

A Research Note

Rodent Excreta Contamination and Insect Damage of Wheat

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ABSTRACT

A survey was made to determine the levels of insect damage and rodent excreta pellets in wheat. The analytical data obtained represented the various grade designations of wheat normally encountered during wheat grade certification in the 34 Agricultural Marketing Service, Grain Division, field offices. The mean and range of weights of insect-damaged kernels per 100 g and rodent excreta pellets and pellet fragments per kilogram were 71.5 mg (0-3809 mg) and 0.9 mg (0-100 mg), respectively. The mean and range of numbers of insect-damaged kernels and rodent excreta pellets were 3.3 (0-169) and 0.1 (0-11), respectively. The percentages of samples containing insect-damaged kernels and rodent excreta were approximately 35 and 7%, respectively.

During 1950 and 1951 the Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) conducted a cooperative investigational program to determine the incidence of rodent and insect contamination in wheat and to study the relationship of insect-damaged wheat to the levels of insect contaminants in flour. As a result of this program, the regulatory limit for rodent pellets in wheat was set at one or more pellets per pint, and in September 1952, enforcement inspections and analyses were begun. In May 1953, the enforcement program was suspended and a joint committee appointed by the USDA and the Department of Health, Education, and Welfare (HEW) began a study of the grain sanitation problem. As a result of the committee's deliberations and review of data, the enforcement inspections were resumed in January 1955, with a regulatory limit of two or more rodent pellets per pint and 2% or more insect-damaged kernels.

In July 1956, the regulatory limits were lowered to one or more rodent pellets per pint and 1% or more insect-damaged kernels. After 16 years of enforcement under the 1956 regulatory limits, a joint FDA/USDA study was conducted to develop data on the levels of rodent excreta and insect damage in wheat. The sampling and analytical details of that program are presented in this report.

MATERIALS AND METHODS

Samples were collected by USDA grain inspectors from 34 field offices of the Agricultural Marketing Service, Grain Division. A total of 1200 samples was submitted by the field offices to the FDA at a rate of 100 samples per month for a 1-year period. The samples represented

the various grade descriptions of wheat normally encountered in each field office jurisdiction.

Analyses were conducted by FDA analysts. Samples weighing 1000 g were analyzed for rodent (rat and mouse) excreta pellets and pellet fragments according to *Microanalytical Manual (I)*, using method M3A1 (a) (updated October 1962). Rodent excreta was confirmed by the presence of striated hairs in the pellet or pellet fragment. Samples weighing 100 g were analyzed for insect damage according to *Microanalytical Manual (I)*, using method M3A1 (b) (updated October 1962). Data were obtained on 1,166 samples.

RESULTS AND DISCUSSION

Wheat examined during this survey was found to contain various amounts of insect-damaged kernels and rodent excreta pellets and pellet fragments.

Table 1 presents a frequency distribution of weights of insect-damaged kernels in 100-g samples of wheat. The weight of insect-damaged kernels ranged from 0 to 3,046 mg. Approximately 35% of the wheat examined contained insect-damaged kernels. The median weight of insect-damaged kernels was 0.0 mg; the mean weight was 71.5 mg.

Table 2 presents a frequency distribution of the numbers of insect-damaged kernels in 100-g samples of wheat. The number of insect-damaged kernels ranged from 0 to 169. The median number of insect-damaged kernels was 0; the mean was 3.3.

Table 3 presents a frequency distribution of the weights of rodent excreta pellets and pellet fragments in 1000-g samples of wheat. The weight of whole pellet and

TABLE 1. Frequency distribution of weight of insect-damaged kernels in 100-g samples of wheat.

Weight of insect-damaged kernels (mg)	Number of samples	% Samples	Cumulative %
3000 - 3046	1	0.1	0.1
2000 - 2999	6	0.5	0.6
1000 - 1999	12	1.0	1.6
900 - 999	1	0.1	1.7
800 - 899	0	0.0	1.7
700 - 799	3	0.3	2.0
600 - 699	7	0.6	2.6
500 - 599	1	0.1	2.7
400 - 499	10	0.9	3.6
300 - 399	15	1.3	4.9
200 - 299	16	1.4	6.3
100 - 199	71	6.0	12.3
1 - 99	259	22.2	34.5
0	764	65.5	100.0

TABLE 2. Frequency distribution of number of insect-damaged kernels in 100-g samples of wheat.

Number of insect-damaged kernels	Number of samples	% Samples	Cumulative %
101 - 169	5	0.4	0.4
91 - 100	4	0.3	0.7
81 - 90	2	0.2	0.9
71 - 80	3	0.3	1.2
61 - 70	2	0.2	1.4
51 - 60	2	0.2	1.6
41 - 50	3	0.3	1.9
31 - 40	5	0.5	2.4
21 - 30	8	0.7	3.1
11 - 20	30	2.6	5.7
1 - 10	338	28.9	34.6
0	764	65.4	100.0

TABLE 3. Frequency distribution of weights of rodent excreta pellets and pellet fragments in kg samples of wheat.

Weight of excreta pellets & pellet fragments (mg)	Number of samples	% Samples	Cumulative %
100	1	0.1	0.1
51 - 60	2	0.2	0.3
41 - 50	1	0.1	0.4
31 - 40	0	0.0	0.4
26 - 30	2	0.2	0.6
21 - 25	5	0.4	1.0
16 - 20	10	0.9	1.9
11 - 15	10	0.9	2.8
6 - 10	25	2.1	4.9
1 - 5	21	1.8	6.7
0	1089	93.3	100.0

pellet fragments ranged from 0 to 100 mg. Approximately 7% of the wheat examined contained rodent excreta. The median weight of rodent excreta was 0.0 mg; the mean weight was 0.9 mg.

Table 4 presents a frequency distribution of the numbers of rodent excreta pellets in 1000-g samples of

wheat. The number of rodent excreta pellets ranged from 0 to 5. The median number of excreta pellets was 0; the mean was 0.1.

Table 5 provides a statistical summary of both weights and numbers of insect-damaged wheat and rodent excreta pellet contamination.

TABLE 4. Frequency distribution of numbers of rodent excreta pellets in kg samples of wheat.

Number of excreta pellets	Number of samples	% Samples	Cumulative %
5	1	0.1	0.1
3	2	0.2	0.3
2	11	0.9	1.2
1	46	3.9	5.1
0	1106	94.9	100.0

TABLE 5. Statistical summary for defect variables in wheat.

	Rodent excreta per kilo		Insect damaged kernels per 100 g	
	Weight (mg)	Number (pellets)	Weight (mg)	Number
Median	0	0	0	0
Mean	0.89	0.10	71.48	3.28
Standard ^a deviation	5.11	0.50	283.88	13.68
Minimum value	0	0	0	0
Maximum value	100.00	5.00	3046.00	169.00

^aAssuming normal distribution.

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nants, or as part of the native microflora. The degree of thermonuclease inactivation effected by the isolates varied; however, any loss in thermonuclease activity may be undesirable when only low levels are present in foods being screened for the presence of *S. aureus*. Therefore, the thermonuclease test might not serve as a reliable indicator of prior growth of *S. aureus* in food if: (a) *S. faecalis* subsp. *liquefaciens* also had been present in the food, (b) TIF had been produced and (c) the proper environmental conditions had obtained in the food to allow expression of TIF activity.

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