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EVALUATION OF SNAP-TRAPS AS A NON-CHEMICAL CONTROL FOR A BROWN RAT INFESTATION

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Abstract A field trial on a typical market-leading rat snap trap for the control of a Brown rat, *Rattus norvegicus,* infestation was undertaken. The purpose of the trial was to assess the efficacy of the trap in a rural rat infestation and record observations regarding humaneness. The initial infestation was estimated at approximately 778 rats. During the 21 days of trapping, a total of 105 rats were caught, that is less than 14 % of the initial infestation. Post-21 days trapping, the size of the infestation had increased by 18.5 % to approximately 930 rats. Adult rats avoided the traps to a greater extent than juvenile rats, 79 % of the rats caught were juveniles and their capture had no effect on the fecundity of the infestation. In total, 37 % of rats caught were caught by a body part that would have likely resulted in a painful, distressing and inhumane death. Three rats were caught but still alive when the traps were checked and not would have not experienced a quick and humane death had they not been humanely culled. Four non-target Wood mice (*Apodemus sylvaticus*) were found dead in the traps. Therefore, the snap traps were highly ineffective, and extremely time consuming, in controlling the significant Brown rat infestation and from the body position of the snap trap strike, concerns over their humaneness for both target and non-target animals are also raised.

Key Words *Rattus norvegicus***,** field trial, efficacy, humaneness, non-targets.

INTRODUCTION

For more than 50 years the control of commensal rodents has been dominated by chemical control, namely anticoagulant baits, with the recent re-introduction of cholecalciferol into the European and global market. Despite the regulatory challenges faced by these chemicals, they continue to be authorised within the EU for rodent control due to a lack of efficient and viable alternatives, including non-chemical control methods. European guidelines[4] have recently been published for the evaluation of non-chemical rodent control (NoCheRo), particularly rodent snap-traps, as such a viable alternative. BASF undertook a rural trial on a market-leading rat snap trap according to these guidelines. The farm site had a heavy Brown rat (*Rattus norvegicus*) infestation. The aim of the trial was to assess the efficacy of the snap traps and record any target and non-target humaneness or welfare concerns. The trapping period was terminated after 21 days due to the problems for the farm animals and farm workers associated with the size of the infestation increasing and the occurrence of trap avoidance by the rats.

The efficacy of the snap traps was measured using pre- and post-trapping census indices, that is census diet takes and tracking patches to rat record activity. The Pest Management Alliance. **"**Code of practice. Humane use of break-back traps"[5] was followed with the snap traps placed in a suitable box or tunnel and checked every day.

MATERIALS AND METHODS

Big Snap-E® Rat Trap, supplied by Kness, designed to be triggered by the rat contacting a treadle with a bar striking the rat and killing it via mechanical force, was chosen as a typical representative of the commercial snap traps available in the current market. One hundred snap traps were strategically placed throughout the site. Peanut butter was placed in the well of the snap trap. Each snap trap was placed in either a commercially available lockable rat bait box (Roguard® bait station) or inside a wooden tunnel measuring 46 x 8 x 7 cm (l x w x h), so that fifty bait boxes and fifty wooden tunnels each contained a snap trap. The snap traps were secured to the wooden tunnel by a wire in such a way so as not to impede the action of the trap. The bait boxes and wooden tunnels provided cover and protection for the traps and helped funnel the rats over the activating plate. The trial was undertaken at a farm in Chester, England. The site contained a discrete Brown rat infestation with little chance of rapid reinvasion from adjoining areas. The method for the field trial studies was a modification of that prescribed in the Biocidal Products Directive Technical Notes for

Guidance on Product Evaluation, Product Type 14[1] and according to Appendix F (Field studies for rodent traps: Efficacy testing) in the NoCheRo-Guidance for the Evaluation of Rodent Traps Part A Break back/Snap traps[4].

The pre- and post-trapping methods utilised were census diet (whole wheat) to measure rat diet consumption and tracking patches to measure rat activity. The number of traps and their location was the same as would be used for bait points if a rodenticide baiting programme and not a trapping programme was being set-up. The position of the traps in tunnels and traps in bait boxes were alternated equally throughout the site so that there was no bias between the two. In order to allow the rats to acclimatise to all the equipment and thereby minimise any neophobic response, all traps were placed, unset, inside either the bait box or tunnel for 5 weeks prior to the start of the trapping period. The trapping period was 21 days. For each trap, the following recordings were made daily: weight and sex of the rat or non-target animal caught; species of any non-target animal caught; if an animal was caught, was it dead or alive; a subjective assessment of the stress level of any animal found still alive; if the trap was triggered but no animal caught; location on the body by which the rat (or non-target animal) was caught; and the occurrence of any cannibalisation.

Data analysis

The efficacy of the trapping using the pre- and post-census indices was calculated as follows: Efficacy % = (mean pre-treatment index - mean post-treatment index) *x* 100 / mean pre-treatment index

RESULTS AND DISCUSSION

Efficacy; (see Table 1). Assuming a census bait take of 10 g per rat per day, the pre-and post-trapping census diet takes indicated a heavy Brown rat infestation level of approximately 778 rats and 930 rats, respectively. That is, the size of the infestation in fact increased by 21 %.-The mean pre- and post-trapping tracking scores of 207 and 240 respectively indicated that the size if the infestation had increased by 16 %. Therefore, the mean overall level of control, after 21 days of trapping, was an increase in the size of the infestation of 18.5 % . During the trapping period a total of 105 rats were caught, less than 14 % of the total initial infestation. The largest number of rats caught per day was on days 1 and 2 (14 rats per day). From days 3 to 21 the number of rats caught per day ranged between 2 and 7. This reduction in rats caught after the first two days, suggests a learnt further neophobic response to the snap traps. Therefore, the snap traps were highly ineffective in controlling the heavy Brown rat infestation. This confirms tthat snap traps “may be effective in situations where infestations are small but are unlikely to be cost-effective against large and dispersed rodent infestations” (Sustainable use of rodenticides as biocides in the EU, EBPF European Biocidal Products Forum, 2010[1]).

Table 1. Chester farm. Estimates of the control of the Brown rat infestation post 21 days trapping.

	Percent Reduction in Population		
	Census Diet Take, g	Tracking Score	Overall mean
Mean pre-trapping	7, 782	207	
Mean post-trapping	9, 301	240	
% Control	**+ 21**	**+ 16**	**+18.5**

The total number of rats caught by the traps that were protected by the wooden tunnels and those inside a bait box were 73 and 32, respectively. This difference was not unexpected as the wooden tunnels were made of natural material, as opposed to the plastic bait boxes, and also had no floor but were placed directly onto the ground. Therefore, it can be assumed that the neophobic response to the traps in tunnels was significantly less than the neophobic response to the traps in bait boxes. Despite over twice as many rats being caught by the traps inside the wooden tunnels, statistical analysis, using a t-test, shown that there was no significant difference.

Of the rats where sex could be determined, twice as many males (62) as female rats were caught (30). The reason for this is uncertain, other than female rats appear to be more cautious of the traps than males. Of the rats caught in the snap traps, 79 % were juveniles weighing less than 100 g (see Table 2) and not of breeding age: hence their capture had no effect on the fecundity of the infestation. Adult rats avoided the traps to a greater extent than juvenile rats.

Table 2. Bodyweight of caught Brown rats caught in snap traps

Weight of rats caught, g	Number caught	% of total rats caught
0 - 50	40	38.1
51 - 100	43	41.0
101 - 150	7	6.7
151 - 200	1	1.0
201 +	4	2.9
cannibalised	11	10.5
Total	**105**	**100**

Of the rats caught, 11 (10.5 %) had been cannibalised (see Table 2) and their bodyweight could not be measured. It was not possible to determine if these rats were cannibalised pre- or post-death, see Figure 1.

Figures 1a, 1b and 1c; Three rats found dead and cannibalised.

Humaneness. The area of the body the snap trap caught the rat (Figure 2) is related to the how quickly that rat dies and the humaneness of their death. Rats caught by the leg, tail or lower abdomen are likely to have taken longer to die and experienced a much greater degree of pain and distress. According to the NoCheRo guidance with regards to laboratory snap trap studies: "If an animal is not dead within 120 seconds, it must be killed using a recognized humane method". Rats caught by the leg, tail, lower abdomen or a combination of these body areas (Figures 3a and 3b) would take longer than 120 seconds to die can thus be considered as an inhumane kill. In total, 39 of the 105 rats caught (37 %) were caught by a body part that would have resulted in a painful, distressing and inhumane death.

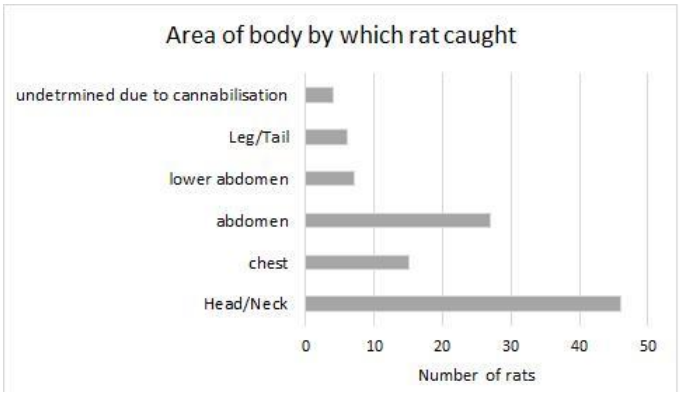

Figure 2. Chester farm: number of rats caught by each area of the body

Figure 3a and 3b. Chester farm; rats found dead, caught by lower abdomen and limbs

Figure 4. Rat found alive caught by lower limbs

Three (2.9 %) of rats caught were found still alive when the traps were checked. Of these, two were caught by the leg/tail and one by the neck. All were humanely culled. All rats caught but still alive, presented a health risk as they continued to urinate and defecate therefore increasing the likelihood of human exposure to pathogenic microorganisms. Despite previous assumptions that when an animal is caught by the neck, death is quick and humane, this rat caught by the neck was still alive and extremely vocal (squealing). The vocalisation could be heard several meters away and the rat was clearly in a great deal of pain and distress (see Figure 4).

One of the traps had been found triggered with no animal caught, but fresh blood found in the bait box, indicating that the animal had been injured by the trap but managed to escape. The extent of the injuries here or indeed how many other animals were injured and escaped (and the extent of their injuries) was not known. There was a total of 55 incidences where the traps were triggered but no animal was caught, hence potentially 55 injured animals here.

A total of four non-target *Apodemus sylvaticus* (Wood mice) were caught, one by the lower abdomen.
During the 21 day trapping period, a total of 40 operator hours were spent. Based on previous experience of the triallist and use patterns of the product, a rodenticde baiting treatment on this farm, with 100 bait points of Selontra® (0.075 % cholecalciferol paste bait), over a 21 day time period would require approximately 18 operator hours. This is with the same number and location of bait points as trap points. Therefore, trapping takes over twice as many opeartor hours and requires the commitment to be able to visit and inspect the site every day and the infestation may not be controlled.

CONCLUSION

The results of the field trial carried out on a Brown rat, *R. norvegicus*, infestation on a farm in Chester, England using 100 market-leading rat snap traps (Big Snap-E® Rat Trap) are reported. During the 21 days of trapping a total of only 105 rats were caught from an original infestation of approximately 778 rats. That is less than 14 % of the total infestation. Post-21 days of trapping there was an overall increase in the size of the infestation of 18.5 % . If the trapping period had even continued for 35 days, it would not be possible to control the infestation due to avoidance of the traps by the rats and the significant growth in the size of the infestation. Therefore, the snap traps were highly ineffective in controlling the significant Brown rat infestation. With a rodenticide bait treatment, the infestation would have significantly decreased and not increased by 21 days, and unlike the trap trial, control would be achieved.

Of the rats caught, 79 % were juveniles and not of breeding age and their capture had no effect on the fecundity of the infestation. In total, 37 % of the rats caught were caught by a body part that would have resulted in a painful, distressing and inhumane death. Three rats were caught but still alive when the traps were checked, thus, a total of 2.9 % of all rats caught were still alive and had not experienced a quick and humane death. There was a total of 55 incidences where traps were triggered but no animal was caught, thus potentially a further 55 injured animals here.

Attempting to control the infestation by trapping alone took over twice as many operator hours as would be expected for a rodenticide bait trial and required the commitment to be able to visit and inspect the site every day. Trapping rodents is generally considered labour-intensive because large numbers of traps are usually needed, they can be bulky to carry, and they require regular checking (e.g., Meehan A P 1984, Killgerm 2000).

REFERENCES CITED

European Biocidal Products Forum. 2010. Sustainable use of rodenticides as biocides in the EU. https://hnlkg4f5wdw34kx1a1e9ygem-wpengine.netdna-ssl.com/wp-ontent/uploads/2017/01/UK_ Sustainable-use-of-rodenticides-as-biocide.pdf

Killgerm. 2000. Notes on rodent control. http://www.killgerm.com

Meehan A.P. 1984. Rats and Mice Their Biology and Control. The Rentokil Library. East Grinstead, UK.

NoCheRo. 2021. Guidance for the Evaluation of Rodent Traps Part A Break back/Snap traps, German Environment Agency, 74/2021. https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2021-05-06_texte_74-2021_nochero_0.pdf.

The Pest management Alliance. 2018. Code of practice. Humane use of break-back traps.