

Insect Pests of Stored Grain



Insect Pest Population Potential

- Insects are 1/16 to ½ inch depending on the species.
- Large numbers insects in small amounts of debris.
- 500 female insects
- each female produces 200 offspring
- 10 million insects in two generations.

Adapted from the Penn State University Agronomy Guide



Store Grain Insects Economic Damage

- Lose up to 10% of the grain weight in a full storage bin
- grain bin containing 30,000 bushels of corn valued at \$3.00 per bushel would lose \$9,000
- The loss does not include dockage or the cost of eliminating the insects from the grain.

Adapted from the Penn State University Agronomy Guide



Sampling for Bugs



Looking for Bugs

Docking screens can be used to separate beetles from the grain.



Primary Stored Grain Feeders in NYS

Weevils

- Granary Weevil
- Rice Weevil
- Maize Weevil

Beetles

- Lesser Grain Borer

Moths

- Angoumois grain moth



Weevils Have Snouts!



Maize Weevil



Lesser Grain Borer



Granary weevil

Sitophilus granarius (L.)

- polished, blackish or brown.
- 3/16 of an inch long
- no wings
- Not in the field
- longitudinal punctures-
thorax
- 80-300 eggs laid
- One egg per grain kernel
- corn, oats, barley, rye,
and wheat



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Rice Weevil (*Sitophilus oryzae*)

- 3/32 of an inch.
- reddish brown to black
- Small round pits-thorax
- Has wings with yellow markings
- Lays 80-500 eggs inside of grain
- One egg per grain kernel
- Start in the field
- wheat, corn, oats, rye, barley, sorghum, buckwheat, dried beans



Joseph Berger, Bugwood.org

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Maize Weevil

Sitophilus zeamais

- Very similar to rice weevil
- slightly larger
- 1/8 of an inch long
- Small round pits on thorax with a mid line.
- Darker than the rice weevil
- Wings with yellow markings
- Adults live 3 to 6 months
- Lays 80-500 eggs inside of grain
- Start in the field
- wheat, corn, oats, rye, barley, sorghum, buckwheat, dried beans

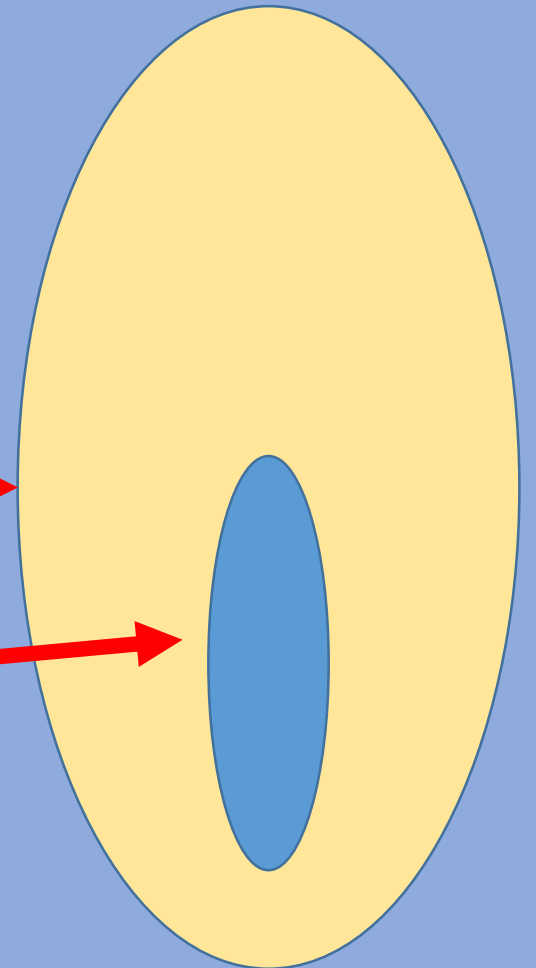


Life Cycle of the Weevil



**Chew a hole and
lay eggs inside a
kernel**

**Larvae feeds on
the inside of the
kernel**



Damage by Weevils

- Primary Pest
- 5% to 40% losses
- Cause secondary insects pests feed on fines
- Larger infestations can increase heat and moisture. Molds can occur.



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Lesser grain borer *Rhyzopertha dominica*

- 0.1 inch long
- brown to black beetles
- head directed downward
- Lay 200 and 500 eggs on the grain
- maize, oats, barley, rice, millet, sorghum, wheat, durum wheat



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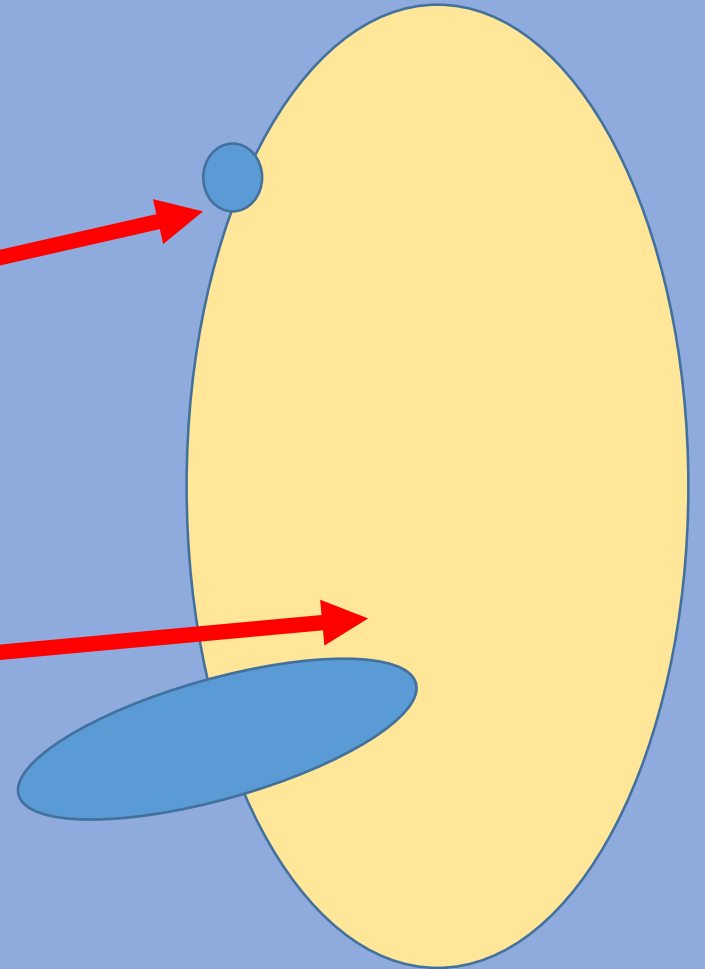
Life Cycle of the Lesser Grain Beetle



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Lay eggs on a kernel

Larvae chews its way inside



Lesser Grain Borer Damage

- Dust and fines
- Both larvae and adults feed on grain
- sweet, musty odor



Whitney Cranshaw, Colorado State University, Bugwood.org



Angoumois grain moth (*Sitotroga cerealella*)

Description

- Yellow-brown moth
- 1/3 inch long
- Wings are fringed on rear margins
- eggs white turn red.
- Larvae reach 1/5 inch long
- white-yellowish head.
- Infestations start in the field
- Mostly a pest of corn in a crib
- Larvae chew their way into the kernels



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Indian Meal Moth (*Plodia interpunctella*)

- Secondary Pest
- 3/16 – 7/16 inch
- 2/3 wing is reddish
- Has darker bands
- 1/3 of wing is grayish
- Hind wings have a fringe
- eggs laid within the pile grain
- Larvae feed on fines and broken parts of grain



ark Dreiling, Bugwood.org



Indian Meal Moth (*Plodia interpunctella*)

- Forty to 400 eggs
- Larvae are yellow-white
- About 1/2 inch
- Webbing



Whitney Cranshaw, Colorado State University, Bugwood.org

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Cornell Cooperative Extension



Integrated Pest Management

Saw-Toothed Grain Beetle (*Oryzaephilus surinamensis*)

- Secondary Pest
- 1/10 inch
- Lays an average of 375 eggs
- Feed on broken grain, fines and processed foods
- Saw tooth shape thorax
- It will NOT attack sound grain



Saw-Toothed Grain Beetle (*Oryzaephilus surinamensis*)



Mohammed El Damir, Bugwood.org



Cornell Cooperative Extension



Integrated Pest Management

Confused flour beetle (*Tribolium confusum*)



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- **Secondary Pest**
- **1/8 inch**
- **Eggs laid in broken grain area**
- **400-500 eggs**
- **Does not fly**
- **Does not attack sound grain**
- **3 segments on antennae**
- **Prefer feeding on the moist broken or proceeded grains**



Red flour beetle (*Tribolium castaneum*)



- 1/8 inch
- Eggs laid in broken grain area
- 400-500 eggs
- Does not attack sound grain
- Can fly
- 3 segments on antennae
- Prefer feeding on the moist broken or proceeded grains



Red flour beetle (*Tribolium castaneum*)



Frank Peairs, Colorado State University, Bugwood.org

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Integrated Pest Management

Book Lice-*psocids*



- Less than .1 inches
- Not true lice
- Associated with moisture
- Does not feed on grain
- Feeds on molds
- Do not bite
- Do not transmit diseases
- No need for insecticides
- Control moisture
- Some have wings



Secondary insect pests of stored grain

- Red flour beetle (*Tribolium castaneum*)
- Confused flour beetle (*Tribolium confusum*)
- Saw-toothed grain beetle (*Oryzaephilus surinamensis*)
- Flat grain beetle (*Cryptolestes* spp.)
- Indian meal moth (*Plodia interpunctella*)
- Warehouse moth (*Ephestia* spp.)
- Warehouse beetle (*Trogoderma variable*)
- Rusty Grain Beetle (*Cryptolestes* spp.)
- Foreign Grain beetle (*Ahasverus advena*)
- Merchant Grain beetle (*Oryzaephilus Mercator*)

Soybeans

- Bean weevil (*Acanthoscelides obtectus*)
- Cowpea weevils (*Callosobruchus* spp)
- Pea Weevil (*Bruchus pisorum*)



Main modes of Pesticide Application

There are four main modes of pesticide application for stored grain:

- 1. CLEAN-empty bin sprays**
- 2. grain protectants**
- 3. Topdressing**
- 4. Fumigation**

Adapted from the Penn State University Agronomy Guide



Stored Grain Insecticides Registered for use in New York State

Products registered in NY as of 8/24/2020. Note that this is not an exhaustive list; other product options may be available. Always read and follow label directions.

Compiled by: Mike Helms, Extension Support Specialist, Pesticide Management Education Program, Cornell University, Ithaca, NY

Active Ingredient	Trade Name	EPA Reg. No.	Restricted-use Pesticide in NY?	Labeled Use								
				Empty Bin Treatment	Corn	Barley	Oats	Soy-bean	Rye	Wheat	Comments	
Fumigation	aluminum phosphide (phosphine gas)	Weevil-Cide Pellets	70506-14	Yes		X	X	X	X	X	X	Several weevils, beetles, and moths listed; see label.
		Degesch Phostoxin Pellets	72959-5	Yes		X	X	X	X	X	X	Several weevils, beetles, and moths listed; see label.
		Detiaphos Pellets	72959-5	Yes		X	X	X	X	X	X	Several weevils, beetles, and moths listed; see label.
		Weevil-Cide Tablets	70506-13	Yes		X	X	X	X	X	X	Several weevils, beetles, and moths listed; see label.
		Detiaphos Pellets	72959-4	Yes		X	X	X	X	X	X	Several weevils, beetles, and moths listed; see label.
		Degesch Phostoxin Tablet Prepac	72959-9	Yes		X	X	X	X	X	X	Several weevils, beetles, and moths listed; see label.
Head Space	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i>	Dipel DF	73049-39	No		X	X	X	X	X	X	Indian meal moth, almond moth
		Javelin WG	70051-66	No		X	X	X	X	X	X	Indian meal moth, almond moth
	beta-cyfluthrin	Tempo SC Ultra	432-1363	Yes	X							Several beetles and moths listed; see label.
	diatomaceous earth (silicon dioxide)	Dryacide 100	69261-3-1381	No	X	X	X	X	X	X	X	For any stored grain insect.
		Desect Diatomaceous Earth Insecticide	7655-1	No	X	X	X	X	X	X	X	See label for list of pests controlled.
		Desect Ag	7655-1	No	X	X	X	X	X	X	X	See label for list of pests controlled.
		Diatomaceous Earth Crawling Insect Killer	73729-1-4	No		X	X	X	X	X	X	For any crawling stored grain insect.
	dichlorvos	Prozap Insect Guard	5481-533-47000	No		X	X	X	X	X	X	Any stored insect pest. See label for specific use instructions.
	deltamethrin	Suspend SC	432-763	Yes	X	X	X	X			X	See label for list of pests.
		D-fense SC	53883-276	Yes	X	X	X	X			X	See label for pest information.
Barricor SP		432-1597	Yes	X							See label for list of pests.	

Top Dress and/or Protectant



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					Corn	Barley	Oats	Rye	Soy-bean	Wheat		
deltamethrin + chlorpyrifos-methyl	Storcide II	264-992	No	X		X	X			X	Several pests noted. Also note use restrictions and equipment requirements when treating empty bin.	
deltamethrin + piperonyl butoxide	Centynal Synergized Insecticide	89459-115	No	X	X	X	X	X	X	X	All stored grain pests.	
deltamethrin + piperonyl butoxide + S-methoprene	Gravista Insecticide	89459-116	No	X	X	X	X	X	X	X	All stored grain pests.	
malathion	Malathion 5	9779-5	No	X							Only for use on storages being prepared to store wheat, oats, corn, rye, and barley. Several pests listed on label.	
	Malathion 57 EC	34704-108	No	X							Only for use on storages being prepared to store wheat, corn, oat, rye, and barley. Several pests listed on the label.	
Fumigation	phosphine + carbon dioxide gas	Eco ₂ fume Fumigant Gas	68387-7	Yes		X	X	X	X	X	X	Several beetles, moths, and weevils listed on the label.
	pirimiphos-methyl	Actellic 5 EC	1381-170	No		X						See label for specific beetles, weevil, and moths controlled.
	piperonyl butoxide	PBO-8 Synergist	89459-33	No		X	X	X	X		X	Used as an additive to improve control of insects. Product has no insecticidal effect of its own.
	pyrethrins + piperonyl butoxide	Prozap DyFly Aerosol Insecticide	47000-69	No	X	X	X	X	X		X	See label for specific pests controlled and use instructions.
		Stryker Insecticide Concentrate	53883-308	No	X	X	X	X	X		X	See label for specific pest list.
		Pyronyl Crop Spray	89459-26	Yes	X	X	X	X	X		X	See label for specific pest list.
		Zeposector –S _{II}	1021-2670-1270	No	X							See label for specific insects controlled.

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Active Ingredient	Trade Name	EPA Reg. No.	Restricted-use Pesticide in NY?	Empty Bin Treatment	Labeled Use					Comments	
					Corn	Barley	Oats	Rye	Soy-bean ¹		Wheat
pyrethrins	Evergreen Pyrethrum Concentrate	1021-2560	No	X	X	X	X	X	X ¹	X	Several insect pests listed on label. Can be used as a surface treatment of stored grain to control Indian meal moths, Angoumois grain moths, and Mediterranean flour moths. ¹ Label refers to beans as a crop.
	Evergreen Pyrethrum Dust	1021-1871	No	X							See label for specific insects controlled.
(S)-methoprene	Diacon IGR	2724-427	No	X	X	X	X	X	X	X	Various moths and beetles. Used to prevent larvae development into adults.
	Diacon-D IGR	2724-788	No	X	X	X	X	X	X	X	Various moths and beetles. Used to prevent larvae development into adults.
spinosad	Sensat	264-995	No		X	X	X			X	For all insect pests.



Review: An IPM Program includes:

1. grain bin and harvest equipment sanitation (**very important!!!**)
2. grain cleaning
3. uniform distribution of the grain during uploading into the bin
4. moisture management
5. temperature management
6. periodic grain monitoring
7. monitoring insect pests
8. residual insecticide treatment for long-term storage
9. fumigation as a last resort. If the first eight tactics are used effectively, fumigation should be needed only rarely.

Adapted from the Penn State University Agronomy Guide



Can lights on a grain bin attract insect pests

Following pests are attracted to lights

- Rice Weevil
- Maize Weevil
- Indian Meal Moths
- Lesser grain borer
- confused flour beetles
- Red flour beetles
- Angoumois grain moth

Following pests are NOT attracted to lights

- granary weevil

What suggestions do you have for killing bug harboring under the aeration floor?

- Clean it every 1 to 5 years

Where to place a pit fall trap in a grain bin

- Top Middle (Use a long pole to place it)
- Do NOT go in the bin
- If you have access to the top of the grain with a side door use that.

Using heat to kill insects in an empty bin

Heat treatment for disinfestation of empty grain storage bins

<https://pubag.nal.usda.gov/download/13276/PDF>

HEAT TREATMENT OF EMPTY STORAGE BINS AND GRAIN-PROCESSING FACILITIES: FACTORS INFLUENCING EFFICACY AGAINST ADULTS OF THE RED FLOUR BEETLE, TRIBOLIUM CASTANEUM (HERBST)

<https://core.ac.uk/download/pdf/77977809.pdf>

Questions?

