

and tm is an index of increased weight in blank test which keeping pace with the repellent tests. Actual amount of the bait fed by roaches is computed by the following formula :

$$\text{Actual bait eaten} = R_0 - \left\{ r / (1 + tm) \right\}.$$

R_0 is weight of the bait given, r is remnants of the same, and tm is the index which is obtained from the blank test.

e) Comparison of the Repellent Effects Resulted from Various Testing Methods

As shown in Table 5, it is obvious that the repellent effect varies with the testing method. In the shelter method, high repellent effect of MGK repellent 11 to roaches must be influenced by the roach's habit so that once the roaches have inhabited in a shelter of their choice, they did not hide in other sheltered places easily. Of course, in the method, the roaches could not enter into the treated carton while the concentration of repellent is maintained sufficiently, but, since the roaches have such a habit it may be easily imaginable that they still avoid the treated carton even if the repellent becomes ineffective on them.

The other two methods may not be complete methods, but these may be sufficient for evaluating the repellent effects. Let us suppose

that the treated pen as a kitchen which has been treated with repellent, and that the test cage with crevices which the roaches could hide as environment for their existence. Under these conditions, the repellent tests will proceed without intervention of the roach's habit.

Résumé

In the present paper, the author dealt with some methods to evaluate the effectiveness of a certain cockroach repellent in laboratory, and had compared the efficiencies with various testing methods. From the results so far obtained, poisoned bait or compulsory feeding method was adequate to measure the repellent effects in practice, whereas the shelter method was found to be inadequate to this purpose.

Although higher appraisal of repellent was obtained from the shelter method, these good results must be influenced by the reorientation of the roaches.

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Feeding Preferences in Certain Species of Adult Cockroaches. Insect Repellents and Attractants. IX. Yasunosuke IKEDA (Takamine Laboratory, Sankyo Co., Ltd. Yasu-cho, Shiga Pref.). Received Apr. 30, 1959. *Botyu-Kagaku*, 24, 86, 1959.

18. ワモンゴキブリおよびクロゴキブリの嗜好性 忌避剤・誘引剤について 第9報
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ゴキブリの嗜好性を知るため、ワモンゴキブリおよびクロゴキブリの数種食料品に対する摂食試験をおこなった。この実験から、2, 3の材料がゴキブリ駆除用の毒餌調整に効果的に使用できることを見出した。

In order to ascertain the food preferences of adult cockroaches, the feeding tests of a number of vegetable and dairy products to *Periplaneta americana* L. and *P. picea* Shiraki were carried out in laboratory. Some foodstuffs were found to be useful in the preparation of poison baits for the control of cockroaches.

The appearance of insecticide resistant roaches is becoming an increasingly important problem in various countries^{1, 4)}. Nowadays, it

has been well known that among several methods of applying insecticides for the control of certain insecticide resistant insects, the most

effective and satisfactory is the poison bait application.

The present paper reports the food preferences in two species of adult cockroaches, *Periplaneta americana* and *P. picea*. The result obtained may be helpful to prepare an effective poison bait for killing insects.

The author wishes to express his appreciation to Prof. O. Shinoda, Osaka University of Liberal Arts, for his kind guidance and encouragement given to him in the course of the present work. The author is also deeply indebted to the executives of Sankyo Co., Ltd. for their helps and kind intentions.

Methods and Materials

The feeding stuff adopted in the present experiment was a number of vegetable and dairy products such as rice-bran, wheat bran, flour, soybean flour, corn meal, cornhusk, starchiness, sugar, molasses, honey, powdered milk, lactose and casein, those were sold in shop.

The materials used were two species of the adult cockroaches, *Periplaneta americana* Linné and *Periplaneta picea* Shiraki, reared on the Oriental's Rat Food NMC5 (Pellet for the rearing of experimental animals, made by Oriental Yeast Manufacturing Co.), had been bred for 3 years in the author's laboratory. In the test, adult roaches were selected at random without regard to sex, and 50 roaches were used for each test.

The test cage is consisted of a wooden box, 60cm long and 30cm broad, and 15cm in height, with a netted trap-door in the ceiling. On either inside wall of the cage was fitted with a board of 18×10cm, at a space of 2cm, and 3cm from the bottom, so that the roaches could hide in the crevice.

A container for the test samples consisted of a double dish, smaller one of 4.5cm in diameter and 1.5cm in height was placed on larger one, 8.5cm in diameter and 2.0cm in height. A given amount of the sample put in the inner smaller dish, so that the roaches did not scatter the sample about a floor of the cage. Water was provided in the center of the cage, and

dishes with test samples were placed around a water supply.

The tests were made in dark so roaches could behave at all times, since species used were nocturnal. After the exposure of 24 hours the sample was removed and weighed.

In the tests, certain foodstuffs such as ground cereal and sugar were often wetted with humid air. In such a case, weight of moistened materials were corrected by the following formula :

$$tm = (R - R_0) / R_0,$$

where R_0 is weight of the material before testing, R is weight of the same at the end of the test, and tm is an index of increased weight in this blank test which keeping pace with the other feeding tests. Actual amount of the material fed by roaches is computed by the following formula :

$$\text{Actual material eaten} = R_0 - \{r / (1 + tm)\}.$$

R_0 is weight of the material given, r is remnant of the same, and tm is the index which is obtained from the blank test.

Table 1. Comparison and the order of acceptability of certain cereal in adults of *Periplaneta americana* and *P. picea* when the materials were provided at the same time. At 29°—30°, relative humidity 70—80%.

| | Material | Feeding amount mg/roach/24 hrs. | 95% Confidence interval in mg |
|---------------------|---------------|---------------------------------------|----------------------------------|
| <i>P. americana</i> | Corn husk | 7.2 | 5.2—9.5 |
| | Wheat bran | 5.0 | 3.2—7.0 |
| | Rice-bran | 4.2 | 2.5—6.1 |
| | Corn meal | 3.4 | 2.0—5.4 |
| | Soybean flour | 1.5 | 0.5—2.7 |
| | Flour | 1.4 | 0.5—2.7 |
| | Total | 22.7 | |
| <i>P. picea</i> | Corn meal | 9.9 | 7.8—11.8 |
| | Rice-bran | 5.1 | 3.5—7.1 |
| | Corn husk | 2.0 | 1.0—3.5 |
| | Flour | 1.4 | 0.6—2.7 |
| | Soybean flour | 1.1 | 0.4—2.2 |
| | Wheat bran | 0.2 | 0.0—1.0 |
| | Total | 19.7 | |

Table 2. Comparison of acceptability of several blended cereals in two species of adult roaches. Average of two replicates. At 29°–30°, relative humidity 70–80%.

| Blended cereal (1:1) | <i>P. americana</i> | | <i>P. picea</i> | |
|---|---------------------------------|-------------------------|---------------------------------|-------------------------|
| | Feeding mg per roach per 24 hr. | 95% Confidence interval | Feeding mg per roach per 24 hr. | 95% Confidence interval |
| Rice-bran : Wheat bran | 1.0 | 0.4–1.9 | 2.8 | 1.4–4.6 |
| Rice-bran : Soybean flour | 0.6 | 0.1–1.4 | 3.3 | 1.8–5.0 |
| Rice-bran : Corn meal | 3.8 | 2.7–5.2 | 6.1 | 4.1–8.2 |
| Wheat bran : Soybean flour | 2.5 | 1.4–3.7 | 0.4 | 0.0–1.4 |
| Wheat bran : Corn meal | 5.7 | 4.3–7.1 | 7.1 | 5.0–9.4 |
| Soybean flour : Corn meal | 0.6 | 0.1–1.4 | 3.2 | 1.8–5.0 |
| Total amount of feeding in mg per roach per day | 14.2 | | 22.9 | |

Results

The results of the tests with comparison and the order of acceptability of certain cereal and their mixtures in two species of adult roaches are given in Tables 1 and 2.

Periplaneta americana preferred wheat bran and rice-bran, and *P. picea* was very fond of corn meal and rice-bran, whereas the adults of both species did not eat flour and soybean flour. The results of the feeding tests of certain blended cereal showed some characteristics of the food preferences in these species. There was something in common between two species that they preferred a mixture of wheat bran and corn meal or rice-bran and corn meal, and they did not eat these materials when an undesirable material such as flour was mixed with them.

As shown in Tables 3–5, roaches had a strong power to discriminate for some sweeten-

Table 3. Comparison and the order of acceptability of starchiness and sweetenings in adults of *Periplaneta americana* and *P. picea* when the materials were provided at the same time. Average of five replicates. At 29°–30°, relative humidity 70–80%.

| | Material | Feeding amount mg/roach/24 hrs. | 95% Confidence interval in mg |
|---------------------|---------------|---------------------------------|-------------------------------|
| <i>P. americana</i> | Sugar | 11.6 | 10.1–13.2 |
| | Powdered milk | 6.7 | 5.2– 8.0 |
| | Starch | 2.4 | 1.6– 3.4 |
| | Dextrine | 2.3 | 1.6– 3.4 |
| | Lactose | 2.1 | 1.3– 3.1 |
| | Cornstarch | 0.9 | 0.3– 1.6 |
| | Total | 26.0 | |
| <i>P. picea</i> | Molasses | 22.2 | 17.5–26.5 |
| | Sugar | 15.7 | 11.8–19.7 |
| | Honey | 14.8 | 10.7–18.6 |
| | Powdered milk | 2.7 | 1.1– 5.6 |
| | Lactose | 1.0 | 0.0– 3.4 |
| | Total | 56.4 | |

Table 4. Comparison of the amount of consumption between two species of adult roaches when the feeding-stuffs were provided individually.

| Feeding-stuffs | <i>P. americana</i> | | <i>P. picea</i> | |
|------------------------|-------------------------------------|-------------------------|-------------------------------------|-------------------------|
| | Consumption in mg per roach per day | 95% Confidence interval | Consumption in mg per roach per day | 95% Confidence interval |
| Sugar | 51.0 | 41.0–61.0 | 100.2 | 93.0–110.0 |
| Casein | 42.0 | 32.0–52.0 | 30.0 | 21.1– 40.0 |
| Starch | 19.3 | 12.3–28.3 | 10.5 | 5.5– 18.5 |
| Starchiness | 18.5 | 11.5–27.5 | — | — |
| Cereal | 18.4 | 12.4–25.5 | 21.2 | 16.0– 27.2 |
| Cereal with sugar (5%) | 18.6 | 12.6–24.8 | 26.7 | 19.7– 34.0 |

ings, especially it was remarkable in *P. picea*. The amount of consumption of some cereals in *P. picea* was slightly increased by adding a small quantity of sugar.

It is an interesting feature that roaches were very fond of casein. The other practical tests with roach control showed that some sweetenings such as sugar or molasses increased the effectiveness of certain bait formulations containing a given amount of lindane or chlordane.

Discussion

Since the roach has developed resistance to some insecticides, new scientific method to control these insects must be developed. Poison bait application may be one of them which serves this purpose, since a bait guides and detains an insect to a place existing some deposits of insecticide.

It has been long-established that a number of vegetable materials such as wheat bran, rice-bran, maize meal, and others are helpful for the preparation of poison baits to control certain agricultural pests⁵⁾. The fact that the effectiveness of certain insecticide is increased by adding cornstarch in a roach control measure was also established⁶⁾.

From the results obtained in the present tests, it is clear that corn meal, rice-bran and wheat bran are effective as baits for *Periplaneta americana* and *P. picea*, and sugar is enhanced the acceptability of these materials. While it

has been well known that these bait formulations are ineffective against *Blattella germanica*⁷⁾. In the present tests, effective materials in every time are sweetenings, while sugar and any material like sugar said to be not true attractants, but taste materials^{2, 3)}.

Résumé

In the present paper, the author dealt with the feeding preferences in two species of adult roaches, *Periplaneta americana* L. and *Periplaneta picea* Shiraki to various feeding-stuffs.

The roaches preferred some cereals such as corn meal, rice-bran and wheat bran, whereas they did not attracted for these materials when appreciable amount of flour or soybean was mixed with them.

Sugar, molasses or honey were suitable for their preferences, especially it was remarkable in *Periplaneta picea*.

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The Rate of Hydrolysis of Some Organophosphates. Chemical Studies on Organophosphorus Insecticides. IV. Rokurō SATŌ and Hiroshi KUBO (Agricultural Chemicals Inspection Station, Ministry of Agriculture and Forestry, Kodairamachi, Tokyo.) Received April 30, 1959. *Botyu-Kagaku*, 24, 89, 1959.

19. 有機燐剤のアルカリによる加水分解の反応速度論的考察 有機燐殺虫剤の化学的研究 第4報 佐藤六郎・久保博司(農林省農薬検査所) 34. 4. 30 受理

EP, MP 及び EPN のアルカリによる加水分解を反応速度論的に検討した。これらの三化合物はアルカリに対して本質的に EP>MP>EPN の順に安定であり P 原子の求電子的性質の弱い方が安定である。加水分解に際して反応系溶媒のメタノールと水との比率が増すにつれて加水分解速度が減少する。これは反応生成物 (*p*-nitrophenol-Na 塩) がアルコールよりも水に溶解し易い為と考えられる。ボルドー液中では EPN 乳剤の方が MP 乳剤よりも安定となるが、これは EPN の親油性に基くものと判断される。この際 Cu 成分は MP の加水分解を若干促進するが EPN に対しては特に影響を及ぼさない。