INSECT INFESTATION IN WESTERN CANADIAN GRAIN LOADED IN RAILWAY CARS AT PRIMARY ELEVATORS

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Introduction

During the storage and transport of cereal grains, pest control procedures are applied at as many points as possible in the system to eliminate insect populations. Grain exported from Canada must be substantially free of any live insects. Measurements of insect populations have been made in a terminal elevator (Smith and Loschiavo 1979) and in railway boxcars (Loschiavo 1974). Sampling of farm granaries has also been conducted (Liscombe and Watters 1962). Some of these measurements were based on too small a sample to give a reliable estimate of the population. Therefore, a programme was begun to re-assess some of these measurements. The estimate of infestation of grain loaded on boxcars was selected as one that needed to be reassessed with a different method. The method and the results obtained by using it are reported in this paper.

Method

Five primary elevators within an area 50 km south and west of Winnipeg, Manitoba, were chosen for sampling once a month from the beginning of summer until the grain shipments declined in the cold weather. The objective was to sample grain being loaded into 4 railway cars at each elevator each month. Sometimes this was not possible because not enough cars were loaded at the elevators that month.

To collect the sample, a grain scoop holding 100 g of wheat was drawn through the stream of grain as it dropped from an elevator bin into the scale hopper which held about 1.4 t (50 bu) of wheat. In 1977, a sample of 1 kg (1600 cc) of grain was collected from each hopper of grain; in 1978, 2 samples of 500 g (800 cc) from each hopper of grain, in an attempt to improve the accuracy of the estimate. About 35 samples were collected at random from the grain loaded into a boxcar; about 65 samples were collected from hopper cars. Samples were taken from 103 boxcars and 22 hopper cars in 1977 and 113 boxcars and 23 hopper cars in 1978. The amount of grain in a boxcar, averaged 52 t (114,000 lb) and ranged from 36 to 71 tonnes (79,470 to 156,000 lb). Hopper cars held an average of 84 t (185,000 lb) of grain and ranged from 74 to 92 t (162,000 lb to 202,400 lb).

The temperature of every 10th sample was taken at the elevator immediately after sample collection. Moisture content was measured on a Halross moisture meter at the laboratory, before each sample was placed in a Berlese-Tulgren funnel to remove live insects and mites. Adults and larvae of the insects were counted but mite numbers were estimated only.

Results

Insects Found - Nine different kinds of insects were found in the samples as well as mites. Mites were found most frequently, followed by the rusty grain beetle, Cryptolestes ferrugineus (Stephens) (Fig. 1). Three other major pests were found rarely: red flour beetle Tribolium castaneum Herbst, sawtoothed grain beetle Oryzaephilus surinamensis (L.), and granary weevil Sitophilus granarius (L.). Three kinds of scavengers were found relatively frequently, psocids, dermestid larvae and fungus beetles. The depressed flour beetle, Palorus subdepressus (Wollaston), was found in 5 railway cars and

Table 1. Infestation of Railway Cars Sampled at Primary Elevators in 1977 and 1978.

	1977[1]		1978[2]	
	# Railway Cars	Per Cent	# Railway Cars	Per Cent
Mites (Acarina)	97	78	122	90
rusty grain beetle (C. ferrugineus)	47	38	72	53
black flour beetle (Tribolium audax)	4	3	1	0.7
sawtoothed grain beetle (O. surinamensis)	2	2	5	4
granary weevil (S. granarius)	0	0	1	0.7
yellow mealworm (Tenebrio molitor)	2	2	0	0
depressed flour beetle (palorus subdepressus)	2	2	3	2
Dermestids (Dermestidae)	16	13	24	18
Fungus beetles (Lathridiidae, Cryptolophagidae)	16	13	4	3
Psocids (Psocoptera)	25	20	22	16

[1]Total Railway Cars in 1977 = 125

[2]Total Railway Cars in 1978 = 136

yellow mealworm Tenebrio molitor (L.), in 2 over the 2-year sampling period.

The frequency of occurrence of C. ferrugineus increased in July and remained at relatively high levels until October in 1977 and November in 1978. The other insects did not occur often enough to exhibit a pattern of seasonal occurrence.

Comparison of Infestation at Primary and at Terminal Elevators - An attempt was made to relate the infestation of C. ferrugineus detected at primary elevators with that found at the terminal elevators in Thunder Bay, Ontario. At the terminal elevators a composite sample of 14 kg was taken from each railway car from which 1 kg was sent to the Plant Products and Quarantine office to be examined for insects. In 1977, only 26 of the 125 railway cars sampled were located for re-checking at the terminal elevators. No infested railway cars were found in this group at the terminal elevator although infestation was detected in 3 at the primary elevator. In 1978, the railway cars sampled at the primary elevators were identified by stamping the words "Research Sample" in red on the loading ticket that is placed on the railway car at the primary elevator and removed on arrival at the terminal elevator. In that year, 81 of 136 railway cars sampled at the primary elevator were re-checked. Five (6.2%) of the railway cars infested at the primary elevator were detected at the terminal elevator. One railway car that had been classed as free of infestation at the primary elevator was classed as infested at the terminal elevator. In contrast, 52 cars infested at the time of loading were not detected at the terminal elevators.

Infestation in Grain Delivered to the Primary Elevator - Occasionally, grain was transferred directly from a farmer's truck to the railway car if it was the same type and grade of grain being loaded in the railway car. Usually, grain from an elevator bin was added to fill the car. Since samples were taken from the grain as it was unloaded from the truck, the infestation of C. ferrugineus in railway cars from this source could be estimated. In 1977, 17 railway cars containing some grain from a farm truck were sampled, and 29 in 1978. In 1977, only the farmer-delivered grain was infested in 3 railway cars (18%), both farmer-delivered grain and grain from the elevator was infested in 1 railway car (6%), and only grain from the elevator was infested in 5 railway cars (29%). This group of railway cars was 14% of all railway cars sampled in 1977. Only 3.2% of the entire group of 125 railway cars were infested from farmer-delivered grain compared to 35% that were infested from the grain in the elevator.

In 1978, no carloads were infested solely from farmer-delivered grain, 7 (24%) were infested from both the farmer-delivered grain and the grain in the elevator, and 6 (21%) were infested only from grain in the elevator. This group of railway cars was 21% of the 136

railway cars sampled in 1978. The estimate of railway cars that could have been infested from farmer-delivered grain was 5.2% compared to 48% that were infested from grain in the elevator.

Conclusions

About 40 to 50% of the railway cars sampled were infested with C. ferrugineus at the time of loading at the primary elevator. At unloading at the terminal elevator about 6% or less of the infested railway cars were detected. No more than 5.2% of infested carloads of grain could be attributed to infestations on farmer-delivered grain, the majority of infestation comes from grain stored in the primary elevator.

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