

Epidemic Infestations of Wheat by a Dermestid, *Trogoderma glabrum* (Herbst)¹

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Prior to 1954, infestation of stored grain in the United States by dermestids was of a very minor nature. While their occurrence in grain was fairly common, none of the species was taken in large numbers. During the fall of 1954, however, severe infestations of *Trogoderma glabrum* (Herbst) were observed in wheat stored on Commodity Credit Corporation (hereinafter referred to as CCC) bin sites at Beloit and LaCrosse, Kansas. This species was first described from North America by Beal (1954). Beal (1956, pp. 561-562) states "There is little question but that *Trogoderma boron* Beal is identical with the Palearctic *glabrum* (Herbst)." During 1955 and 1956 the species has demonstrated its ability to develop and maintain large populations in stored wheat and shelled corn at about the same magnitude as its close relative, the khapra beetle (*Trogoderma granarium* Everts), has done in stored barley and grain sorghum in Arizona and California.

With the discovery of severe infestations in Kansas, personnel of the U. S. Department of Agriculture Stored-Product Insects Laboratory, located at Manhattan, Kansas, began preliminary observations on population trends, effect of environmental factors, and exploratory control measures. In May of 1956, the authors initiated a more intensive study of the entire dermestid problem in Kansas grain, with emphasis on *T. glabrum*.

DISTRIBUTION.—During 1955 and 1956, large numbers of dermestid specimens from many localities have been collected and received, and identifications were made by taxonomists of the U. S. Department of Agriculture in Washington, D. C. These records show *T. glabrum* to be widely distributed in Kansas, and show it also to occur in South Dakota, Nebraska, Missouri, Colorado, Minnesota, Illinois, California, Idaho, Washington, New Mexico, Alabama, and Iowa.

Trogoderma inclusum LeConte appears to be predominant in Oklahoma, particularly in farm-stored grain, and

may become a problem in the near future. In eastern Colorado, *T. glabrum* and *T. parabile* Beal have been found in CCC stored grain with the majority of the dermestid population being *T. parabile* Beal. *Trogoderma teukton* Beal (1956, p. 565) has been found as far north as Fargo, North Dakota.

POPULATION TRENDS.—The stored hard red winter wheat in which serious infestation developed in the fall of 1955 was of the 1952 crop and was delivered from farm storage to CCC bin sites in May 1953. A number of bins of that wheat were reserved for experimental work. It was in some of these bins that the infestation by *T. glabrum* was first observed. At the time of delivery of the wheat, no dermestids were noted. Consequently, when the outbreak developed in the fall of 1954, the source of the original infestation was doubtful.

In the spring of 1956, samples of wheat were taken directly from trucks as the grain was delivered in satisfaction of the CCC loans. These samples, which were drawn from widely scattered and representative counties of Kansas, showed that nearly 10% of the wheat delivered from farm storage was infested with *T. glabrum*.

The populations which developed in circular metal bins of 3,300-bushel capacity are shown in table 1.

DISTRIBUTION OF THE POPULATION IN THE GRAIN BULK.—In the spring of 1956, five circular metal bins, each of 3,300-bushel capacity, were reserved for ecological observations in order to determine distribution, abundance, and migration habits of dermestids in stored grain. Four of the five bins contained hard red winter wheat with a moisture content below 11%. The fifth bin contained No. 2 yellow corn with a moisture content below 10%. From May to November, samples were drawn with a 5-foot grain trier once each week from 24 to 32 locations in

¹ Accepted for publication January 10, 1957.

Table 1.—Development of infestation by *Trogoderma glabrum* in hard red winter wheat stored in 3,300 bushel, circular, metal bins, Beloit, Kansas, June 16, 1953 to October 24, 1956.

DATE SAMPLED	SURFACE POPULATION PER 1,000 GRAMS OF WHEAT	
	Adults	Larvae
1953		
June 16	0	0
August 3	0	0
August 26	0	0
Sept. 24	0	0
Oct. 2	0	0
Nov. 25	0	0
Dec. 24	0	0
1954		
Jan. 18	0	0
Feb. 10	0	0
March 21	0	0
April 20	0	0
May 20	0	0
June 29	0	0
July 23	0	0
Aug. 24	0	2
Sept. 20	0	30
Oct. 28	0	0
Nov. 12	0	10
Dec. 11	0	10
1955		
Jan. 15	0	0
Feb. 14	0	0
March 14	0	0
April 12	0	10
May 13	0	60
June 9	0	4
July 13	0	400
Aug. 16	0	1600
Fumigated because of excessive insect population		
1956 ^a		
May 24	0	112
June 20	16	12
July 2	54	0
July 26	15	16
Aug. 10	194	140
Aug. 21	38	142
Sept. 7	0	46
Sept. 18	0	12
Sept. 27	0	17
Oct. 3	0	14
Oct. 10	0	7
Oct. 24	0	6

^a The following observations were continued later in a comparable bin at the same site.

each bin. The insect populations were determined by the examination of these samples. Each sample contained about 500 grams of wheat.

Ten 500-gram samples were taken at intervals of 6 inches from the surface to a depth of 5 feet. Twelve 500-gram horizontal surface samples were taken, 10 of which were taken at 1-foot intervals from the perimeter of the bin toward the center. Five-foot samples of 500 grams each were taken at the center top, center middle, and center bottom of the bin. All of the samples were examined and the number and species of insects were recorded according to location. Fluctuations in the dermestid population within the grain mass were thus observed.

Tables 2 and 3 show the monthly distribution, location, and magnitude of the *T. glabrum* population in wheat stored in a circular metal bin of 3,300-bushel capacity.

It may be noted from table 3 that 74.2% of the infestation was located in the surface grain in June, 70% in July, 68.8% in August, 53.7% in September, and 21% in October. The top foot of the grain contained 95.9% of the infestation in June compared with 39% in October. These data indicate that there is a downward movement of *T. glabrum* with the advent of cooler weather in the fall.

Tables 2 and 3 also show the monthly population distribution of *T. glabrum* in a 3,300-bushel circular metal bin

For Table 2 see next page

containing shelled No. 2 yellow corn. In comparing the population and distribution of the *T. glabrum* in the corn and wheat bins, it is evident from tables 2 and 3 that more dermestids were below the 5-foot level in corn than in wheat.

EXPLORATORY CONTROL STUDIES.—Some preliminary dermestid control work done in the fall of 1955 showed that standard dosages of common liquid grain fumigants were insufficient to kill the dermestid population in the surface grain. Additional field studies were initiated in June 1956. Eight fumigant mixtures and three protectants were applied to grain stored in circular metal bins of 3,300 bushel capacity. All of these bins were infested with *T. glabrum*. After the treatments were applied, samples were drawn at monthly intervals from each bin.

Of the 11 materials tested in 1956 only calcium cyanide, liquid HCN, and methyl bromide showed promise of being useful. The data are incomplete because the work is still in progress at the time of preparation of this paper.

Trogoderma glabrum is difficult to control with fumigants in stored grain because of its habit of concentrating in the top foot of the grain mass, with the majority of this population being in the surface 2 inches, especially in wheat. It is difficult to maintain a lethal concentration of fumigant in this portion of the grain mass. While no widespread serious damage to stored grain by *T. glabrum*

Table 3.—Percentage of live dermestids present at different levels in circular metal 3,300-bushel bins of grain. Concordia, Kansas. 1956.

DEPTH	JUNE	JULY	AUGUST	SEP-TEMBER	OCTOBER
<i>Wheat</i>					
Surface 2"	74.2	70.0	68.8	53.7	21.0
2"-12"	21.7	17.2	14.0	16.12	18.0
1'-2'	2.5	7.9	10.5	10.8	26.0
2'-3'	1.0	2.0	4.24	13.9	20.0
3'-4'	0.3	1.4	1.4	2.1	12.0
4'-5'	0.3	1.5	1.0	3.2	3.0
5'-10'	0.0	0.0	T ^a	T ^a	0.0
10'-15'	0.0	0.0	0.0	0.0	0.0
<i>Shelled Corn</i>					
Surface 2"	73.0	37.0	25.0	42.0	16.6
2"-12"	18.0	18.0	7.0	4.0	T ^b
1'-2'	0.0	18.0	22.0	21.0	16.6
2'-3'	T ^b	12.0	18.0	12.5	16.6
3'-4'	T ^b	8.0	14.0	12.5	16.6
4'-5'	9.0	4.0	11.0	4.0	25.0
5'-10'	0.0	0.0	2.0	4.0	8.6
10'-15'	0.0	2.0	T ^b	0.0	0.0

^a Trace—less than 0.1 dermestid per 1,000 grams of wheat.

^b T=Less than 1%.

Table 2.—Distribution and magnitude of population of *Trogoderma glabrum* in grain stored in 3,300-bushel circular metal bins, Concordia, Kansas, 1956.

SAMPLE LOCATION	LIVING DERMESTIDS PER 1,000 GRAMS OF GRAIN									
	June		July		August		September		October	
	Adults	Larvae	Adults	Larvae	Adults	Larvae	Adults	Larvae	Adults	Larvae
<i>Wheat</i>										
Horizontal surface samples										
Center, radial 5 feet	16	12	34	8	116	141	0	25	0	9
South half, 5 radial probes, distance from bin perimeter										
1 foot	46	16	32	129	50	185	1	29	0	15
2 feet	86	26	205	153	85	291	2	58	0	11
3 feet	72	44	65	101	147	322	0	33	0	6
4 feet	54	22	174	34	150	387	2	43	0	6
5 feet	22	14	44	158	140	305	3	32	0	2
North half, 5 radial probes, distance from bin perimeter										
1 foot	204	104	94	171	137	379	3	109	0	19
2 feet	268	174	110	151	114	420	13	153	0	17
3 feet	184	166	141	143	134	445	5	198	0	19
4 feet	266	112	101	149	125	400	4	247	0	21
5 feet	222	124	125	142	90	403	9	131	0	26
Vertical samples (center)										
Top 5 feet	0	0	0	0	2	8	0	0	0	1
Middle 5 feet	0	0	1	7	0	1	0	1	0	0
Bottom 5 feet	0	0	0	0	0	0	0	0	0	0
Composite samples										
6 inches	66	28	30	60	20	118	0	42	0	13
1 foot	18	8	4	16	6	36	0	19	0	9
1.5 feet	2	4	0	20	4	83	0	14	0	17
2 feet	0	8	0	30	2	45	0	25	0	17
2.5 feet	0	2	0	6	0	27	0	31	0	9
3 feet	0	4	0	7	0	26	0	21	0	18
3.5 feet	0	2	2	5	0	16	0	7	0	11
4 feet	0	0	2	0	0	12	0	1	0	5
4.5 feet	2	0	0	2	0	4	0	3	0	2
5 feet	0	0	0	8	1	8	0	8	0	2
<i>Shelled Corn</i>										
Horizontal surface samples										
Center, radial 5 feet	14	4	9	11	25	6	11	0	T ^a	0
South half, 5 radial probes, distance from bin perimeter										
1 foot	21	8	26	27	40	17	34	16	2	5
2 feet	14	17	15	12	25	24	13	10	0	1
3 feet	14	3	11	15	31	23	19	6	1	5
4 feet	8	3	15	12	27	24	8	2	0	1
5 feet	3	4	8	7	13	6	3	1	1	0
North half, 5 radial probes, distance from bin perimeter										
1 foot	8	8	21	11	45	27	33	7	33	T ^a
2 feet	6	10	27	10	25	16	8	5	2	T ^a
3 feet	6	4	26	17	37	31	15	5	1	2
4 feet	4	0	28	18	19	9	10	3	2	5
5 feet	5	0	28	21	26	9	6	4	T ^a	1
Vertical samples (center)										
Top 5 feet	1	0	6	1	3	9	0	0	0	0
Middle 5 feet	0	0	1	0	T ^a	3	0	1	0	2
Bottom 5 feet	0	0	2	0	0	T ^a	0	0	0	0
Composite samples										
6 inches	4	1	6	8	3	6	T ^a	1	0	2
1 foot	0	1	7	16	2	11	2	1	0	1
1.5 feet	0	0	3	18	3	36	1	8	0	5
2 feet	0	0	4	10	3	35	0	11	0	2
2.5 feet	0	0	3	13	1	18	0	7	0	5
3 feet	2	0	3	8	1	25	0	6	0	3
3.5 feet	1	0	1	10	0	16	0	8	0	5
4 feet	0	0	3	3	1	32	T ^a	3	0	3
4.5 feet	2	1	3	5	1	14	2	T ^a	0	4
5 feet	2	0	1	1	3	16	0	3	0	5

^a T—Less than one dermestid per 1,000 grams of corn.

has as yet been recorded, the fact that the species is common in farm-stored wheat, together with its ability to build up to intense populations in grain stored for prolonged periods, makes it a potentially destructive pest.

SUMMARY.—Prior to 1954, dermestid infestation of stored grain in the United States was fairly common but of a very minor nature. During 1954 severe infestations of *Trogoderma glabrum* (Herbst) developed in wheat stored on Commodity Credit Corporation bin sites at Beloit and LaCrosse, Kansas. It is also present in farm-stored wheat. The species exhibits a strong tendency to infest the upper portions of the grain bulk.

Preliminary control work has demonstrated that

standard dosages of common liquid grain fumigants were insufficient to control the infestation in the surface grain. Of 11 treatments tested during 1956 only three exhibited promise of being useful as a means of control.

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Reprinted from the
JOURNAL OF ECONOMIC ENTOMOLOGY
Vol. 50, No. 4, pp. 382-385, August 1957

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Agricultural Marketing Service
U. S. Department of Agriculture