UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION
*Department of Entomology*

# Controlling The Firebrat In Buildings By Means of Poisoned Bait

By

CLAUDE WAKELAND AND HAROLD WATERS

BULLETIN NO. 185 NOVEMBER, 1931

Published by the University of Idaho, Moscow, Idaho

## Summary

"Firebrats" become very abundant under the favorable conditions afforded in heated buildings. They destroy book bindings, manuscripts and various paper products, and may become the source of great loss and annoyance. Experiments described in this bulletin indicate that they do not feed on paper products if they have ready access to food substances they like better, and that they select vegetable foods high in carbohydrate content. They prefer moist wheat flour to all other foods tested. It is more practical to use a dry food than a moist food in a bait which is to be attractive over long periods of time. Oatmeal proved to be the preferred dry food, therefore it was used as a basis for poisoned bait. The attractiveness of oatmeal is further increased by adding sugar and salt. White arsenic is an effective poison for firebrats and it does not repel them when added to food they like. A poisoned bait composed of oatmeal, white arsenic, sugar and salt gave almost complete control in the experiments and practical applications enumerated.

*Control Recommendation:* It is recommended that a poisoned bait for firebrat control be composed of the following ingredients:

| | | |
|---|---|---|
| Oatmeal (finely cut or ground | 100 parts | (by weight) |
| White arsenic | 8 parts | " " |
| Granulated sugar | 5 parts | " " |
| Salt | 2.5 parts | " " |
| Water to make slightly moist. | | |

Mix together dry the oatmeal, white arsenic, sugar, and salt. Moisten the mass and mix thoroughly to bind the substances together. Then thoroughly dry the bait to prevent mold, and crush it up into small bits so it may be scattered lightly.

*Applying the Bait:* Scatter the poisoned bait lightly behind bookcases, radiators, on shelves, etc., or in any places frequented by firebrats. It is effective over long periods of time if placed in position where it will not be swept up or disturbed. It is advisable to renew bait occasionally since it becomes dust-covered and unattractive to the insects.

# Controlling the Firebrat in Buildings By Means of Poisoned Bait

By

CLAUDE WAKELAND AND HAROLD WATERS*

"FIREBRATS," *Thermobia domestica* Packard, are known to be destructive and annoying insects in many parts of the world. (See Fig. 1). They are sometimes called "silverfish" and are closely related to that species, *Lepisma saccharina* Linn. They have been of extremely rare occurrence in Idaho in the past, but they have become established in many of the buildings and heating tunnels of the University of Idaho where their presence was not discovered until 1929 when they had caused noticeable injury to paper products and valuable records (Fig. 2). It became necessary to devise means of control to prevent loss on the University campus and possible damage in other parts of the state.

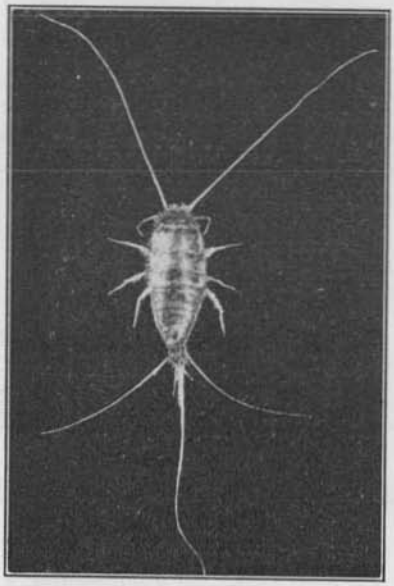


**Fig. 1— Firebrat Adult**
(Greatly Enlarged)

A review of available literature showed that recommendations for the control of the firebrat were not very positive and that different writers do not agree on the kind of foods eaten. No records of successful, practical control could be found, so a series of experiments to that end was planned. The problem was divided into two phases: first, to learn the food preference of the insects; and, second, to find an effective poison which, when mixed with the preferred food, would make an efficient poison bait.

## Determination of Food Preference

A large number of firebrats were trapped and placed in cages. Twenty-four cages, each containing 100 to 125 insects, were used in the experiment. The cages were made of card-

*Entomologist Agricultural Experiment Station, and Senior Student in Entomology, respectively.

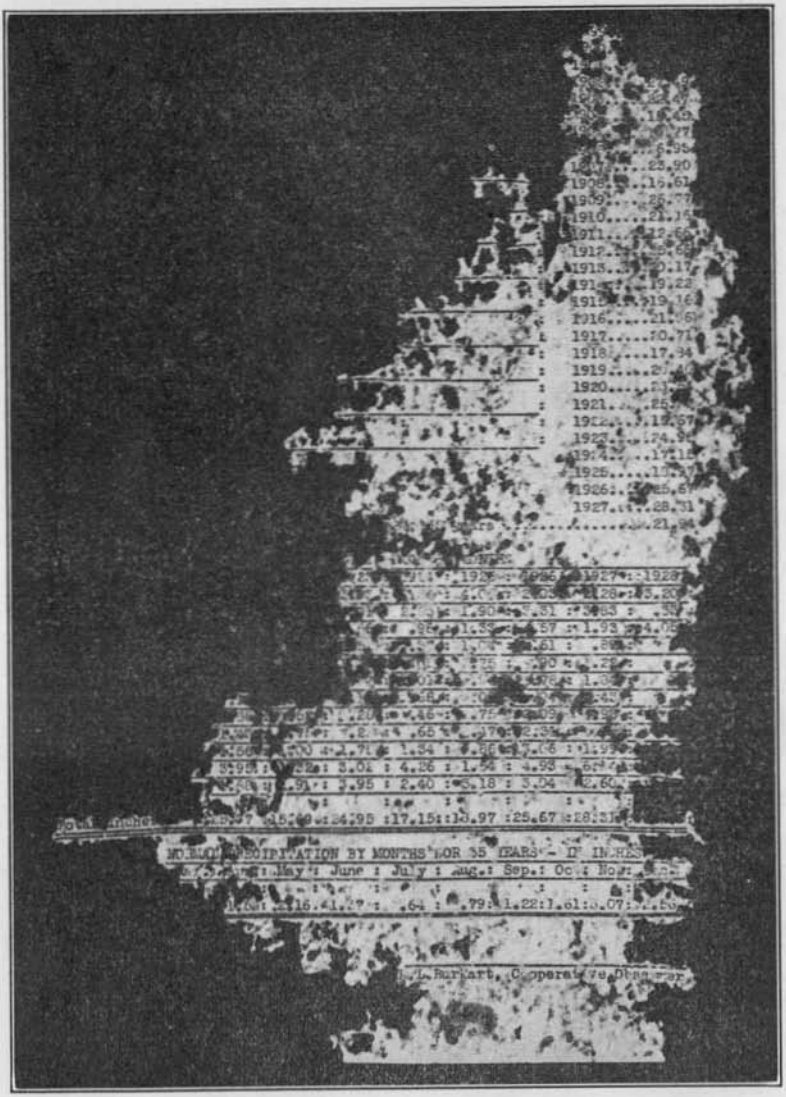


Fig. 2— **Typical Injury by Firebrats**
**Photograph of the remains of a sheet of printed matter destroyed in a filing cabinet.**

board boxes, ten inches square and two inches deep. The sides of the cages were lined with heavy waxed paper to prevent the insects from escaping. The cages were kept in a dark room

where the temperature and humidity were high, because the insects prefer these conditions.

Several common substances were tried as food. The first tests showed that wheat flour was well liked, so in most of the tests it was used as the "standard" food. In the tests at the last of the experiment, oatmeal was used as the standard food. The procedure of comparing the foods was as follows: A sample of the standard food and a sample of the food to be tested, each weighed to tenths of a milligram, were placed in a cage containing insects. No other food was put in the cage. Each cage was continuously supplied with moisture by inverting a water-filled bottle on a macerated blotting paper base from which the insects imbibed free water as needed. The samples were left in the cage until an appreciable amount of one or both of the samples had been eaten. This usually re-

**TABLE I**

**Summary of All Food Tests in Which Dry Wheat Flour Was the Standard Food**

| Sample | Tests Conducted in Cages | | Tests Conducted in Heating Tunnel | |
|---|---|---|---|---|
| | Number of Trials | Ratio | Number of Trials | Ratio |
| Moist wheat flour | 6 | 887.1 | 2 | 301.6 |
| Dry wheat flour containing 20 per cent sugar | 6 | 172.6 | 1 | 164.4 |
| Dry oatmeal | 6 | 168.9 | 2 | 127.8 |
| Dry dead firebrats mixed with wheat flour | 3 | 120.0 | | |
| Dry wheat flour containing 5 per cent sugar | 6 | 113.2 | 1 | 115.6 |
| Dry wheat flour (standard food) | 82 | 100.0 | 6 | 100.0 |
| Dry wheat flour containing 10 per cent sugar | 3 | 93.9 | | |
| Dry wheat flour containing 15 per cent sugar | 3 | 92.1 | | |
| Dry white wheat bread | 4 | 76.4 | | |
| Dry yellow cornmeal | 3 | 69.5 | | |
| Dry dead firebrats | 6 | 53.9 | | |
| Dry whole wheat flour | 3 | 40.9 | | |
| Dry egg yellow | 3 | 30.5 | | |
| Dry dried milk | 7 | 26.7 | | |
| Dry cornstarch | 4 | 19.4 | | |
| Dry meatmeal | 3 | 12.1 | | |
| Dry wheat flour flavored with sassafras | 3 | 8.8 | | |
| Dry sizing glue | 4 | 3.1 | | |
| Dry potato starch | 4 | 2.4 | | |
| Dry "Knox" gelatine | 4 | 2.1 | | |
| Dry egg white | 1 | 1.1 | | |

quired three or four days. The food was then removed, and the amount of each sample eaten was determined. The ratio of the two weights furnished a basis for comparing the preference of the insects for different foods. The standard food was arbitrarily given a value of 100 in these ratios. Thus if the insects ate 0.060 gram of Food A and 0.030 gram of the standard food, Food A would have a value of 200, or twice that of the standard food. The preference of the insects for the different foods is expressed by this method in the tables and charts which appear in this bulletin.

Not all of the tests were conducted in the cages. The best results from the cage tests were checked in the university heating tunnels, where the firebrats were present in large numbers under their natural conditions. The food samples were placed where only the firebrats could feed on them. Otherwise the procedure here was the same as with the cage tests.

Some foods were tested in the moist condition. The samples were kept moist by embedding one end of a strip of blotting paper in the food sample, and placing the other end of the paper in a tube of water.

Data concerning the preference of firebrats for various foods are presented in Tables I, II, and III, and in Graphs I, II, and III.

**TABLE II**

**Summary of All Food Tests in Which Moist Wheat Flour Was the Standard Food**

| Sample | Tests Conducted in Cages | | Tests Conducted in Heating Tunnel | |
|---|---|---|---|---|
| | Number of Trials | Ratio | Number of Trials | Ratio |
| Moist wheat flour containing ⅛ of one per cent sodium chloride (Dry basis) | 3 | 149.9 | 1 | 121.9 |
| Moist wheat flour (standard food) | 33 | 100.0 | 4 | 100.0 |
| Moist wheat flour containing raisins | 3 | 84.3 | | |
| Moist oatmeal | 6 | 79.1 | | |
| Moist wheat flour containing 5 per cent sugar (Dry basis) | 3 | 76.5 | | |
| Dry oatmeal | | | 1 | 60.7 |
| Moist dead firebrats mixed with wheat flour | 3 | 50.2 | | |
| Moist dead firebrats | 3 | 41.9 | | |
| Moist sunflower seed | 3 | 21.1 | | |
| Dry wheat flour | 6 | 11.2 | 2 | 37.5 |
| Moist oilmeal | 3 | 7.0 | | |

A moist bait is impracticable for firebrats since its use entails constant care in keeping it in an attractive condition, and it molds easily. It seemed advisable, therefore, to select the

preferred dry food of the insects as a basis for compounding a poisoned bait, even though tests indicated that moist substances are more attractive than dry. Oatmeal was the preferred dry food of all those tested as is shown by the ratios in Tables I, II, and V. Further tests with dry oatmeal proved that its attractiveness to firebrats could be increased by the addition of salt and sugar as indicated by the ratios in Tables III and IV.

**TABLE III**

**Summary of All Food Tests in Which Dry Oatmeal was the Standard Food**

| Sample | Tests Conducted in Cages | | Tests Conducted in Heating Tunnel | |
|---|---|---|---|---|
| | Number of Trials | Ratio | Number of Trials | Ratio |
| Dry oatmeal containing ⅛ of one per cent sodium chloride and 5 per cent sugar | 6 | 202.3 | 1 | 199.9 |
| Moist wheat flour | | | 1 | 164.7 |
| Dry oatmeal containing ⅛ of one per cent sodium chloride | 6 | 152.7 | 1 | 115.9 |
| Dry oatmeal containing 5 per cent sugar | 6 | 141.4 | 1 | 122.9 |
| Dry oatmeal (standard food) | 24 | 100.0 | 5 | 100.0 |
| Dry wheat flour | 6 | 59.2 | 1 | 78.2 |

**TABLE IV**

**Summary of the Most Favorable Foods**

| Sample | Tests Conducted in Cages | | Tests Conducted in Heating Tunnel | |
|---|---|---|---|---|
| | Number of Trials | Ratio | Number of Trials | Ratio |
| Moist wheat flour containing ⅛ of one per cent sodium chloride | 2 | 1329.4 | 1 | 367.7 |
| Moist wheat flour | 6 | 887.1 | 2 | 301.6 |
| Moist oatmeal | 6 | 701.6 | | |
| Dry oatmeal containing ⅛ of one per cent sodium chloride and 5 per cent sugar | 6 | 341.7 | 1 | 195.2 |
| Dry wheat flour containing 20 per cent sugar | 6 | 172.6 | 1 | 164.4 |
| Dry oatmeal | 6 | 168.9 | 2 | 127.8 |
| Dry wheat flour (standard food) | 24 | 100.0 | 7 | 100.0 |

## Protein and Carbohydrate Foods

Six common foods having a high carbohydrate content and six having a high protein content were included in the food tests. Data in Table V show the order of preference of the firebrats for these foods and indicate that, of the foods tested, the ones having a high carbohydrate content are preferred.

TABLE V
Summary of Ranking of Dry Foods Tested

| Sample | Tests Conducted in Cages | |
|---|---|---|
| | Number of Trials | Ratio |
| Dry oatmeal | 6 | 168.9 |
| Dry wheat flour (standard food) | 46 | 100.0 |
| Dry white wheat bread | 4 | 76.4 |
| Dry yellow cornmeal | 3 | 69.5 |
| Dry whole wheat flour | 3 | 40.9 |
| Dry egg yellow | 3 | 30.5 |
| Dry dried milk | 7 | 26.7 |
| Dry cornstarch | 4 | 19.4 |
| Dry meatmeal | 3 | 12.1 |
| Dry sizing glue | 4 | 3.1 |
| Dry potato starch | 4 | 2.4 |
| Dry gelatine | 4 | 2.1 |
| Dry egg white | 1 | 1.1 |

Data in Tables III, IV and VI indicate that oatmeal containing sugar or salt is preferred to plain oatmeal even when the concentration of these substances is fairly high. Data in Table VI indicate that oatmeal containing 5 per cent sugar is preferred to that containing 50 per cent sugar. This may be partly due to the fact that 50 per cent sugar causes the bait to become hard so that it is much more difficult for the insects to chew than the bait containing 5 per cent sugar. The data in Table VI furthermore show that firebrats prefer bait containing 5 per cent salt to that containing ⅛ of one per cent salt.

All results of tests enumerated in this bulletin indicate that firebrats prefer foods containing 5 per cent sugar and 5 per cent salt over those containing 50 per cent sugar or ⅛ of one per cent salt. The series of tests was not carried out far enough to discover the optimum percentages of sugar and salt, but it is probable the optimum sugar content is between the extremes of 5 per cent and 50 per cent, and that the optimum salt content is between ⅛ of one per cent and 5 per cent. It is planned to carry this series of food tests further.

**TABLE VI**

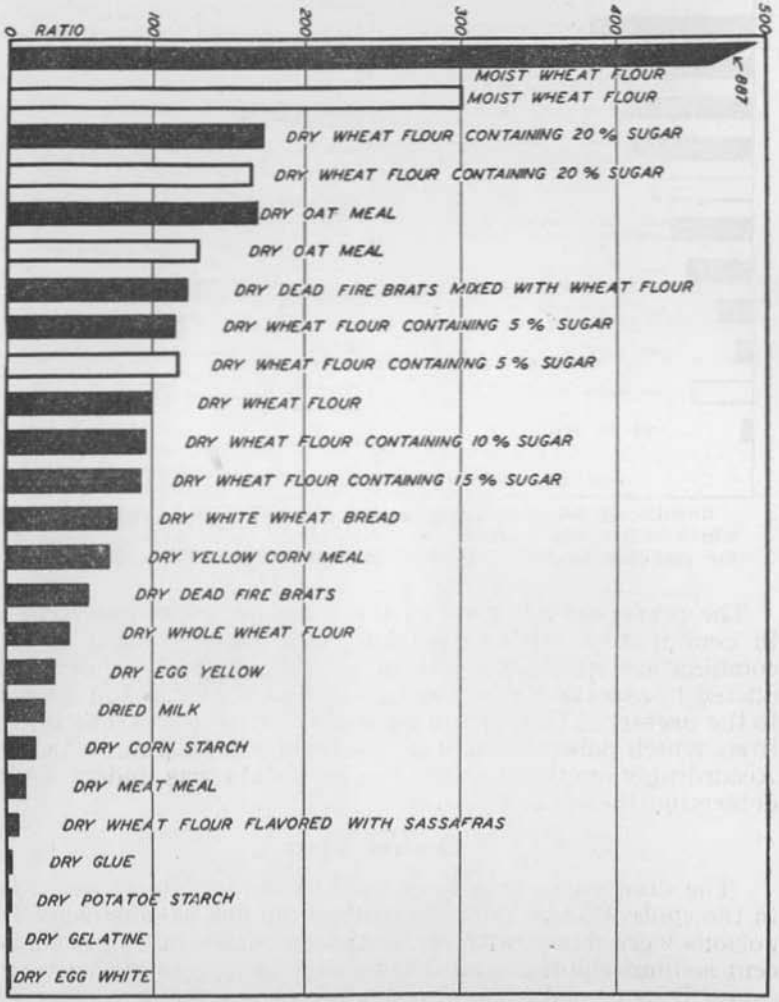
**Summary of Tests Combining Dry Oatmeal with Different Proportions of Salt and Sugar**

| Food Combination | Number of Trials | Ratio | |
|---|---|---|---|
| | | Individual Tests | General Average |
| Dry oatmeal (standard) | 1 | 100.0 | |
| | 1 | 100.0 | |
| | | | 100.0 |
| Dry oatmeal plus 5 per cent NaCl | 1 | 131.9 | |
| | 1 | 88.3 | |
| | | | 110.1 |
| Dry oatmeal (standard) | 1 | 100.0 | |
| | 1 | 100.0 | |
| | | | 100.0 |
| Dry oatmeal plus 50 per cent sugar | 1 | 151.6 | |
| | 1 | 122.1 | |
| | | | 136.8 |
| Dry oatmeal plus 5 per cent sugar (standard) | 1 | 100.0 | |
| | 1 | 100.0 | |
| | 1 | 100.0 | |
| | 1 | 100.0 | |
| | 1 | 100.0 | |
| | | | 100.0 |
| Dry oatmeal plus 50 per cent sugar | 1 | 56.5 | |
| | 1 | 66.3 | |
| | 1 | 65.2 | |
| | 1 | 52.4 | |
| | 1 | 59.5 | |
| | | | 59.9 |
| Dry oatmeal plus ⅛ of one per cent NaCl (standard) | 1 | 100.0 | |
| | 1 | 100.0 | |
| | 1 | 100.0 | |
| | 1 | 100.0 | |
| | 1 | 100.0 | |
| | | | 100.0 |
| Dry oatmeal plus 5 per cent NaCl | 1 | 117.1 | |
| | 1 | 131.6 | |
| | 1 | 181.1 | |
| | 1 | 145.4 | |
| | 1 | 143.3 | |
| | | | 143.7 |

Writers have not agreed concerning the preferred food of silverfish. Some assert they feed on articles containing paste or glue, while others maintain they prefer animal products and still others that they select foods of vegetable origin. Some writers maintain the food selection is on the basis of carbohydrates, proteins or fats. The results of experiments already described in this bulletin indicate that firebrats select vege-

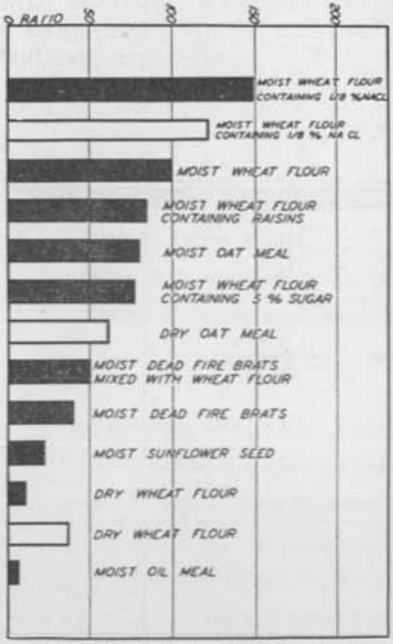
table foods high in carbohydrate content. When they were given a choice of food, they did not feed on paper or paper products which had previously been so severely damaged by them, and the conclusion is that they attack such products only in the absence of food more to their liking.

GRAPH NO. I



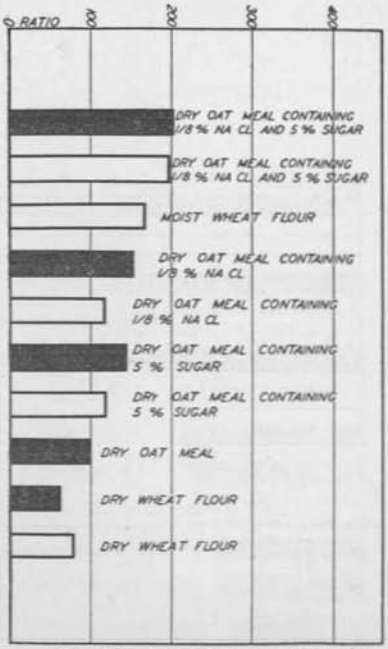

**Results of all food tests in which dry wheat flour was the standard food. In this graph and in graphs II and III the solid columns represent the foods tested in feeding cages; the outline columns represent the foods tested in the heating tunnel.**

GRAPH NO. II




**Results of all food tests in which moist wheat flour was the standard food.**

GRAPH NO. III




**Results of all food tests in which dry oatmeal was the standard food.**

The preferred dry food in the foregoing tests was oatmeal in combination with sugar and salt. Having found a food combination which the insects relished, tests were next conducted to ascertain whether baits prepared by adding poisons to the preferred food would be readily eaten by the insects, and if so, which poisons would be the most practical and effective. Accordingly another series of experiments was undertaken to determine these facts.

## Control Tests

The same cages that were used in the food tests were used in the control tests. Fifty firebrats were put in each cage. The poisons were mixed with dry oatmeal containing 1/8 of one per cent sodium chloride and 5 per cent sugar, and placed in the cages. Unpoisoned oatmeal containing the same proportions of sodium chloride and sugar was also placed in each cage so that the insects would have a choice and would not be forced to eat the poisoned food. Moisture was supplied in the same way as

## TABLE VII

### Summary of Results of Poisoning Tests Against Firebrats

| Cage No. | Poisoned Bait (comprising 100 parts oatmeal, ⅛ of one part salt and 5 parts sugar plus the poison in this column). | Number Dead per Week | | | | | | | Ave. No. Dead per Week | Total No. Dead | No. Left in Cage | Total Killed Plus No. Left in Cage* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st | 2d | 3d | 4th | 5th | 6th | 7th | | | | |
| 50 | White arsenic, 8 parts | 7 | 25 | 14 | 2 | | | | 12.0 | 48 | 6 | 54 |
| 43 | White arsenic, 4 parts | 1 | 10 | 12 | 13 | 3 | | | 7.8 | 39 | 7 | 46 |
| 48 | White arsenic, 4 parts | 2 | 19 | 14 | 6 | 5 | 2 | 5 | 7.6 | 53 | 6 | 59 |
| 44 | Sodium fluoride, 12 parts | 1 | 6 | 7 | 8 | 4 | | | 5.2 | 26 | 18 | 44 |
| 47 | Paris green, 4 parts | 0 | 2 | 7 | 10 | 5 | 5 | 6 | 5.0 | 35 | 9 | 44 |
| 51 | Thallous sulphate, 4 parts | 0 | 7 | 8 | 4 | | | | 4.8 | 19 | 30 | 49 |
| 52 | Thallous sulphate, 8 parts | 2 | 3 | 4 | 4 | | | | 3.3 | 13 | 28 | 41 |
| 46 | Sodium fluoride, 12 parts | 2 | 3 | 4 | 1 | 1 | 6 | 2 | 2.7 | 19 | 9 | 28 |
| 42 | Paris green, 4 parts | 1 | 1 | 4 | 4 | 4 | 0 | | 2.5 | 14 | 33 | 47 |
| 60 | Check, no poison | 2 | 1 | 0 | 0 | 1 | 2 | 1 | 1.0 | 7 | 50 | 57 |
| 61 | Check, no poison | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 41 |
| 62 | "Evergreen," 1 c.c. to 1 gm. of bait | 0 | 0 | 0 | 0 | | | | 0 | 0 | | |
| 49 | Tartar emetic, 4 parts | 0 | 0 | 0 | 0 | | | | 0 | 0 | | |
| 65 | Lead acetate, 10 parts | 0 | 0 | 0 | 0 | | | | 0 | 0 | | |
| 64 | Mercuric Chloride, ⅛ part | 0 | 0 | 0 | 0 | | | | 0 | 0 | | |
| 65 | Mercuric chloride, ⅛ part | 0 | 0 | 0 | 0 | | | | 0 | 0 | | |

*NOTE: The number of insects killed plus the number left in the cage at the end of the test should have equalled 50 in each case. Two factors account for the differences in this column. First, although it was impossible for the insects to escape from the cages, it was possible for the firebrats that infested the building to get into the cages. Second, some of the live or dead insects were probably eaten by the firebrats, as this species is quite cannibalistic.

during the food tests. The dead were counted and removed each day. Table VII presents data summarizing the results of all the control tests.

Results of poisoning experiments indicated that firebrats eat their preferred food readily when mixed with poisons and that several of the poisons tested caused a greater or less mortality of the insects under conditions where they were given opportunity to fed on unpoisoned, preferred food. It is very probable that under natural conditions where they do not have their preferred food they will feed more readily on a poisoned bait containing oatmeal than they did in the experiments enumerated here. White arsenic was the most effective poison tested. At eight parts per hundred it gave a quicker kill and the heavier dosage did not repel the insects.

### Control Results on the University Campus

The poisoned bait proved so effective under test conditions that it was prepared and distributed in the heavier infested portions of the heating tunnels and in some of the buildings in early June 1930. The formula used contained 100 parts oatmeal, 4 parts white arsenic, ⅛ of one part sodium chloride and 5 parts sugar. The oatmeal was ground fairly fine and mixed thoroughly with the other ingredients. Part of the bait was then moistened and mixed into a paste which was spread on small pieces of stiff cardboard and allowed to dry. The remainder was dampened, allowed to dry, and then broken into small particles. The cardboard squares were hung on the wall behind pictures, maps, etc., which were being destroyed by firebrats, and the crumbled bait was spread lightly behind bookcases, in filing cases, around steam pipes, and other places where the insects were known to be abundant. In less than a month all injury had ceased where bait was distributed and firebrats were extremely hard to find. It was observed that poisoned bait on cardboard squares was eaten freely.

Other buildings and departments reported damage from the insects in the fall of 1930. Additional bait was prepared and generally distributed throughout all of the heating tunnels, most of the University buildings, and in several of the students' group houses. Eight pounds of white arsenic per 100 pounds of oatmeal were used. It appears to have been entirely effective since no further reports of damage from firebrats were received and it is now difficult to find the insects in places where hundreds of them could be trapped in a single night before poisoned bait was applied.

## LITERATURE STUDIED


1. BACK, E. A.—**The "Silver Fish" or "Slicker"—An Injurious Insect.** U.S.D.A. Farmers' Bulletin 902 (October, 1917).
2. BROOKS, A. J.—**Work Connected with Insect and Fungus Pests, and Their Control.** Cambia. Annual Report Department of Agriculture 1924, pp. 13-18, Series A, Vol. 13, p. 554 (1925).
3. CHAPMAN, R. N.—**Insects Infesting Stored Food Products.** Minnesota Bulletin 198, p. 59 (1921).
4. CHARLTON—**Spermatogenesis of Lepisma domestica.** Journal of Morphology, Vol. 35, pp. 381-423 (1921).
5. COMSTOCK, J. H.—**An Introduction to Entomology.** Second Edition. (1925).
6. COOLEY, R. A.—**Fourteenth Annual Report of the State Entomologist.** Montana Bulletin 112, p. 55 (1916).
7. CORNWALL, J. W.—**L. saccharina—Its Life History, Anatomy and Gregarine Parasites.** India Journal of Medical Research, Calcutta III, No. 1, July 1915, pp. 116-131, 5 plates, (1915).
8. CROSBY, C. R.—**Insect Pest Survey Bulletin,** Vol. II, No. 1, April, 1922, p. 29 (1922).
9. DAVIS, J. J.—**Insect Pest Survey Bulletin.** Vol. 7, No. 5, July 1927, p. 184 (1927).
10. ..... —**Insect Problems in the Home.** Indiana Agricultural Experiment Station Circular 150 (1928).
11. ..... —**Insect Pest Survey.** Vol. 8, No. 4, June 1929, p. 133 (1929).
12. DEAN, G. A.—Kansas Bulletin 139, p. 235 (1913).
13. ESSIG, E. O.—**Insects of Western North America.** (1926).
14. DE FARIA, D.—**Os Inimigos dos nossos Livros (Enemies of Our Books).** Servico Sanit. do Estado de Sao Paulo, S. Paulo, N. S., No. 4, 1919, 40 pp., 5 plates.
15. FELT, E. P.—**Curious Insect Tastes.** Country Gentleman, May 11, 1899, p. 368 (1899).
16. FLINT, WESLEY P.—**Control of Household Insects.** Illinois Agricultural Experiment Station Circular No. 257 (April 1922).
17. GARMON, H.—**Does the Silver Fish (L. saccharina L.) Feed on Starch and Sugar?** U.S.D.A. Bureau of Entomology Bulletin 60, n.s., pp. 174-176 (1903).
18. ..... —**Household Insects and Their Treatment.** Kentucky Agricultural Experiment Station Circular 15 (1917).
19. GARMAN, S.—**The Ravages of Book Worms.** Science, March 24, 1893, p. 158 (1893).
20. GIBSON, ARTHUR and TWINN, C. R.— **Houshold Insects and Their Control.** Dominion of Canada, Department of Agriculture. New Series, Bulletin 112.
21. GLOVER, T.—**Report of Entomologist and Curator of the Museum from the Report of U.S. Commission of Agriculture for 1874 and 1875.** pp. 122-146 (1895)
22. HARVEY, F. L.—**Report of Botanist and Entomologist.** Annual Report of Maine Agricultural Experiment Station 1894, pp. 82-123 (1894).
23. HASEMAN, L.—**Insect Pest Survey Bulletin.** Vol. 6, No. 7, Sept. 1926, p. 268 (1926).
24. HERRICK, G. W.—**Insects Injurious to the Household.** (1916).
25. HOULBERT, C.—**Thysanoures—Dermopteres et Orthopteres de France de et la faune Europeinne.** I.-16 mo., XII-382 pp., 87 figs., 9 pls. Paris, Octave Doin, 1924.

26. JACKSON, R. T.—**A New Museum Pest.** Science, May 28, 1886, v. 7, pp. 481-483 (1886).
27. MARLATT, C. L., and HOWARD, L. O.—**The Principal Houshold Insects of the United States.** U.S.D.A. Division of Entomology Bulletin No. 4, n.s., pp. 76-78 (1896).
28. MARLATT, C. L.—**The Silver Fish.** U.S.D.A. Division of Entomology Circular 49, (1902)
29. ..... —**The Silver Fish; an Injurious Household Insect.** U.S.D.A. (1915).
30. McDANIEL, E. I.—**The Silver Fish (Lepisma sp.)—The Habits and Control of this Troublesome Household Pest.** Quarterly Bulletin Michigan Agricultural Experiment Station, IV, No. 2, Nov. 1921, pp. 62-64. (1921).
31. ..... —**Cockroaches, Silver Fish and Book Lice.** Michigan Agricultural Experiment Station Circular No. 101 (April 1928.)
32. METCALF, C. L., and FLINT, W. P.—**Destructive and Useful Insects.** First Edition. (1928).
33. MITCHELL, P.—**Observations on the Use of $MgSO_4$ vs. Napthaline for the Prevention of Silver Fish, Moths, Cockroaches, etc., in Linens and Other Fabrics.** Health, II No. 3, pp. 84-85, Melbourne, May 1924.
34. MOHR, E.—**Biologisches uber Lepisma saccharins L.** (Biological Notes on L. saccharina L.). Zool. Anz. LVI, No. 7-8, pp. 174-181, May 8, 1923.
35. MORITA, HELENE—**Some Observations on the "Silverfish" (Lepisma saccharina L.)** Proc. of Hawaiian Entomological Society 1925, VI, No. 2, pp. 271-273, July 1926.
36. ..... —**Some Observations on the Silverfish—Lepisma saccharina.** Proc. Hawaiian Entomological Society VI (2): pp. 271-273 (1926).
37. MURTFELDT, M. E.—**Drought, Heat and Insect Life.** U.S.D.A. Division of Entomology Bulletin No. 31, n. s. pp. 97-99 (1902).
38. RILEY, C. V.—**The Systematic Position of the Orthoptera in Relation to Other Orders of Insects.** Third Annual Report of U.S. Entomology Commission. Chapter XI, p. 295 (1883).
39. RILEY, C. V. and HOWARD, L. O.—**The Skein Centipede and Silverfish.** Insect Life, v. 2, 1890, pp. 315-316 (1890).
40. ROUBAUD, E.—**Les Insectes et la Degeneresccence des Arachides au Sengal. (Insects and the Deterioration of Ground Nuts in Senegal.)**
41. SANBORN, C. E.—**Report of Entomologist.** Twenty-seventh Annual Report of Oklahoma Agricultural Experiment Station, p. 35. (1918).
42. ..... —**Report of Entomologist.** Twenty-eighth Annual Report of Oklahoma Agricultural Experiment Station, pp. 43-44. (1919).
43. ..... —**Report of Entomologist.** Twenty-ninth Annual Report of Oklahoma Agricultural Experiment Station, p. 35. (1920).
44. SLINGERLAND, M. V.—**A Strange Insect—The Fish Moth.** Rural New Yorker, July 16, 1898, p. 497 (1898).
45. ..... —**The Book Worm.** Rural New Yorker, Mar. 16, 1901, p. 189 (1901).
46. SMITH, J. B.—**Some Household Pests.** New Jersey Agricultural Experiment Station Bulletin 203 (1907).
47. WHITEMARSH, R. D.—**Insect Pests of the Household.** Ohio Agricultural Experiment Station Bulletin 253, p. 133 (1912).
48. ..... —**Forty-third Annual Report.** Ontario Agricultural College, Toronto, pp. 18-24 (1917).