surfaces.

The repellency of glue traps has been noted occasionally in trade journals and educational leaflets (e.g., Frishman 1992; Marsh 1982; Story 1982). Frantz and Padula (1983) also reported that some laboratory mice shifted their activity away from pathways that contained glue boards.

The biological mechanisms and interactions involved with mouse explorations and behavior relative surface substrates is lacking or scarce. But, significant insight into the possible biological and behavioral mechanisms associated with rodents avoiding dangerous surfaces may be provided by studies and discussion on the vibrissal apparatus of rodents (e.g., Sokolov and Kulikov 1987; Barnett 1975, 1988). These studies and papers discuss the location, function, and use of the various groups of the vibrissae sensory organs on rodents. Sokolov and Kulikov (1987), show that specific groups of vibrissae are used for general orientation to, and detection of, various substrates. By means of the whisker vibrissae, for example, the animal investigates the environment in which it is moving (i.e., detects obstacles and feels unfamiliar objects). Other groups of vibrissae are used to protect the snout from damage, while others help control movement of the rodent in relation to various substrates such as soil, stones, tree branches, etc.

The facial vibrissae of the adult house mouse can reach lengths slightly greater than 2.5 cm. Sokolov and Kulikov (1987) illustrate how rodents project their facial vibrissae out in front of the animal to "feel" and explore the area immediately in front of them. Using their vibrissae for this function, house mice would certainly be equipped to avoid a surface which grabs and holds these sensory tactile organs. Moreover, other vibrissal groups, located on the feet and belly, may also play a role in the avoidance of dangerous surfaces.

Presumably, following a dangerous encounter with a sticky surface and object, mice are capable of remembering the encounter due to both the visual shapes of the object (i.e., the glue trap), as well as the odors that abound off of glue traps from the resins, rubbers, and other chemicals making up the glue. These odors are easily detectable by people. At the level of a mouse's nose to the glue surface, coupled with their excellent olfactory capabilities, odor association with a dangerous event for this rodent is likely to be significant. The role of the adhesive odors and any possible repellency effects, however, are undocumented.

Glues vs. Non-glue Traps

The overwhelming difference in this study between glue and non-glue traps (snap traps and curiosity traps) as seen in Tables 1-4, at first is surprising and somewhat of a mystery. However, part of the solution lies in observing mice during their nightly forays. Mice tend to make many short trips out of their nests for feeding and general exploratory forays. These trips take them back to the same runways and objects several, and sometimes many, times in one evening. This investigative mode or tendency toward "curiosity" in mice is well documented and reviewed in the literature (e.g., Mills 1947; Crowcroft 1966; Meehan 1983).

Mice, upon exploring a new surface or object for the first time, may be forewarned of the glue surfaces either through their vibrissal apparatus, their sense of smell, or both. A brief negative encounter with such a surface or object allows the mice to avoid the glue object, but to continue exploring and eventually encounter a snap trap.

The snap trap itself is also approached slowly and cautiously (to varying degrees). However, no sticky surface "grabs" at the mouses's foot, face, or body. Moreover, the chemical odors associated with the glue traps are lacking with the snap trap. And, if the snap trap is baited with peanut butter, it is actually likely to be an attractive odor to investigating mice. Nevertheless, it is well known that some mice still approach snap traps with the utmost caution and are capable of licking or stealing bait off of mouse traps without setting off the trap. Moreover, it is important to mention that the folded glue trap design, as compared to the openness of the snap traps, may also have had an impact on the results of the snap trap vs. glue board study (see discussion below).

A similar scenario occurs in the tests comparing glue traps with curiosity traps. When encountering a "curiosity" trap, mice, if in an investigative mode, may elicit an opportunistic response to a potential new burrow (Corrigan 1988). It has been visually observed and documented on film in the field by this author that, although mice investigate new "holes" in their environments, the initial stages of the new hole investigation are often slow and cautious, the same as is seen around other new objects such as the snap traps discussed above (unless the mouse is being chased). Thus, unbeknownst to a pest controller finding a dead mouse in a curiosity trap, the mouse may have spent several trial and error approaches and partial entries to a curiosity trap before committing itself and entering. During the partial entries, the metal or plastic surface of the curiosity trap is of no threat (no "grabbing" of the feet or body) to the rodent, nor would present any repellent nature.

Pheromonal cueing, no doubt, plays a significant positive role in interactions following the first capture (Corrigan 1988; Hurst and Berreen 1985), but any cumulative effect of pheromonal cueing at least beyond 24 hours was not a concern in these tests. It is not known whether or not pheromones play a negative (or positive) role in the interactions and repeated captures of mice on glue traps. However, negative impact does not seem as likely, at least with juvenile captures, as when multiple captures occurred, the capture was often entirely made up of juveniles.

When approaching a covered glue trap in a investigative mode (as opposed to running or being chased to it), the mouse elicits the same "cautious" approach to these "holes" in their path as with the curiosity traps. However, a partial "entry" into this new hole results in the facial and feet vibrissal apparatus adhering to the glue—no doubt causing an alarming reaction to the investigating mouse. It is hypothesized that because the uncovered traps do not present the mouse with a visual hole to enter, a greater chance of the mouse encountering the glue surface on the run, since there is no visual tunnel for them to cautiously explore. This, in part, explains why the non-covered and unfolded traps captured nearly twice as many mice as the covered and folded traps (Tables 3 and 4), although the glue traps were still significantly less effective than non-glue traps.

In the tests comparing trays vs. boards, the lip of the tray traps which elevates the trap off the floor by 6 to 8 mm may help to explain why tray traps did not perform as well in these field tests as the flat cardboard traps (Table 5). With a lip to step up onto, this presents a visual and physical obstacle to an approaching mouse, as well as being off of the mouse's familiar runway floor. Both of these increase the chances for a mouse to make a hesitating approach or a reactionary jump to the trap. The concern of this elevated trap entry area is even considered within the design of current glue tray traps by manufacturers (e.g., Bell Laboratories 1998). Throughout this study, it was common to find captured mice within the middle of the glue trays, or held by only their hind quarters with the front half of their bodies hanging off the trap. As was seen during night vigils during this research, many mice attempted a "long jump" to clear the traps. Weak jumpers were captured either entirely or partially on the traps. In several cases, the tails or only the tips of one rear foot became entrapped, and the traps were dragged away.

In addition to the natural aversions some mice exhibit towards sticky surfaces and traps, another disadvantage associated with glue traps is the role of dust, dirt, and moisture in relation to glue trap efficacy. This relationship is twofold: first, dust and dirt particles are typically carried along the floor air currents within commercial buildings. This particulate matter constantly settles and becomes entrapped on glue trap surfaces. Depending on the cleanliness of a particular structural environment, a glue trap might be rendered ineffective, or at least reduced in effectiveness, progressively over the course of a few hours or days (Walter 1990). Second, while traveling along commercial floor areas, mice themselves may accumulate and carry varying levels of dirt, grease, moisture, or dust particles on their feet and bodies.

In both scenarios, even thin layers of any of these films on glue surfaces may give a mouse the slight edge it needs to escape entrapment—especially in those instances when they slowly approach a trap surface during an investigative mode. In his comments regarding glue traps, Meehan (1983) states: "Some (glue traps) are so ineffective as to be useless for practical purposes, and most suffer from the disadvantages that they will not catch rodents with wet or dusty feet."

Glue "Bridges"

It was common in this study to occasionally discover traps with various types of debris covering the glue surface. Pieces of cardboard, paper, Styrofoam wall and pipe insulation, and dirt excavated from beneath the slab, all were used by mice to build "bridges" over the glue surface of the traps. Sometimes, bridges were built within the first night of a mouse's encounter with the trap. The author observed one mouse make about 100 trips back and forth to a particular glue trap carrying pieces of cardboard and dropping the cardboard on the trap until the trap was nearly covered. Thereafter, this and other mice in the area readily traveled across the neutralized trap, presumably due to kinesthetic behavior, and possible pheromonal attachments and guidance. Debris being deposited on glue traps has also been reported by Marsh (1983), Frantz and Padula (1983), and by many PCOs in the field for both rats and mice.

Bridging activity considered together with the behavior of mice feeding on trapped cockroaches on sticky monitors without committing themselves to the monitor's surface, serves to confirm that not only are some mice aware of the dangerous glue surfaces, but they are also adept at learning or knowing how to neutralize them.

Maximizing Capture Success

Despite the fact that many mice do not thoroughly interact with glue traps, and the fact that the glue traps in these tests failed to perform as well as non-glue traps, there are also many testimonial reports of satisfactory results and indications among pest management professionals (Anon. 1981; Walter 1990; Frishman 1992). But the factors and circumstances that impact glue board success have not been measured. Population densities, age classes, resource availability, environmental and substrate variables, and various other non determinable factors (e.g., pheromonal cueing) may all affect efficacy rates from one situation to another (Corrigan 1994).

In nearly all of the tests conducted in this project, the overwhelmingly majority of captured mice were juveniles (unpublished data). This is often also seen by pest management professionals in the field. Juvenile mice may not have developed fully the necessary physical skills for avoiding real world dangers (predatory avoidance maneuvers) or have not had enough experience in learning to avoid dangerous surfaces. Vibrissal apparatus and sensory organ development may also not be complete enough to provide mice with the maximum physiological advantages of their vibrissae (Sokolov and Kulikov 1987). Too, like other mammals, the juveniles of mice are often noted to be involved in chase and play behavior which may result in less "caution" associated with movement activities. Certainly, more research is needed addressing age-class exploratory and associated avoidance behaviors.

Frequently, multiple captures of young mice occurred on the same glue trap. From night vigils and observations by this author, it was common to see mice traveling along major runways in close proximity to one another. In some cases, this may be chaser and chasee, where both rodents are so distracted by the chase they stumble into the trap (Temme 1980).

In other cases, it was typical to discover 3 to 5 juveniles mice entrapped on one trap. This was likely a result of sibling exploratory forays as young mice follow each other, as well as odor trails left by their mother or their litter mates (Rowe and Redfern 1969). These multiple captures of litter mates was also seen with the use of mechanical multiple catch "curiosity traps" (Corrigan 1988).

Fitzwater (1983) commented that among attractive baits for glue traps, the best attractant may, in fact, be another trapped rodent. And Frantz and Padula (1983) found that trapped rodents do not repel other mice from becoming entrapped.

Perhaps the most important factors relating to successful captures of mice on glue traps are good placement of traps onto high activity runways, and the use of traps models which minimize the "hesitation factor" by presenting as few physical and visual obstructions to a rapidly approaching mouse as possible. This, in turn, would maximize the chances of a mouse totally committing its entire body by unavoidingly stumbling or jumping onto the trap while *kinesthetically* traveling along its runways (Corrigan 1997; Fitzwater 1982).

This is important, as in actuality kinesthetics may play the most important role in the successes of a glue trap. In other words, trapped rodents may most likely be a result of kinesthetically driven rodents which have been using well established runways. As summarized by Meehan (1983) regarding kinesthetic movement, "patterns" of movements of rodents become so ingrained that if rats or mice get used to moving around an obstacle which is subsequently removed, they will continue to move in the same way as if the obstacle was still present.

ACKNOWLEDGMENTS

The author would like to acknowledge and thank Daniel Richardt, Dick Byrd, Ken Wolber, Emilie Story, and John Cummings for their assistance in conducting these field tests.

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