

PULSED BAITING: LABORATORY EVIDENCE FOR BEHAVIOURAL EXCLUSION IN WILD RATS

Pete SMITH, Robert H. SMITH and Richard M. SIBLY

Vertebrate Pests Unit
Department of Pure and Applied Zoology
University of Reading
Whiteknights, P.O.Box 228
Reading RG6 2AJ
United Kingdom.

ABSTRACT

Baiting strategies in modern rodent control programmes utilise a large number of small bait stations as opposed to providing a few large bait points. Part of the rationale for this procedure is that dominant animals are assumed to exclude behaviourally subdominant animals from the feeding place. By providing a large number of bait points, the number of animals competing at any one bait point is reduced. Indirect evidence in support of this hypothesis has been reported but no direct laboratory support has previously been published.

The results of this laboratory study demonstrate a close relationship between body weight, social dominance and the behavioural exclusion of the sub-dominant by the dominant animal. Furthermore, when excluded by the dominant rat from a preferred food source in a limited duration trial, subdominant animals fed for a higher proportion of their time upon a less-preferred food source compared to when they were allowed to feed alone. These findings are consistent with the behavioural exclusion hypothesis and the hypothesis that sub-dominant animals adapt their feeding strategies when competing with a dominant animal. Possible implications for rodent pest management in stored products are discussed.

INTRODUCTION

The development of high potency, slow acting anticoagulant rodenticides such as brodifacoum and flocoumafen led to the development of the "pulsed baiting technique" (Dubock, 1979, 1980, 1984). Following field trials of brodifacoum (Rennison and Dubock, 1978) it was hypothesised that because brodifacoum is highly potent but slow-acting, rats which took lethal feeds on the poison early in the baiting period (one feed), continued feeding for at least part of the remaining baiting period and were able to exclude behaviourally other animals from consuming a lethal dose during this period. Pulsed baiting (Dubock, 1979) utilises a high number of bait stations, each containing a small quantity of bait (5-10g of a highly potent single-feed slow acting toxicant) which are replenished at weekly intervals (Dubock, 1979). The large number of bait points is aimed at reducing social interactions and behavioural exclusion around feeding stations (Dubock, 1984).

In many subsequent field trials, pulsed baiting has proved effective and economically efficient (Dubock, 1984), providing circumstantial evidence that behavioural exclusion may be an important factor in reduced efficacy of rodent control programmes, but no direct laboratory evidence for the behavioural exclusion hypothesis has previously been published.

Observational evidence consistent with the behavioural exclusion hypothesis has been reported by Barnett and Spencer (1951), Barnett (1956) and Calhoun (1949) who found that unfamiliar rats were driven away from feeding sites and it was hypothesised as early as the 1950s (Elton and Ranson, 1954) that social interactions around bait points may reduce effective control. It was considered by Chitty (1954), however, that single bait stations would function effectively despite social interaction and effective control has been demonstrated using a single bait point (Fenn *et al.*, 1987).

The primary purpose of the study described here was to investigate the hypothesis of behavioural exclusion in the laboratory environment by measuring the time that each animal in a pair dominated a single limited-access feeding point (food hole). The relationship between behavioural exclusion, social dominance and body weight was examined.

The second aim of this study was to examine the feeding strategies of both the dominant and the sub-dominant animal when given the choice of a preferred and a less-preferred limited-access food source to examine any change in behaviour upon possible exclusion from the preferred food. Excluded rats may feed at less-preferred times (Nott, 1988; M. Berdoy, Pers. Comm.) or at less preferred food sources (Davis, 1953; Hartley and Bishop, 1979; Kendall, 1984). By eliminating the possibility of temporal variation in feeding, the hypothesis that excluded rats feed at less-preferred food sources was investigated in laboratory conditions.

MATERIALS AND METHODS

EXPERIMENTAL PROCEDURE

Twenty pairs of rats born in captivity from mothers caught in the wild, were used in the study described here. Animals were separated into pairs when aged 53-58 days. Pairs were formed from animals of the same sex but from different litters (except one pair). Animals differed in age by a maximum of only four days but often differed in weight quite considerably. Within the above mentioned constraints, animals were selected at random. Animals were individually marked, weighed and were then placed in pairs in large cages (60 X 45 X 40 cm) with two nest boxes attached (20 X 20 X 20 cm). Animals were initially placed in large cages to allow the subdominant rat a defensible area to avoid possible severe attacks by the dominant rat (Barnett, 1958; Nott, 1988) which were never in fact observed.

For the first week the pairs were observed for social dominance interactions using behavioural categories from various studies (Adams and Boice, 1983; Militzer and Reinhard, 1982; Barnett, 1958 and 1975; Grant and Chance, 1958; Baenninger, 1966 and 1970; Steiniger, 1950; Gage, 1978; Drews and Wulczyn, 1975; Drews and Dickey, 1977; Bolles and Wood, 1964; Grant and Mackintosh, 1963; Meany and Stewart, 1981; Calhoun, 1962) which are described fully elsewhere (P. Smith, PhD thesis, in prep.). The categories used were biting attack (when one animal violently attacked another whilst biting it; never observed), pinning (when one animal pushed another on to its back and held it in that position; by far the most common dominance behaviour), boxing (when animals stood on hind legs and beat each other with forelegs; often terminated in one animal fleeing or being pinned), threat posture (when one animal approached another in the way described by Barnett, 1975) and chasing

(when one rat chased another). Interactions from the remainder of the study were added to week one observations and dominance rank was assigned to each animal in the pair (the dominant rat was the one with the higher total of wins minus losses).

After the first week, animals were moved to a competition cage (see figure 1.). For ten days during the next two weeks, animals were deprived of food for four hours each day and were then presented with a preferred food (two heaped teaspoons of 50:50 w/w mixture of wholemeal flour and granulated sugar) for three minutes in a limited access food hole (3cm diameter, side determined at random, see figure 1.). The time that each animal spent dominating the food hole during the 3 minute period was recorded using two stop clocks and mean time dominating the food hole was calculated for each rat as a measure of behavioural exclusion. Similar methods to this were used by Seward (1945b), Uyeno (1960), Candland and Bloomquist (1965), Baeninger (1966, 1970), Becker and Faherty (1968), Hoyenga and Rowe (1969), Ruskin and Coreman (1971), Howells and Kise (1974), Syme *et al.* (1974) and Drews and Dickey (1977). Syme (1974) provides an excellent guide to the use of feeding period length and deprivation period in various experimental designs.

During week two of the study (first week in competition cages) animals were re-marked and re-weighed and given a choice of two foods in two limited access food holes (see figure 1.). In the preferred food hole (same as the hole in single food hole competition), was a quantity of two heaped teaspoons of 50:50 w/w wholemeal flour and granulated sugar mixture. In the less-preferred food hole was one heaped teaspoon of wholemeal flour. Food was available one hour after single food hole competition for a period of ten minutes. In pilot studies, previous feeding during competition trials that day did not prevent animals from competing avidly in subsequent feeding periods. The time that each animal spent at each food source was recorded with a stop watch on each of five days during that week. Rats were then re-weighed and re-marked.

For five days during week three, each animal was allowed to feed alone for ten minutes (the rat allowed to feed first was alternated daily) and the time spent at each food source was noted for each rat to determine whether removal of one rat (by separation - to simulate removal by poisoning) caused a change in the feeding strategy of the other. Animals were then re-weighed.

For each rat, the following measures were known at the end of three weeks: body weight and weight rank for each week; social dominance rank; time spent dominating a single food source in competition; feeding ratio (time spent at preferred food / total time feeding) when feeding alone, and feeding ratio when feeding together with the other rat.

DATA ANALYSIS

A preliminary analysis was carried out using ranked data by means of binomial tests to examine the relationship between body weight, social dominance and feeding performance (behavioural exclusion).

Next, the relationship between social dominance rank and time spent feeding at the preferred food compared to the total time spent feeding (feeding ratio) when animals fed alone or with the other rat in the pair was examined using a series of general linear models (GLM procedure of GENSTAT statistical package on the Reading University mainframe computer). In all models, type II sums of squares were used to assign F and p values for each effect as these fit the effect to the model as if it had been fitted after all other effects and provide the most conservative estimate of F and p values. Lastly, the total times which dominant and subdominant animals spent feeding when together were compared to reveal any differences in total feeding between dominance ranks due to competition using a t-test.

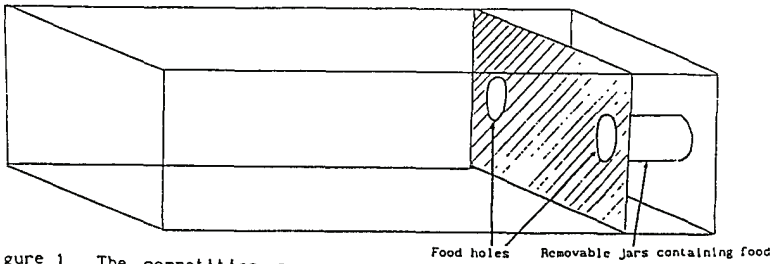


Figure 1 The competition cages used for food competition studies. (50x30x20cm) Note the limited access holes (diameter = 3cm)

RESULTS

When comparing ranked data, in all twenty pairs of rats, the heaviest (weight rank 1) was also the socially dominant rat (dominance rank 1) as determined by wins/losses in spontaneous encounters ($p < 0.0001$).

In 19/20 pairs, the heaviest rat spent more time feeding from the single food hole than the lighter rat ($p < 0.0001$). This suggests that weight and / or social dominance are very important in determining performance in limited-access, single food hole competition. Behavioural exclusion occurred to some extent (one rat feeding for the majority of the feeding period though both attempted to feed), with the dominant rat excluding the sub-dominant animal.

In two of the twenty pairs, neither rat fed at the less preferred food source when feeding together, so that a ranking could not be assigned. Excluding these two pairs, in 16/18 remaining pairs, the socially subdominant rat spent a higher proportion of its time feeding at the less preferred food source ($p = 0.018$), a finding investigated in greater detail by the use of general linear models below.

In the first set of general linear models, the effects of individual variation, and the effects of day of behavioural recording, upon feeding ratios (time at preferred / total time feeding) alone and together were examined (table 1).

TABLE 1. Analysis of variance of feeding ratio when animals fed alone and together. The effects fitted were individual animal and day of recording the feeding ratio. The percentage variation explained by the model (% var), degrees of freedom (d.f.), sum of squares (SS) and mean square (MS) values are given as well as F and p values.

Dependent variable	Source	% var	d.f.	SS	MS	F	p
Feeding ratio, alone	Individual	38.4	39	2.271	0.05824	3.817	<0.01
	Day		4	0.129	0.03233	2.119	>0.05
	Residual		139	2.121	0.01526	—	—
Feeding ratio, together	Individual	39.1	39	7.457	0.19120	3.468	<0.01
	Day		4	0.222	0.05548	1.006	>0.05
	Residual		112	6.175	0.05513	—	—

Animals showed significant individual variation whether feeding alone or together ($F = 3.817$ and 3.468 respectively and $p < 0.01$ in each case) but there was no consistent change in feeding ratio, alone or together over each five day period ($F = 2.119$ and 1.006 respectively and $p > 0.05$ in each case). On the basis of this finding, feeding ratios for each day were used as independent replicates in the third set of general linear models.

The second set of models examined the effects of pair to which the rat belonged and dominance rank on feeding ratios alone and together (table II).

TABLE II. Analysis of variance of feeding ratio when animals fed alone and together. The effects fitted were pair to which the animal belonged and social dominance rank (1 or 2). Abbreviations as in table 1.

Dependent variable	Source	% var	d.f.	SS	MS	F	p
Feeding ratio, alone	Pair	n. s.	19	0.2158	0.01136	0.6094	>0.05
	Rank		1	0.0008	0.00081	0.0435	>0.05
	Residual		19	0.3541	0.01864	—	—
Feeding ratio, together	Pair	26.8	19	0.7865	0.04139	1.238	>0.05
	Rank		1	0.3590	0.35903	10.737	<0.01
	Residual		19	0.6354	0.03344	—	—

The pair to which the animal belonged had no significant effect upon feeding ratio whether the animal fed alone or together ($F = 0.6094$ and 1.238 respectively and $p > 0.05$ in each case). When animals fed alone, dominance rank was not important ($F = 0.0435$; $p > 0.05$, model non-significant). However, when animals fed together, dominance rank accounted for a highly significant level of variation in individual feeding ratios ($F = 10.737$ and $p < 0.01$).

TABLE III. Analysis of variance of feeding ratio for animals of dominance ranks one and two. The effects fitted were individual animal and whether the feeding ratio was recorded when animals fed alone or when they fed together (togetherness). Abbreviations as in table 1.

Dependent variable	Source	% var	d.f.	SS	MS	F	p
Feeding ratio, Rank 1	Individual	12.8	19	1.371	0.07217	2.286	<0.01
	Together?		1	0.052	0.05168	1.637	>0.05
	Residual		151	4.767	0.03157	—	—
Feeding ratio, Rank 2	Individual	29.5	19	2.752	0.14504	2.473	<0.01
	Together?		1	2.227	2.22698	37.977	<<0.01
	Residual		147	8.620	0.05864	—	—

For the third set of general linear models, the effect of individual variation within each dominance rank and the effect of whether or not the animals fed together (togetherness) upon feeding ratios for each dominance rank (1 and 2), were examined (table III).

Again, individual variation, found to be important in experimental conditions alone and together, was found to be important within each dominance rank ($F = 2.286$ and 2.473 for dominance ranks 1 and 2 respectively and $p < 0.01$ in each case). However, the feeding ratios of dominant animals (rank 1) were not affected by the presence of the other rat (ie for togetherness, $F = 1.6737$ and $p > 0.05$), but for subdominant rats (rank 2), the feeding ratio was dramatically affected by the presence of the dominant (ie for togetherness, $F = 37.977$ and $p \ll 0.01$).

When comparing the total time feeding when feeding together for dominance ranks 1 and 2 using a paired t-test, rats of each dominance rank did not differ significantly ($t = 0.77$; d.f. = 19; $p = 0.45$), allowing mean feeding ratios for each dominance rank to be directly compared (table IV).

TABLE IV. Mean feeding ratios for animals of dominance ranks one and two when feeding alone and when feeding together.

	Feeding ratio, alone	Feeding ratio, together
Dominance rank 1	0.941	0.950
Dominance rank 2	0.932	0.761

Feeding ratios were similar for animals of dominance rank one when feeding alone or together but animals of dominance rank two had a lower mean feeding ratio when feeding together than when feeding alone. Mean feeding ratios of dominance rank one and dominance rank two animals were similar when both fed alone, but when together, the mean feeding ratio of dominance rank two rats was lower than that of dominance rank one rats.

DISCUSSION AND CONCLUSIONS

In this study, pairs of rats between ages 53 and 74 days of age showed a highly significant correlation between body weight and non-competitive social dominance. This relationship supports the findings for adult wild rats found by Barnett (1958, 1975), Calhoun (1962) and Nott (1988), but such a relationship was not found in laboratory rats by Sridhara *et al.* (1980), Boice (1972), Baenninger (1970) or Boreman and Price (1972). Price *et al.* (1976) found correlation between social dominance and body weight only in cases where weight asymmetry was great. The discrepancy between the study described here and those in the literature in which no body weight effect was found, may be caused by the use of laboratory rats in the studies showing poor correlation with body weight (see Syme *et al.*, 1974).

Social dominance (and therefore body weight) was found to correlate highly significantly with feeding performance when competing at a limited access food hole (a measure of behavioural exclusion), supporting the finding of Ruskin and Coreman (1971), but such a correlation was not found by Boreman and Price (1972), Baenninger (1970), Drews and Wulczyn (1975), Drews and Dickey (1977), Seward (1945) or Syme *et al.* (1974); again the discrepancy may be due to differences between laboratory and wild rats (Syme *et al.*, 1974).

The finding that socially dominant wild rats spend more time feeding at a limited access food hole than do subdominants is very significant. It demonstrates for the first time in wild rats that under certain conditions,

behavioural exclusion can occur. Many modern bait stations used in rodent control programmes allow only one rat to feed at any one time (eg tunnel bait stations) and although there are no artificial time constraints placed upon feeding, the small quantity of bait provided (Dubock, 1984) in the bait stations may mean that they are emptied quickly in a dense population. Rats may therefore need to compete for food at bait points soon after bait is placed in order to feed before the bait points are emptied thus generating a potential competitive pressure. Under such conditions, social interactions similar to those found in this study may be important in the wild.

With a body weight effect on social dominance in the wild, larger animals would tend to be dominant. If dominant rats secured preferential access to bait points and behaviourally excluded subdominant rats (as demonstrated here in the laboratory), one would expect larger animals to be poisoned before smaller ones, assuming a small number of bait points for the size of population. Cox and Smith (1990) noted that carcasses collected at the beginning of a rodent control programme on a farm were significantly heavier than those collected at the end; these findings are consistent with the hypotheses that larger animals are dominant and that dominant animals secure preferential access to bait points. The laboratory-based findings of the present study and the field work of Cox and Smith (1990) lend support to the practice of pulsed baiting and support the hypothesis that the efficacy of rodent control schemes could be improved in some cases by providing a greater number of bait points and providing more accessible bait stations to minimise behavioural exclusion of subdominant animals by the dominant rats. Buckle *et al.* (1987) found that a larger number of bait points increased both the number of rats taking the bait and the amount of bait taken per rat, findings consistent with those presented here.

Feeding was not affected by dominance rank when animals fed in isolation, but when animals fed together, social dominance rank was highly important. Dominant animals spent a similar time feeding from the preferred food source when alone and when with another animal ie competition from the other rat did not cause dominants to adjust their feeding ratios. However, subdominant animals spent much more time feeding at the less-preferred food source when feeding together with the dominant rat than they did when allowed to feed alone, suggesting that subdominants but not dominants adjust their feeding strategies when forced to feed together. Subdominant rats are known to feed at less preferred times of day (Nott, 1988; M. Berdoy, pers. comm.) but the effects of social dominance on the apportioning of feeding time has only previously been reported for monkeys (Wrangham and Waterman, 1981).

In relation to rodent pest management, the results suggest that dominant rats will behaviourally exclude subdominants from preferred food sites (which may be rodenticide bait points) and the subdominant rats may therefore feed at some other, less preferred, food source. The fact that subdominant animals fed less at a preferred food source than dominants during the week when both animals in each pair fed together, and then fed equally at the preferred food source in the next week when feeding alone, suggests that subdominants fed from the less preferred food source because of the presence of the dominant but could change their behaviour to feed more from the preferred food when allowed to do so. The implications for pest management are that in the wild, when dominants are removed from the population by poisoning, the behaviourally excluded subdominants which may have been feeding at the less preferred food sources, may change their feeding strategy and begin feeding at the preferred food sites.

In summary, the laboratory results lend strong support to the behavioural exclusion hypothesis, show that exclusion is related to social dominance / body weight and show one way in which subdominant animals may adjust their feeding strategies when excluded by a dominant animal.

ACKNOWLEDGMENTS

Pete Smith is supported by a U.K. Natural Environment Research Council research studentship. We are very grateful for statistical advice from Dr. L. New and Dr. D. Collett of the Reading University Statistics Advisory Service.

REFERENCES

- Adams, N. and Boice, R. (1983) A longitudinal study of dominance in an outdoor colony of domestic rats. J. Comp. Psych. **97**: 24-33.
- Baenninger, L.P. (1966) The reliability of dominance orders in rats. Anim. Behav. **14**: 367-371.
- Baenninger, L.P. (1970) Social dominance orders in rats: "spontaneous", food, and water competition. J. comp. physiol. Psychol. **71**: 202-209.
- Barnett, S.A. (1956) Behaviour components in the feeding of wild and laboratory rats. Behaviour **9**: 24-43.
- Barnett, S.A. (1958) An analysis of social behaviour in wild rats. Proc. Zool. Soc. Lond. **130**: 107-152.
- Barnett, S.A. (1975) The Rat: A study of behaviour. University of Chicago Press, London. 318pp.
- Barnett, S.A. and Spencer, M.M. (1951) Feeding, social behaviour and interspecific competition in wild rats. Behaviour **3**: 229-242.
- Becker, G. and Flaherty, T.B. (1968) Group size as a determinant of dominance-hierarchy stability in the rat. J. comp. physiol. Psychol. **66**: 473-476.
- Boice, R. (1969) Dominance and survival in stressed wild and domesticated populations. Proc. Am. Psychol. Ass. 77th Ann. Conv.: 187-188.
- Boice, R. (1972) Some behavioural tests of domestication in Norway rats. Behaviour **42**: 198-231.
- Bolles, R.C. and Woods, P.J. (1964) The ontogeny of behaviour in the albino rat. Anim. Behav. **12**: 427-441.
- Boreman, J. and Price, E. (1972) Social dominance in wild and domestic Norway rats. Anim. Behav. **29**: 534-542.
- Buckle, A.P., Odam, E.M. and Richards, C.G.J. (1987) Chemical bait markers for the study of bait uptake by Norway rats. In: Control of Mammal Pests. [Eds. Richards, C.G.J. and Ku, T.Y.], Taylor and Francis, London: 199-213.
- Calhoun (1949) A method for self control of population growth among mammals living in the wild. Science **109**: 333-335.
- Calhoun, J.B. (1962) The Ecology and Sociology of the Norway Rat. U.S. Dept. Health, Education and Welfare. Public health service no. 1008, Bethesda.
- Candland, D.K. and Bloomquist, D.W. (1965) Interspecies comparisons of the reliability of dominance orders. J. comp. physiol. Psychol. **59**: 135-137.
- Chitty, D. (1954) The study of the brown rat and its control by poison. In: Control of Rats and Mice (Vol. I). [Ed. Chitty, D.] Clarendon Press, Oxford: 160-306.
- Cox, P.R. and Smith, R.H. (1990) Rodenticide ecotoxicology: assessing non-target population effects. Functional Ecology **4**: 315-320.
- Davis, D.E. (1953) The characteristics of rat populations. Quart. Rev. Biol. **28**: 373-401.
- Draws, D.R. and Dickey, C.L. (1977) Observational and competitive measures of dominance in rats. Psychological Record **27**: 331-338.
- Draws, D.R. and Wulczyn, F.H. (1975) Measuring dominance in rats. Psychological Record **25**: 573-588.
- Dubock, A.C. (1979) Alternative strategies for safety and efficacy of rodenticides. Fifth session, Paper 14; 1-15. In: Proceedings of the fifth British pest control conference. Stratford-upon-Avon, U.K. 26-29 September, 1979. BCPC Publications, Thornton Heath.

- Dubock, A.C. (1980) The development and practical use of the novel anticoagulant rodenticide brodifacoum. Plant Protection Bulletin (Taiwan R.O.C): 223-238.
- Dubock, A.C. (1984) Pulsed baiting- a new technique for high potency, slow acting rodenticides. In: Proceedings of a conference on the organisation and practice of vertebrate pest control. [Ed. Dubock, A.C.] ICI, Fernhurst, Surrey, U.K.: 105-142.
- Elton and Ranson (1954) Containers for baiting. In: Control of Rats and Mice. [Ed. Chitty, D.], Clarendon Press, Oxford: 147-159.
- Fenn, M.G.P., Tew, T.E. and MacDonald, D.W. (1987) Rat movements on an Oxfordshire farm. J.Zool.Lond. 213: 745-749.
- Gage, F.H. (1978) A multivariate approach to the analysis of social dominance. Behav. Biol. 23: 38-51.
- Grant, E.C. and Chance, M.R.H. (1958) Rank order in caged rats. Anim. Behav. 6: 183-194.
- Grant, E.C. and Mackintosh, J.H. (1963) A description of the social postures of some laboratory rodents. Behaviour 21: 246-259.
- Hartley, D.J. and Bishop, J.A. (1979) Home range and movement in populations of Rattus norvegicus polymorphic for warfarin resistance. Biol. J. Linn. Soc. 12: 19-45.
- Howells, G.N. and Kise, G. (1974) The measurement of social dominance in rats. Psychological Record 24: 101-108.
- Hoyenga, K.T. and Rowe, T.C. (1969) Assessing social dominance in pairs of male rats by measuring weight gain. Pschon. Sci. 16: 165.
- Kendall, P.B. (1984) Seasonal changes of sex ratios in Norway rat (Rattus norvegicus) populations in Wales. J.Zool.Lond. 203: 288-291.
- Meany, M.J. and Stewart, J. (1981) A descriptive study of social behaviour in the rat (Rattus norvegicus). Anim. Behav. 29: 34-45.
- Miltzer and Reinhard (1982) Rank positions in rats and their relations to tissue parameters. Physiol. Psychol. 10: 251-260.
- Nott, H.M.R. (1988) Dominance and feeding behaviour in the brown rat. PhD Thesis, University of Reading.
- Price, E.O. (1978) Genotype versus experience effects on aggression in wild and domestic Norway rats. Behaviour 64: 340-453.
- Price, E.O., Belanger, P.L. and Duncan, R.A. (1976) Competitive dominance of wild and domestic Norway rats (Rattus norvegicus). Anim. Behav. 24: 589-599.
- Rennison, B.D. and Dubock, A.C. (1978) Field trials of WBA 8119 (PP581, brodifacoum) against warfarin-resistant infestations of Rattus norvegicus. J. Hyg. Camb. 80: 77-82.
- Schumsky, D.A. and Jones, P.D. (1966) Reliable paired comparison dominance orders in rats. Psychol. Rec. 16: 473-478.
- Seward, J.P. (1945) Aggressive behaviour in the rat. III. The role of frustration. J. Comp. Psych. 38: 225-238.
- Sridhara, S., Narasimham, A.U. and Krishnamoorthy, R.V. (1980) Aggressive interactions among wild and domestic rodents. Proc. Indian Acad. Sci. (Anim. Sci.) 89: 351-357.
- Steiniger, F. (1950) Beitrage zur soziologie und sonstigen Biologie der Wanderratte. Zeitschrift für Tierpsychologie 7: 356-379.
- Syme, G.J. (1974) Competitive orders as measures of social dominance. Anim. Behav. 22: 931-940.
- Syme, G.J., Pollard, J.S., Syme, L.H. and Ried, R.M. (1974) An analysis of the limited access measure of social dominance. Anim. Behav. 22: 486-500.
- Uyeno, E.T. (1960) Hereditary and environmental aspects of dominant behaviour in the albino rat. J. comp. physiol. Psychol. 53: 138-141.
- Wrangham, R.W. and Waterman, P.G. (1981) Feeding behaviour of vervet monkeys on Acacia tortilis and Acacia xanthophloea: with special reference to reproductive strategies and tannin production. J. Anim. Ecol. 50: 715-731.

L'APPATAGE LIMITE : MISE EN EVIDENCE EN LABORATOIRE DE L'EXCLUSION COMPORTEMENTALE CHEZ LE RAT SAUVAGE

P. SMITH, R.H. SMITH et R.M. SIBLY

Department of Pure & Applied Zoology
University of Reading
Whiteknight, P.O. Box 228
Reading RG6 2AJ, U.K.

Résumé

Dans les programmes modernes de lutte contre les rongeurs, les stratégies basées sur l'emploi d'appâts utilisent un grand nombre de petites sources d'appâts, le contraire étant l'utilisation d'un petit nombre de sources importantes d'appâts (Ex. : Dubock, 1984). L'une des justifications d'emploi de cette technique vient de l'hypothèse que les animaux dominants excluent compétitivement les animaux sous-dominants des zones d'alimentation. En fournissant un grand nombre de points de distribution d'appâts, on réduit le nombre d'animaux en compétition sur un seul point. Il a été fait mention d'une observation indirecte venant étayer cette hypothèse, mais aucune confirmation n'a été établie en laboratoire ni n'a été publiée.

Le résultat de ces études de laboratoire démontre l'existence étroite d'une relation entre le poids corporel, la dominance sociale et l'exclusion compétitive des sous-dominants par l'animal dominant. En outre, les rats sous-dominants, lorsqu'ils sont exclus d'une de leurs sources de nourriture préférée par les rats dominants, comme cela a été montré au cours d'un essai d'une durée limitée, se sont nourris plus longtemps à une autre source de moindre préférence par rapport à celle qu'ils auraient choisie s'ils avaient été seuls. Ces découvertes sont en accord avec l'hypothèse d'exclusion comportementale et celle prévoyant que les animaux sous-dominants adaptent leur stratégie alimentaire lorsqu'ils sont confrontés à un phénomène de compétition avec un seul animal dominant. Les implications possibles de ces essais sur la gestion des dommages causés par les rongeurs dans les produits stockés sont discutées.