

mount, the wood may be carefully sandpapered and painted. A dark green or black finish is quite satis-

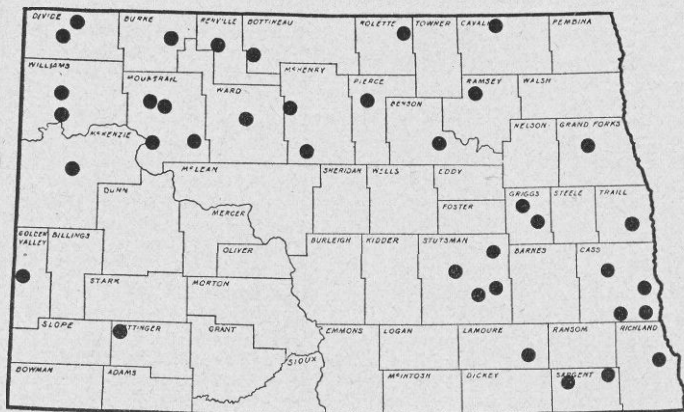
factory. The cost of materials for one of these mounts (4" by 5") is slightly over four cents.

# The Grain Storage Insect Problem in North Dakota

Survey Shows That the Flat Grain Beetle Is Predominating Species

By  
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**M**UCH concern has been expressed of late by representatives of the grain trade regarding the possible insect pest situation in farm bins and grain elevators of the state. While grain storage insects are seldom troublesome in North Dakota, it is felt that, considering the present unusually large carry-over of grain from previous years, a survey of the situation would be of particular interest. Accordingly, a study to determine the occurrence and distribution of these insects has been conducted. The results indicate that the insect pest situation while not serious, at the present time, is of sufficient interest to justify presentation. This investigation is based upon samples of grain received voluntarily from farmers and owners of grain elevators and also as a result of a form letter sent to more than 1100 elevator operators in all parts of the state requesting infested grain samples.<sup>1</sup>

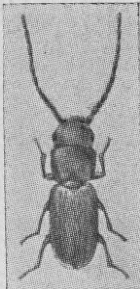


Map showing origin of infested samples

While any one or more of a number of species injurious to stored grain may be found in an infested

bin, the most common insect encountered of late is the flat grain beetle. This beetle is reddish brown

<sup>1</sup>This survey was conducted by the NDAC Experiment Station and Agricultural Extension Service in cooperation with the Marketing Service of the United States Department of Agriculture. Assistance in laboratory routine was rendered by personnel of the National Youth Administration and Work Projects Administration.



The most common insect encountered of late in stored grain is the flat grain beetle.



The granary weevil attacks sound kernels, eating the center and reducing the grain to mere hulls.

in color, flattened in appearance, about 1/16 of an inch in length, and most abundant in grain of a high moisture content. The saw-toothed grain beetle, about the same color but slightly larger than the former species, is characterized by six tooth-like projections on each side of its thorax (suggesting its name), and is an occasional pest. A species commonly encountered is the granary weevil. This weevil is about one-sixth of an inch in length, dark brown in color and characterized by a snout-like prolongation of the head. The granary weevil attacks sound kernels, eating the interior and reducing the grain to mere hulls.

Occasionally the meal snout moth and its larvae are found in infested bins where the grain is fairly damp. The larvae spin a silken webbing which fastens the particles together in a web-like manner. Meal worms, the larvae of tenebrionid beetles, also thrive in accumulations of grain, especially so if the grain is in contact with damp wooden flooring. The worms seldom cause appreciable damage except in grain which is allowed to remain undisturbed over long periods of time. These worms frequently burrow into the wooden walls or floors of bins causing severe injury to the structure. For a more detailed account of the various species the reader is referred to U.S.D.A. Farmers Bulletin No. 1811 on the Control of Insects Attacking Stored Grain, or a special mimeographed circular entitled Insect Pests of Stored Grain and Their Control

prepared by Dr. F. Gray Butcher, Extension Entomologist. The bulletin or circular may be obtained through your County Extension Agent.

Most insects while feeding upon the grain release moisture and warmth from their bodies, which tends to increase the moisture content of the grain and aggravate heating problems. Excess moisture in the grain favors the development of these stored grain pests.

### Sanitation Is Important

Wherever possible the conditions about farm bins and grain storage elevators should be maintained, insofar as possible, to discourage the introduction or establishment of grain storage pests. Frequently the insects may be brought in from outside places in old grain sacks or infested grain, and once established in new bins, they become difficult to eradicate. Sources of infestation are often maintained from year to year in refuse grain or waste material in which the insects breed. Such material should be gathered up and treated or destroyed because if neglected it serves as a continual source of re-infestation. Before placing new grain in old bins, the bins should be carefully inspected and if such inspection reveals the presence of weevils or other insects injurious to stored grains, steps should be taken to destroy the pests.

There are several proprietary mixtures sold under various trade names on the market which are effective in destroying grain storage insects and do not have the objectionable fire hazard feature. One of these is a mixture of Ethylene Dichloride and Carbon Tetrachloride. The containers of these proprietary mixtures are labeled and accompanied by the manufacturer's directions for using the material. Care should be observed that the directions are followed in their use.

### Temperatures Important

For successful fumigation it is important that the temperature of the infested grain be at least 60°F. or above and that the bins be constructed so that loss of the gas through openings and crevices is avoided. Most satisfactory temperatures for fumigation occur in summer, and, except under unusual circumstances, fumigating should be

done then. Bins that are properly constructed and do not permit the wastage or leakage of gas require the minimum of fumigant or material. Since all fumigants are deadly gases when inhaled in suffi-

cient quantity, extreme care should be observed in their use.

Where operators of grain elevators and owners of farm storage bins wish to use carbon disulfide, they are warned to be particularly care-

DISTRIBUTION OF SPECIES<sup>2</sup>

No.	Locality	Flat grain beetle*	Granary weevil	Foreign grain beetle	Saw-toothed grain beetle	Spider beetles	Confused flour beetle	Red flour beetle	Small-eyed grain beetle	Meal worms	Meal snout moth	Psocids	Grain mites**
1	Amenia												
2	Beach		X		X					X			
3	Bergen	X						X					
4	Binford	X							X				
5	Bowbells	X											
6	Cooperstown	X					X						
7	Courtenay	X											
8	Crosby	X										X	X
9	Crosby	X											
10	DeLamere	X	X	X									
11	DesLacs	X											
12	Epping	X											
13	Fargo	X											
14	Fortuna (No Insects)										X		
15	Calchutt	X											
16	Hannah	X											
17	Hickson	X					X						X
18	Hillsboro	X											
19	Jamestown									X			
20	Jamestown		X										
21	Lansford	X	X										
22	Lattimore	X	X										
23	LaMoure	X		X									
24	Medina (No Insects)												
25	Michigan (No Insects)												
26	Minnewaukan	X											
27	Napoleon (No Insects)												
28	New England	X	X										
29	Norwich	X											
30	Plaza	X											
31	Rolls	X											
32	Rugby	X											
33	Sanish										X		
34	Spiritwood	X											
35	Stanley				X	X	X						
36	Stanley												
37	Starkweather												X
38	Sturum		X										X
39	Tolley	X						X					
40	Watford City	X											
41	Webster (No Insects)										X		X
42	Williston						X						
43	Woods	X	X	X								X	
	TOTALS	23	7	3	2	1	4	2	1	2	2	3	5

\* In seven of the 23 samples received, containing the flat grain beetle, parasitic wasps were present. To what extent this parasite may be a natural factor in holding the flat grain beetle in check is an open question.

\*\*Not insects, but closely related to spiders.

<sup>2</sup> Granary weevil, *Sitophilus granarius*.  
 Saw-toothed grain beetle, *Oryzaephilus surinamensis*.  
 Foreign grain beetle, *Ahasverus advena*.  
 Flat grain beetle, *Laemophloeus minutus*.  
 Spider beetle, *Ptinus fur*.  
 Small-eyed flour beetle, *Patorus ratzeburgi*.  
 Confused flour beetle, *Tribolium confusum*.  
 Meal snout moth, *Pyralis farinalis*.  
 Meal worm, *Tenebrio molitor*.  
 Psocids, probably *Troctes divinatorius*.  
 Red flour beetle, *Tribolium castaneum*.  
 Grain mite, probably *Tyroglyphus farinae*.

ful in the handling of this fumigant. Carbon disulfide (sometimes referred to as carbon bisulfide) is **inflammable and explosive** and many insurance companies refuse to pay claims resulting from fires and explosions caused by its use. While carbon disulfide is an effective fumigant, it should be understood that the operator uses it entirely at his own risk. It is as readily ignited as high test gasoline by open flame, sparks, and burning tobacco. Therefore lighted matches and tobacco, sparks and open flame of any kind should be kept away from any place where this gas is being used. Under satisfactory bin and temperature conditions carbon disulfide is applied at the rate of about 1½ gallons per 1,000 bushels of grain. Where temperature and bin conditions are not satisfactory, this dosage may have to be doubled. This fumigant material is usually applied by sprinkling it over the surface of the grain. The fumes being heavy penetrate deeply into the grain.

The most important natural aid in holding these insects in check is a fairly dry climate, characterized by cold winters. Such a situation exists in this northern section of the Great Plains States and is the reason why storage insects are nowhere near the problem they are

in warmer and more humid areas of this country.

### Cold Weather Helps

Practical application of cold weather in the control of grain storage insects is frequently applied by grain elevator operators and owners of farm bins who have facilities for aerating the infested grain during sub-zero weather. It is accomplished by moving the grain by conveyors from one bin to another during the coldest weather in winter and may coincide with the cleaning of the grain. While exposure of the insects in this manner to low temperatures may not be of sufficient duration to destroy all the insects, it will at least cool the grain sufficiently to maintain the surviving insects in a dormant state until conditions are favorable for bin fumigation. From the data available on the lethal temperatures of several of our stored grain insects, it is highly probable that if grain is subjected to zero temperatures for several hours, all stages of the more important species are killed.

For information on the bin temperatures of grain in storage during the winter months, the reader is referred to the next article in this issue of the Bimonthly by Thomas E. Long.

## Temperature of Wheat in Bins of Various Construction\*

By THOMAS E. LONG, Assistant Agricultural Engineer  
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**I**N the preceding article is pointed out the desirability of moving the grain from one bin to another during the coldest portion of winter to aid in the control of stored grain insects. Such a procedure should be particularly useful when combined with cleaning operations of the grain because it would accomplish a two fold purpose—the cleaning of the grain and chilling the contents of the bin in a more uniform manner than would otherwise occur.

\* These data are from results on the Farm Grain Storage Project located at Fargo. This work is on a cooperative basis between the North Dakota Agricultural Experiment Station and the Bureau of Agricultural Chemistry and Engineering, Agricultural Marketing Service and Bureau of Plant Industry, U. S. Department of Agriculture.