

the durations between the application of methoprene and the starting of oviposition were almost the same in individuals collected in different seasons. These results suggest that the JH activity is needed for oviposition and the temperature is necessary for the secretion of JH in the oriental horned wax scale.

Female adults were also inhibited their egg development by the application of methoprene.

No hatched eggs was observed by the application of over 0.2 $\mu\text{g}/\text{female}$. Similar results was obtained when the female adults on the spiraea branches were sprayed by aerosol methoprene and placed under a condition of 28°C. These results suggest a possible utilization of methoprene with JH activity for the control of the oriental horned wax scale.

Studies on the Food Habits of Rats III. Feeding Preferences of Wild Norway Rats in Various Habitats. Yasunosuke IKEDA*, Yuichiro TABARU**, Yohsuke YUYAMA**, and Kiyohisa NAGANUMA*** (Sankyo Co., Ltd., Tokyo* Department of Medical Zoology, Faculty of Medicine, Kagoshima University** Department of Medical Zoology, Osaka City University, Medical School***) Received December 15, 1975. *Botyu-Kagaku*, 41, 75, 1976.

15. ネズミの食性に関する研究 III. 生息場所を異にしたドブネズミの食物嗜好性 池田安之助*, 田原雄一郎**, 湯山洋介**, 永沼清久*** (三共株式会社*, 鹿児島大学医学部医動物学教室**, 大阪市立大学医学部医動物学教室***) 50. 12. 15 受理

食物の豊富な場所に生息するドブネズミの食物嗜好性を知るために、牛舎、養鶏場およびごみ捨て場における野外試験を寒冷期におこなった。

本試験では、他に多くの食物がある場所にもかかわらず、すべてのネズミは食パン、とりわけ生甘藷を強く好んだ。生甘藷と食パンは実用的誘餌として推奨できる。

また本実験で試みたネズミ生息数の簡易測定法は完全なものではないが、実用には十分と考えられる。

A thorough knowledge of the food habits of wild rats is very important for the successful rat control, since rats in different habitats may show differences in their food preferences. Accordingly, the acceptability of the bait drawn from a certain habitat may not be applied to the other rat populations. Also the variability of response in rat population is more revealed in some places where food is readily available to rats all the time.

In the present paper, the authors report the food preferences of wild Norway rats in various habitats where food is readily available, such as a cattle shed, poultry farm and dumping grounds in the cold season.

The results show that fresh sweet potatoes and bread are highly preferred by all rats, even though rats have learnt their particular food preferences.

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Materials and Method

The tests were carried out in some places where food is readily available, viz., a cattle shed (near the Fukuoka Airport, Fukuoka City), a poultry farm (near the foot of Mt. Fuji, Gotenba City) and dumping grounds (Yatsukacho, Shimane Pref., commonly called Daikon-jima Island), during the middle ten days of November and December in 1972.

The baits used were commercially available sweet potatoes (120 calories per 100g), bread (270 cal.), fried beancurd (346 cal.), peanuts (533 cal.), dried small sardines (322 cal.) and fish-meat sausage (144 cal.). The baits were offered in the form of small pieces except peanuts which used as whole legume.

A container for the test baits was made of thin carton, 18 cm $\times$ 12 cm, and 2 cm in height.

Ten cartons containing the excessive amount of different kinds of test baits were scattered in the test area of about 1000 square meters.

The test baits were weighed and renewed each morning and returned to the same spot. The tests in each spot were repeated three times, while the test made in a cattle shed was one day only.

Results and Discussion

The method adopted in the present tests was

the multiple bait preference test which different kinds of the baits were provided at the same time. In advance of the test, the consumption of each bait was determined for a few days, so that rats do not eat up any kind of test bait during the exposure of the whole day. Though the baits used were so solid form that rats might carry them away to their burrows and harborages, the disappeared baits were considered as the amounts eaten by rats.

Table 1. The relative consumption of the test baits and the external caloric intake of wild Norway rats in different dumping grounds.

Test bait	Average daily consumption					
	F-dump-1		F-dump-2		T-dump	
	g	%	g	%	g	%
Sweet potato	574	60.2	nil	nil	413	59.5
Bread	149	15.6	151	33.4	126	18.2
Fried beancurd	81	8.5	83	18.3	65	9.4
Peanuts	94	9.8	99	21.9	nil	nil
Dried small sardines	56	5.9	60	13.2	51	7.3
Fish-meat sausage	nil	nil	60	13.2	39	5.6
Total	954	100.0	453	100.0	694	100.0
Total caloric	2071		1548		1281	
Assumed No. of rat*	(A) 23.9		11.3		17.4	
	(B) 21.8		16.3		13.5	
X ²	0.795		4.212		3.404	

X²_{0.05}(d. f. 2=5.991)

* Number of an average adult rat based on either the bait consumption (A), or the caloric intake (B).

Table 2. Comparison and the order of acceptability of wild Norway rats for the assorted test baits in various habitats.

Test bait	Average daily consumption					
	Dumping ground		Poultry farm		Cattle shed	
	g	%	g	%	g	%
Sweet potato	574	60.2	142	50.0	132	48.9
Bread	149	15.6	65	22.9	58	21.5
Fried beancurd	81	8.5	46	16.2	38	14.1
Peanuts	94	9.8	11	3.9	22	8.1
Dried small sardines	56	5.9	20	7.0	20	7.4
Total	954	100.0	284	100.0	270	100.0
Total caloric	2071		630		632	
Assumed No. of rat*	(A) 23.9		7.1		6.8	
	(B) 21.8		6.6		6.7	

* Number of an average adult rat based on either the bait consumption (A), or the caloric intake (B).

The results of the tests in various habitats are given in Tables 1 and 2. There were significant differences in the amount of daily consumption among the test baits. It is a remarkable evidence that all rats showed stronger preferences for raw sweet potatoes and bread than the other baits listed in the tables, even though they had learned characteristic food preference in their habitats. Rats inhabited in dumping grounds and cattle sheds were essentially omnivorous, they had usually been eating the left over. Rats in poultry farm were quite granivorous, eating a diet consisting of ground cereal and fish meal.

In this report, the authors have made a trial of a rough estimation of the number of an average adult rat by two ways. One of the estimate is based on the amount of bait consumption^{1,2,7)}, and the other is the total calories taken each day. Since an average adult rat (250g) ate about 40 grams of bait per day, the number of rats can be obtained by dividing the amount of consumed baits in grams by 40^{2,4,7)}. It has already been known that the daily caloric intake of a rat is about 50 calories per 100g body weight^{5,7)}. In the previous test, wild rats held in confinement in laboratory took 38.2 ± 6.0 cal. per 100g body weight a day, when several differences of baits in nutritive quantities were provided at the same time⁹⁾. The baits used in the present test were the same conditions to the preceding test, so rough estimation of an average (250g) rat can be determined by dividing the total calories of the consumed baits by 95 as to the daily caloric intake was about 38 cal. per 100g body weight. The results showed that there was a small difference in the assumed number of average adult rats based on either of the two ways.

From the results so far obtained, it may be concluded that bread is most suitable for a base of poisonous bait, because it is easily soaked, coated or mixed with various rodenticides or

additives, such as oils, sugar. It may maintain its good quality for a long term. In general, rats from different habitats preferred fresh sweet potatoes similarly^{3,4)}. Especially, it may be available as a bait under same conditions where water is not readily available. On the other hand, raw sweet potatoes may often lose its moisture in a short time, and once dried up, none of the sweet potatoes may be accepted.

Summary

To know the food preferences of wild Norway rats, *Rattus norvegicus*, inhabited in some places where food is readily available, field tests were carried out in a cattle shed, poultry farm and dumping grounds in the cold season.

In the present tests, bread and especially a fresh sweet potato were strongly preferred by all rats in spite of the test places where many other baits were available.

Raw sweet potatoes and bread have some excellences so that they are recommendable for practical baits.

A method for rough estimate of rat density attempted in this work may not be complete one, but it may be sufficient for practical uses.

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