ACE Preparation Course

GENERAL PEST KNOWLEDGE:
STORED PRODUCT PESTS

Stored product pest familiarity list

Carpet beetles (Anthrenus and Attagenus species)**

Cigarette and drugstore beetle (Lasioderma serricorne and Stegobium paniceum)**

Flour beetles (Tribolium spp.)**

Hide and larder beetles (Dermestes species)**

Mites (stored product)**

Psocids (Order Psocoptera)**

Sawtoothed grain beetles (Oryzaephilus spp.)**

Spider beetles (family Ptinidae)

Weevils (family Curculionidae)**

Rice Weevil (Sitophilus oryzae)

Bean Weevil (Acanthocelides obtectus)

Cowpea Weevil (Callosobruchus maculatus)

Warehouse & Cabinet Beetles (Trogoderma spp.)**

Foreign Grain Beetle (Ahasverus advena)

Plaster Beetles (family Lathridiidae)

Red-Legged Ham Beetle (Necrobia rufipes)

Cadelle (Tenebriodes mauritanicus)

Flat Grain Beetle (Cryptolestes pusillus)

Mealworm Beetles (Tenebrio spp.)

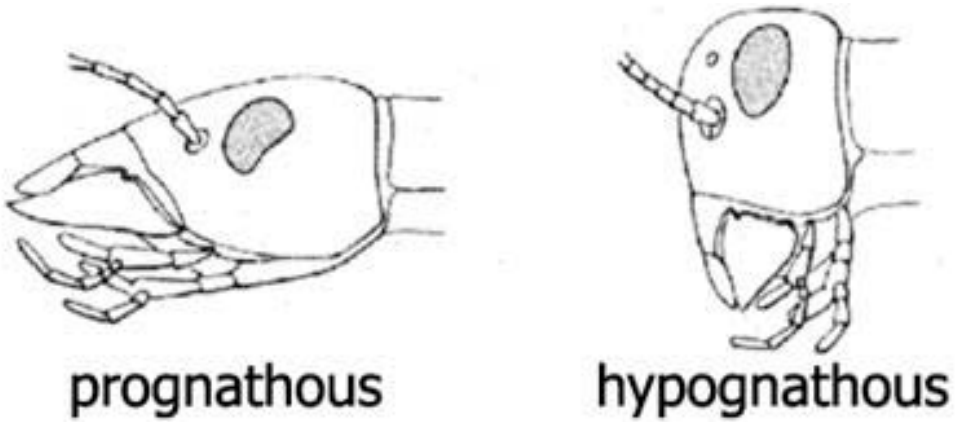
Mediterranean Flour Moth (Anagasta kuehniella)

Angoumois Grain Moth (Sitotroga cerealella)

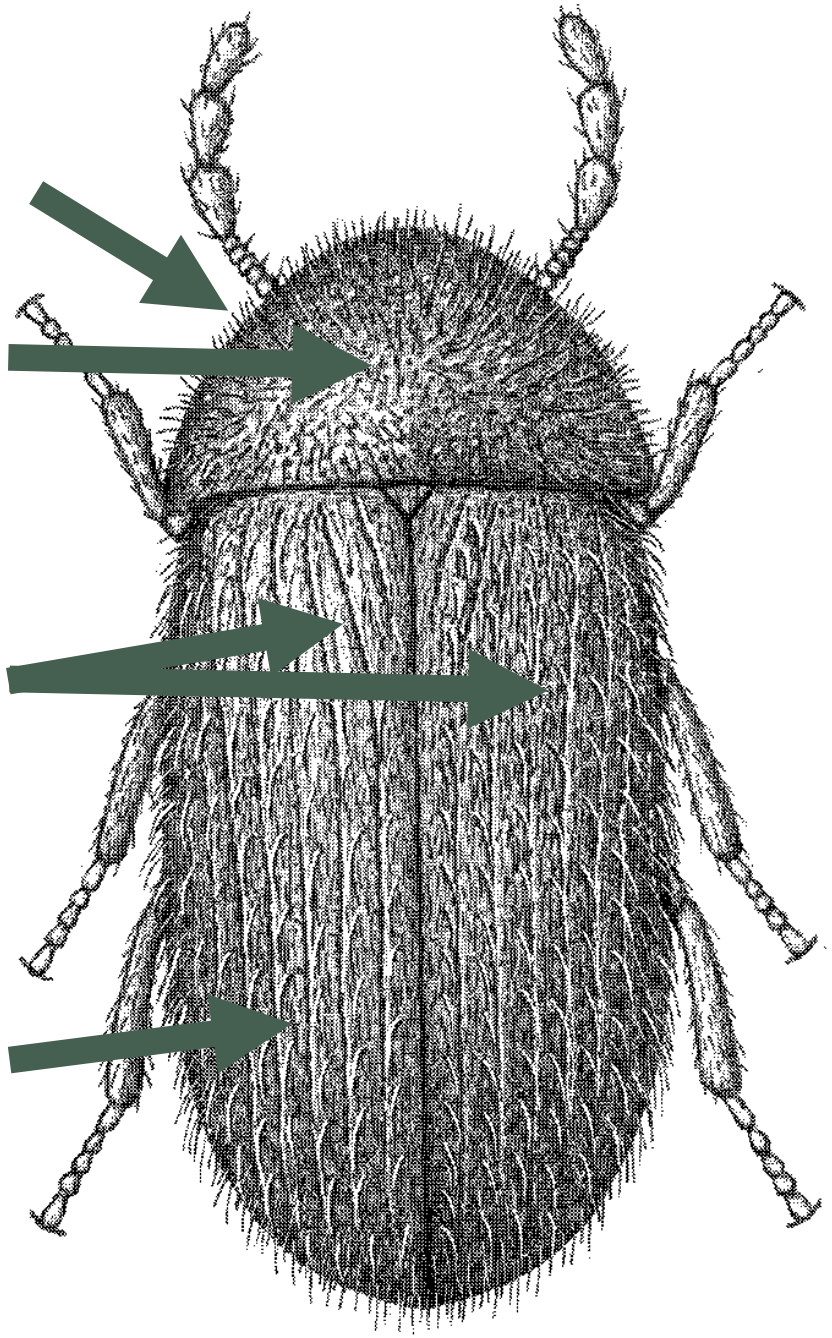
Indian meal moth (Plodia interpunctella)**

Tools for identification

Beetle anatomy

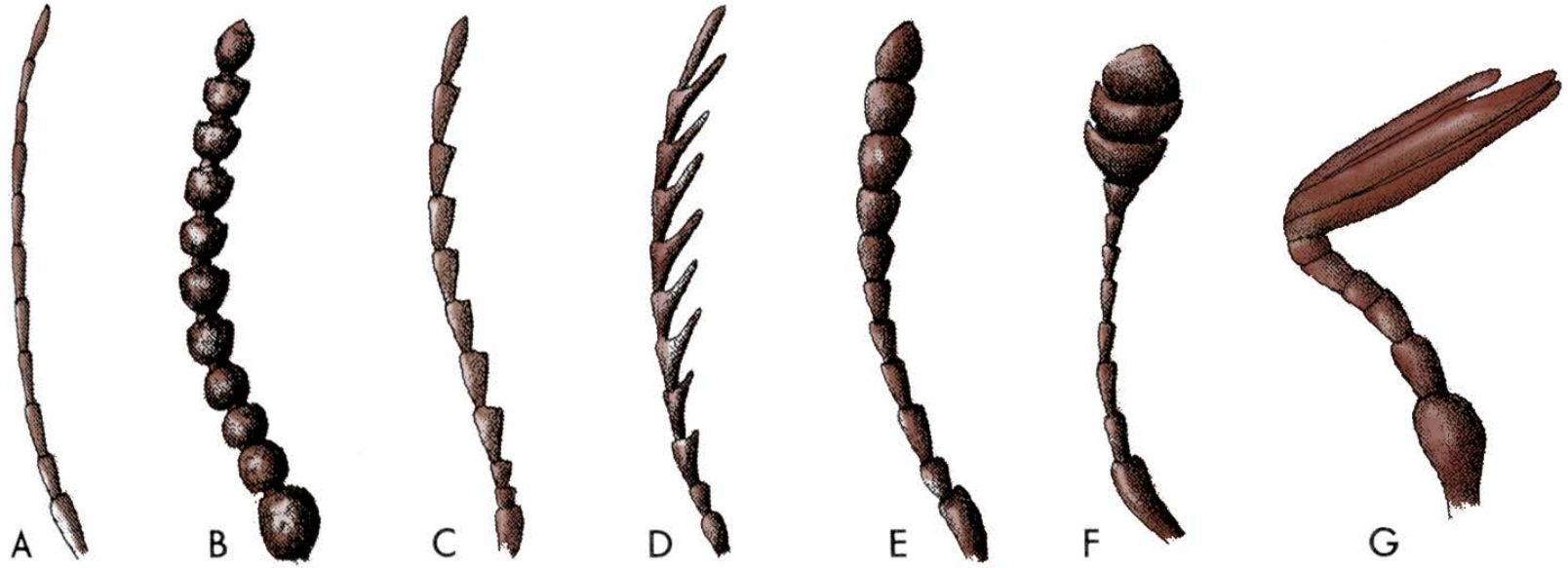


Head direction



Beetle antenna types

A. Threadlike
B. Beadlike
C. Saw-toothed (serrate)
D. Comb-like (pectinate)
E. Clubbed (gradual)
F. Clubbed (abrupt)
G. lamellate



Stored product pests

Where found:

- Homes, pantries
- Commercial food warehouses
- Food processing plants, shipping, warehouses
- Restaurants
- Museums
- Others

Commonly Infested Commodities

Products with plant proteins

- Farinaceous (grain-based) products
- Dried vegetables, fruits and nuts
- Spices, dried flowers, potpourri
- Chocolates and candy
- Dry pet food

Products with animal protein

- Hides, furs, trophy heads, museum specimens
- Feathers
- Dried meats, milk, cheese products
- Woolens, silks


Eukanuba
Large Breed
Grande race
Puppy/Chiots
Small Breed
Petite race
Vital Health System
IAMS
PRO PLAN
PUPPY
LARGE BREED FORMULA

Principal types of feeders

Internal Feeders - larvae develop within kernel of whole grain or seed

External Feeders - larvae develop outside whole grain kernels but are capable of feeding on both whole grains & processed grains

Scavengers - only attack grains that have been processed or damaged by feeding of other insects

Secondary pests - infest grain products that are out of condition or moldy

Weevils

Beetles in family Curculionidae

Generally long proboscis, clubbed antenna

Most are internal feeders on grains, nuts

Photo by Laurie Knight
http://photoblog.msnbc.msn.com/

Internal Feeder

Rice Weevil

2-3 mm

Brown with *closely* spaced, oval pits on thorax and lighter X-marking on wing covers

Attracted to lights, can fly

Life cycle 30+ days

Commonly infest whole corn, wheat, barley, rice, and occasionally old pasta

Internal Feeder
Granary Weevil
Sitophilus granarius

www.forestryimages.org
Australian Pest & Disease Image Library

3-5 mm

Reddish brown with widely spaced, oval pits on thorax

Not attracted to lights

Cannot fly

Life cycle 30-50 days

Commonly infest whole corn, wheat, barley, rice, sunflower seeds, and occasionally old pasta

Rice Weevil

Granary Weevil

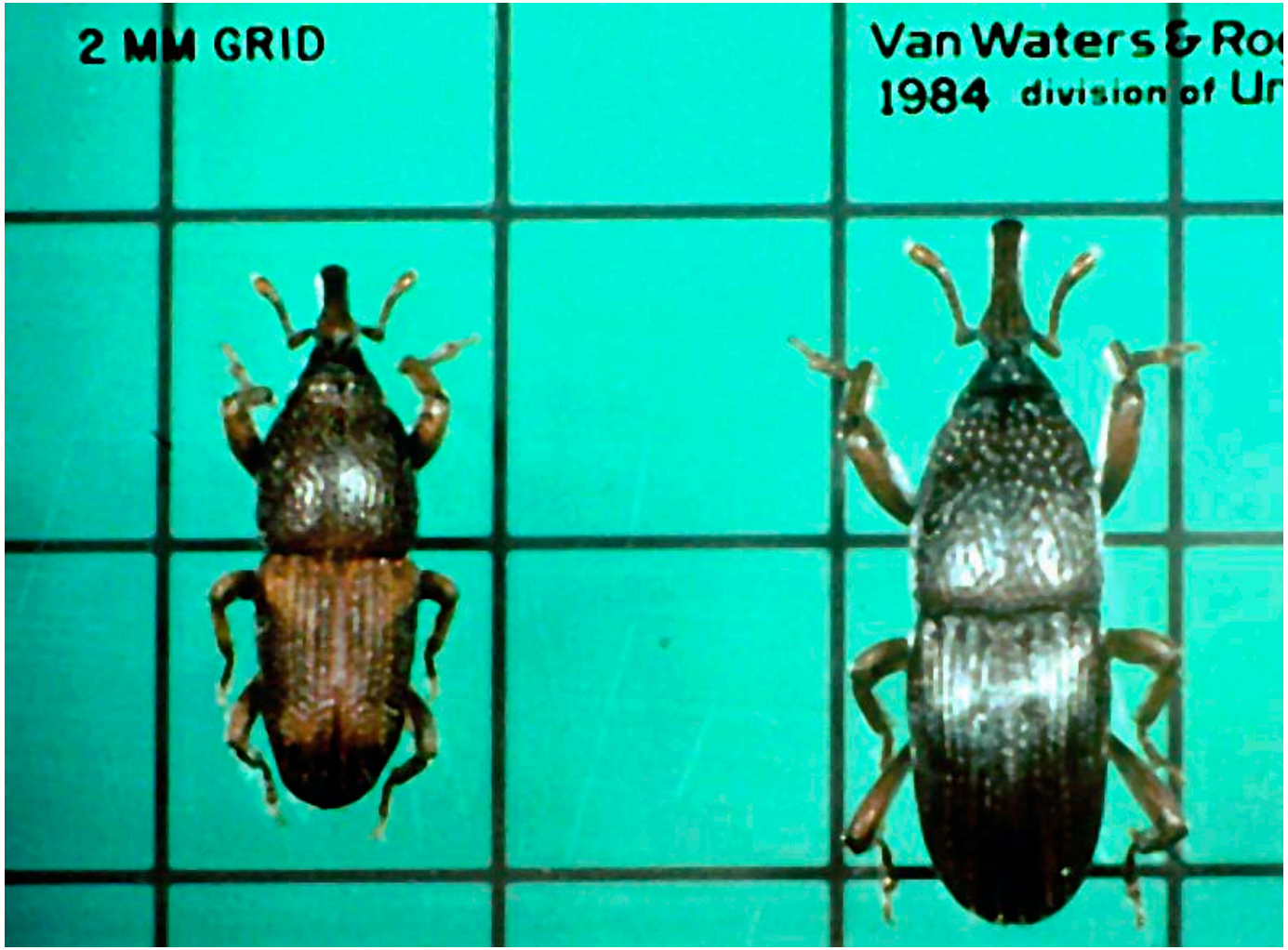


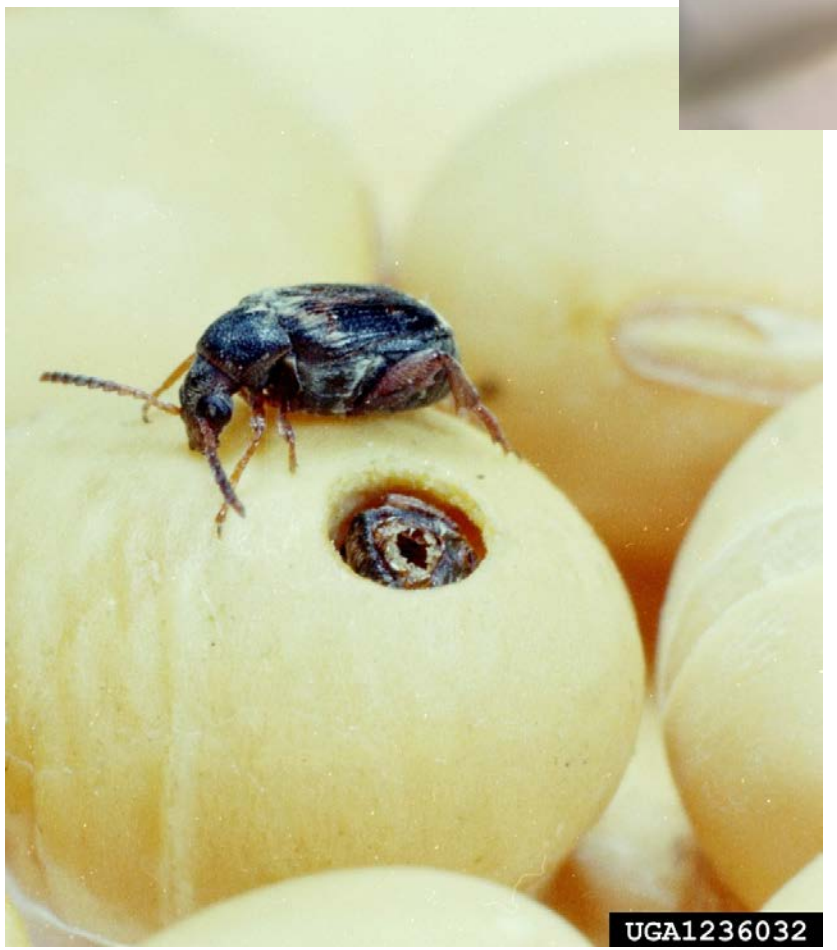
Photo: Univar

Bean & pea weevils

Family Bruchidae. Without long proboscis of true weevils

Characteristic shape (heavy body, v-shaped head, large eyes, serrate antennae)

Internal feeders on peas, beans, peanuts; leave round exit holes in beans



Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org. Lower: Bean weevil, *Acanthoscelides obtectus;* Upper: *Mimosestes nubigens*

Internal Feeder

Angoumois Grain Moth

Sitotroga cerealella

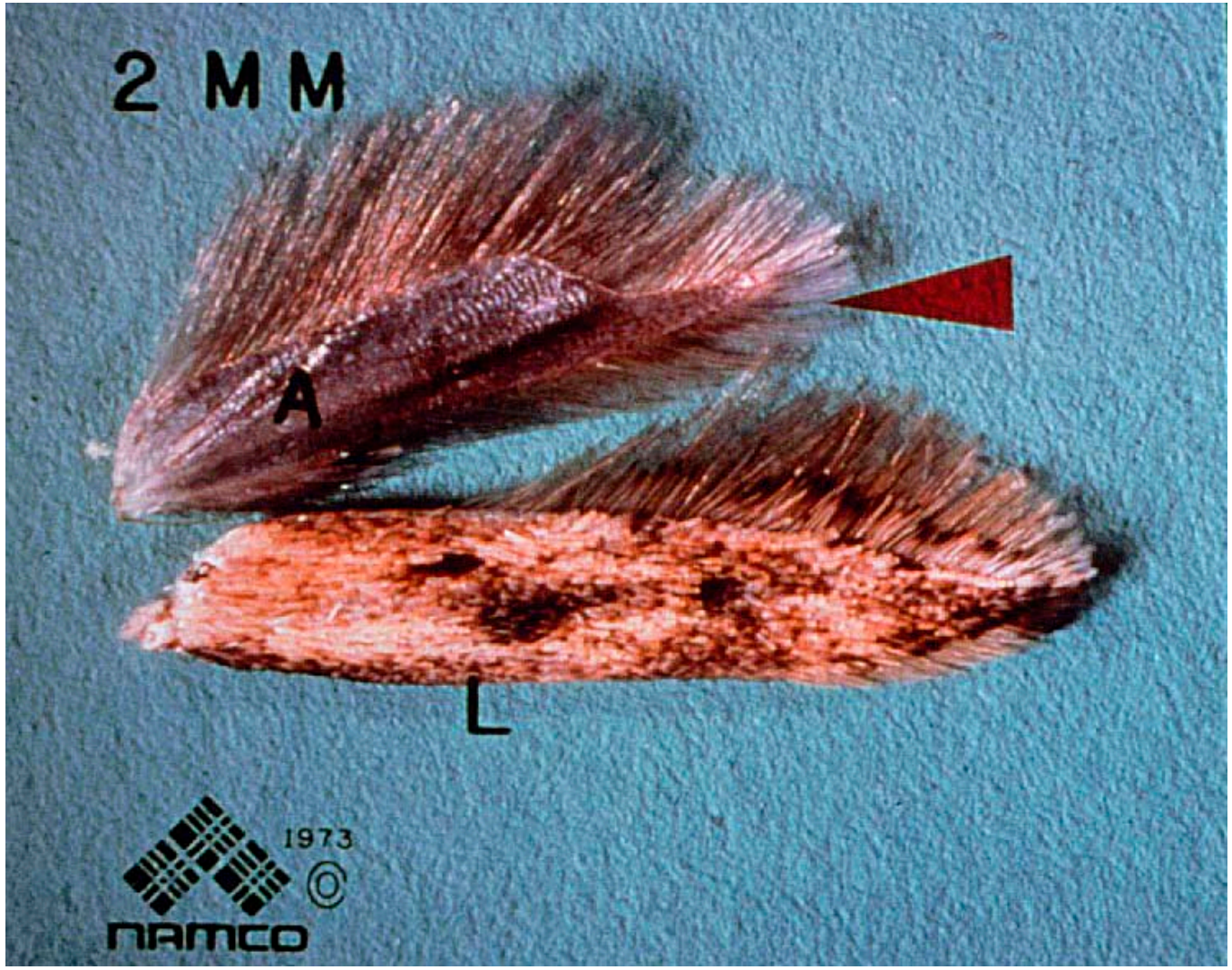
Wing span 13 mm (1/2 inch)

Yellowish white with pale yellow forewings

Life cycle 35-50 days

Commonly infests barley, rye, corn, oats, rice

Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org



Angoumois grain moth: wing

Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org

Angoumois grain moth as internal feeder

External Feeder
Drugstore Beetle

Stegobium paniceum

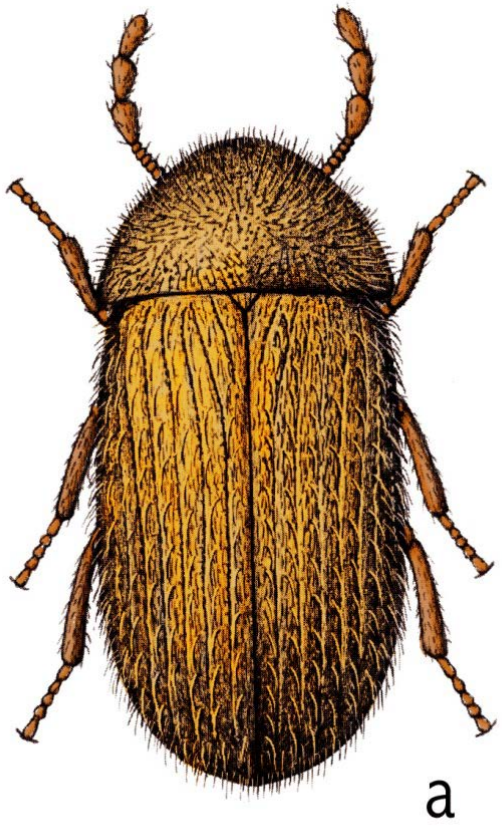


Image modified from USDA

2-3 mm, common

Brown, elytra with rows of longitudinal grooves, antennae with loose 3-segmented club

Attracted to lights, can fly

Life cycle 60-210 days

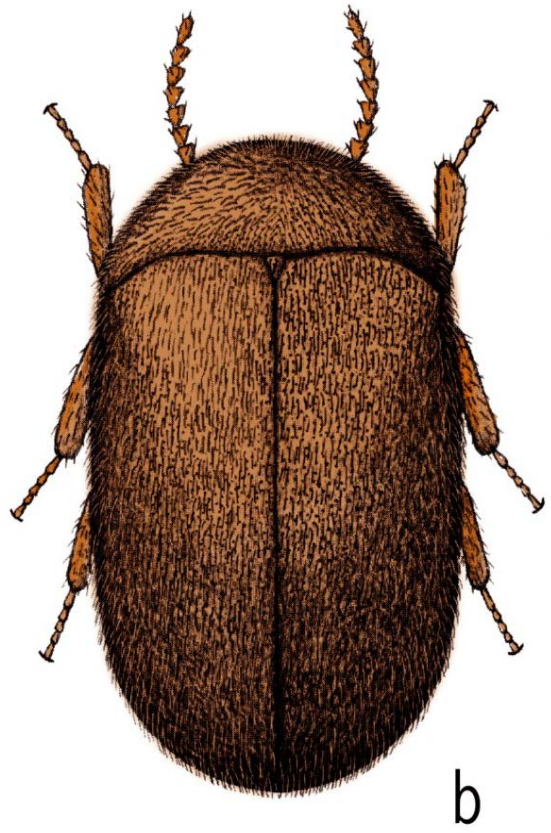
Infests wide variety of products

- pet food, cereals, drugs, peppers, spices, dried fruits, flour pasta

External Feeder

Cigarette Beetle

Lasioderma serricorne



Images modified from USDA

2-3 mm, very common

brown, elytra smooth with no grooves, serrate antennae, no club

Attracted to lights

Can fly

Life cycle 30-50 days

Infests wide variety of products

- pet food, cereals, tobacco, peppers, spices, dried fruits, seeds, flour, pasta

Cigarette & Drug Store Beetle Antennae

Dermestid beetles

Important family identified by oval shape, short clubbed antennae, head often hidden, often covered with patterned scales

Important Genera:

- *Trogoderma:* warehouse, khapra* beetles
- *Anthrenus:* varied and furniture carpet beetles,
- *Attagenus:* black carpet beetle
- *Dermestes:* hide and carpet beetles

* not found in U.S., but major worldwide pest and a quarantine species in US

External Feeder

Hide Beetle

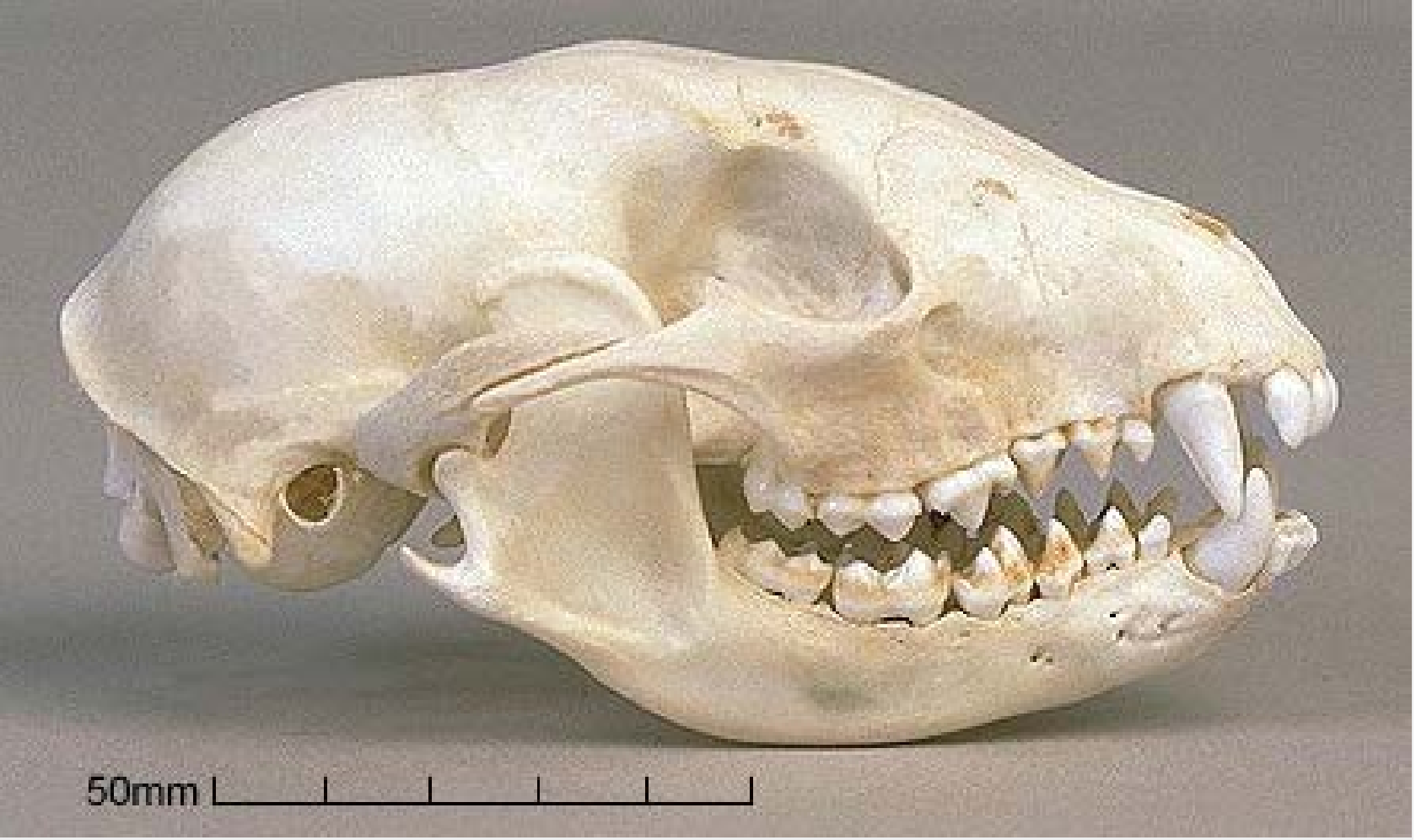
Dermestes maculatus

Various species feed on meats, pet foods containing meat products, dead animals, hides, trophy heads, skins.

Life cycle 2+ months

Larva with banded appearance, hairy, two terminal horns (urogomphi)

Upper, M. Merchant; lower Univar.



Dermestids used in skull cleaning

External Feeder

Warehouse Beetle

Trogoderma variable

Brownish black with elytra having mottled patterns of brown against a dark background & numerous hairs

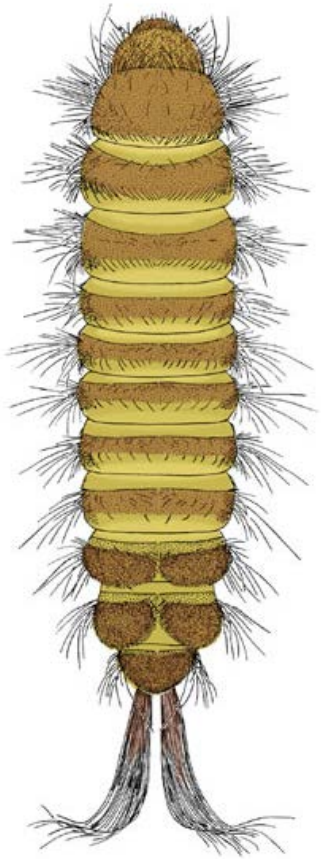
Attracted to lights and can fly

Life cycle 40-50 days

Commonly feed on any grain or animal protein, animal hair or skins, fish meats, dried milk, drugs, pasta, nuts, dried fruits and dead insects.

Trogoderma spp. Joseph Berger, Bugwood.org

Warehouse beetle (Trogoderma variabile) larva



Images modified from USDA

hairy, cigar-shaped larva is typical of other species of dermestid beetles

Hastisetae on three terminal segments

T. variabile is a feeder on grains and grain products

efficient penetrator of food packaging

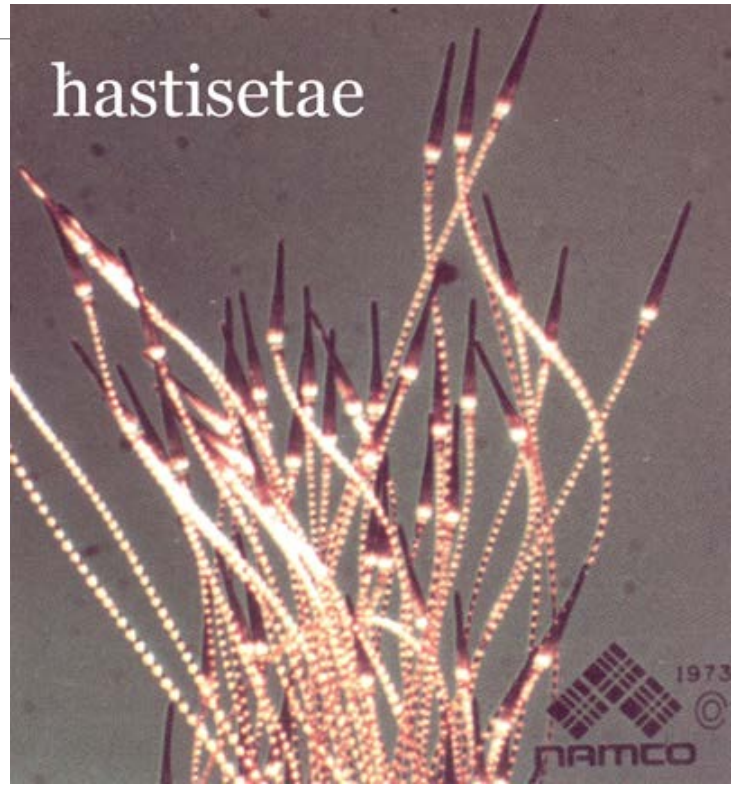
expert skill needed to distinguish from similar khapra beetle

Warehouse & Carpet Beetles

both widely distributed

larvae of *Trogoderma* and *Anthrenus* carry hastisetae which can cause irritation of gastrointestinal tract

warehouse beetle principally feeds on grain, carpet beetles on animal protein



Varied carpet beetle

Anthrenus verbasci

small (3 mm), covered with colorful scales. Larva with hastisetae

larva feeds on variety of products containing animal proteins

- furs, feathers, hair, woolens, dead insects

common indoors and outdoors (bird nests)

Often mistaken for bed bugs

External Feeder

Indian Meal Moth

Plodia interpunctella

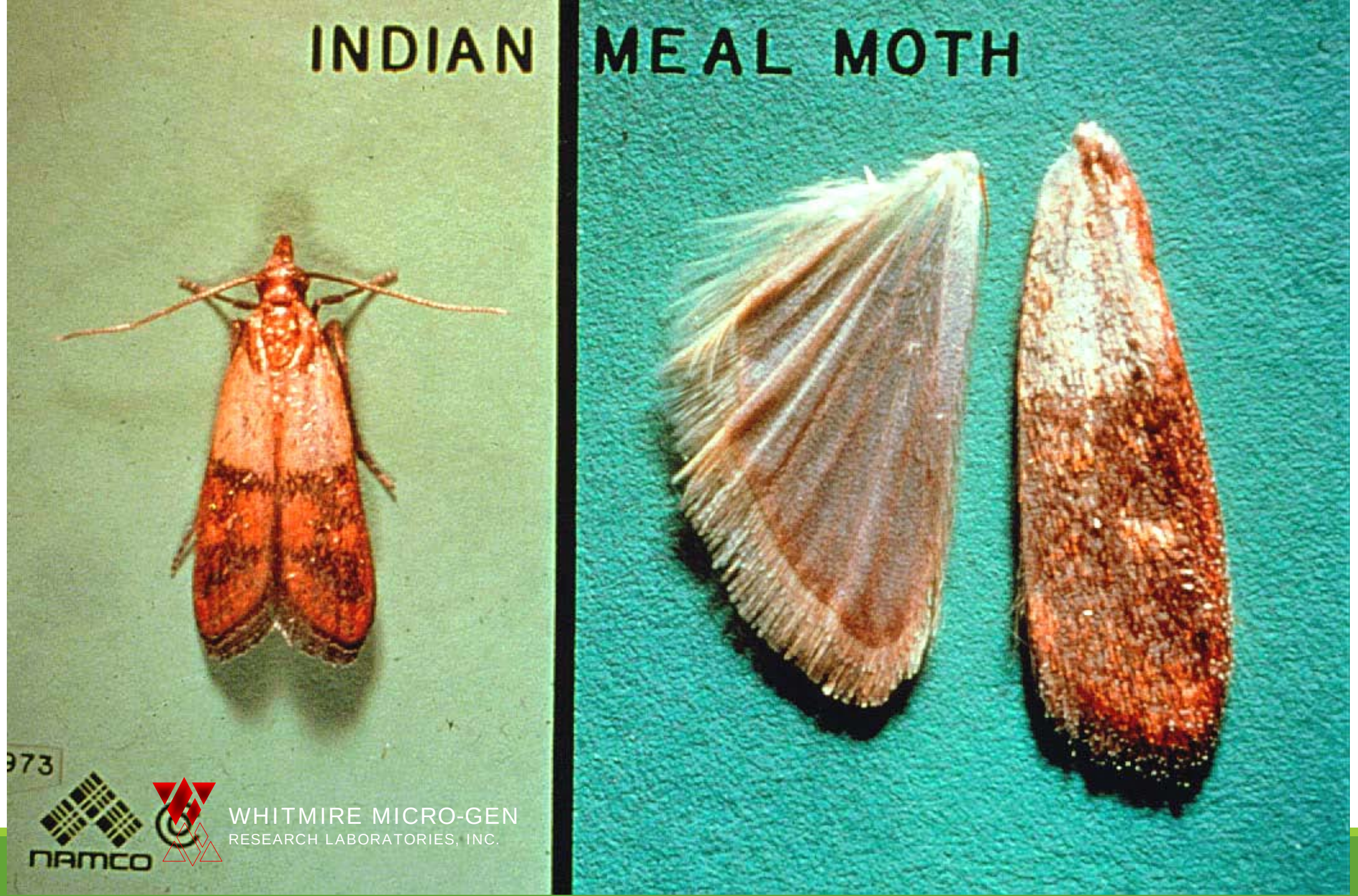
Wingspan 18 mm (3/4 inch), outer 1/2 to 1/3 of front wing is covered with reddish copper scales

Nocturnal, attracted to lights

Life cycle 25-135 days

Feed on grain and grain products, dried fruits, seeds, nuts, candy, dried red peppers, pet food

Silk often associated with infested foods


INDIAN MEAL MOTH
973
NAMCO
WHITMIRE MICRO-GEN
RESEARCH LABORATORIES, INC.

Indian meal moth larva/pupa

Noel Troxclaire, Texas A&M AgriLife Extension

Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org

External Feeder

Mediterranean Flour Moth

Ephestia (Anagasta) kuehniella

Mark Dreiling, Bugguide.net

Wingspan: 25 mm (1 inch)

Hind wings dirty white and forewings a pale gray with transverse black wavy bars

Attracted to lights

Life cycle 30-65 days

Mediterranean Flour Moth

Ephestia (Anagasta) kuehniella

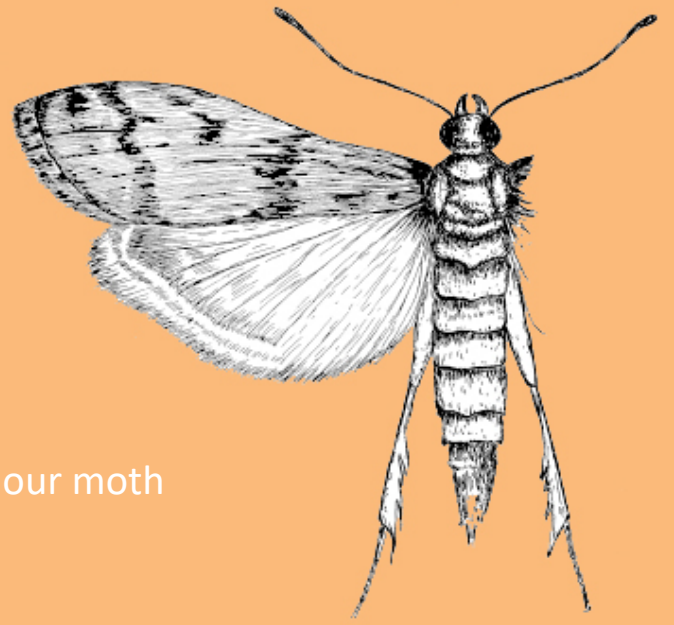
Larva spins silk over feeding substrate (like IMM)

Feeds on flour, meal. Also (less commonly) damaged grains

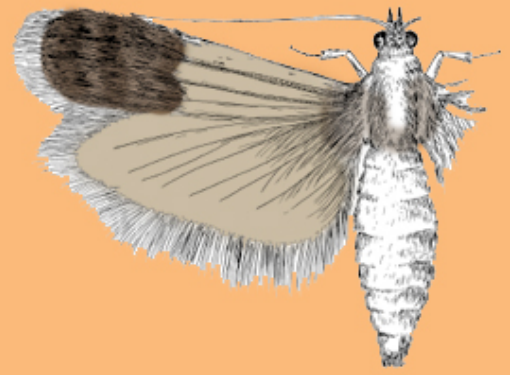
Common pest in flour mills

Moth size comparison

Mediterranean flour moth



Indian meal moth



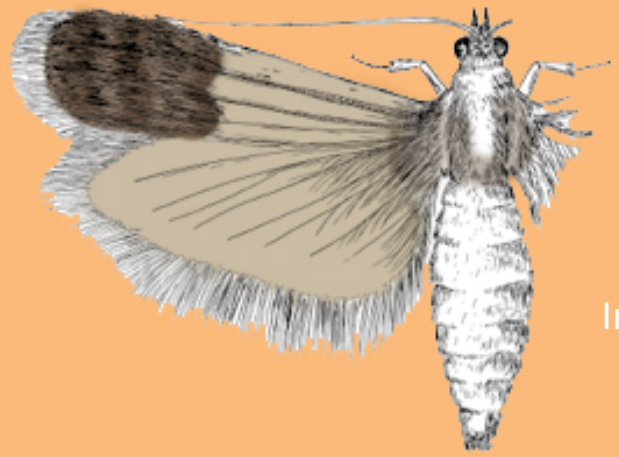
Angoumois grain moth

Distinguishing clothes moths from flour, grain and meal moths

Smaller than Angoumois grain moth (3/8-inch wingspan, 5 to 7 mm-long)

Rarely flies

Tuft of hair between eyes



Indian meal moth

Angoumois grain moth

Clothes moth

Moth pheromones

sex pheromones produced by females to attract males

available for many species

- Indian meal moth, almond moth, raisin moth, tobacco moth and Mediterranean flour moth (one pheromone)
- clothes moths (webbing and clothes)
- Angoumois meal moth
- others

useful in monitoring, some control

Warning: take care with placement. May attract outdoor insects inside

Scavengers

Sawtoothed grain beetle

Orzaephilus surinamensis

Image modified from USDA

2-3 mm, brown with flattened body

Six saw-like projections on side of thorax, not attracted to light

Cannot fly

Life cycle 30-50 days

Feeds on any grain or processed grain product including oats, pet foods, seeds, dried fruits, rice, grain meals, sugar, chocolate, drugs, pasta and tobacco

Scavengers

Red flour beetle

Tribolium castaneum

Tribolium castaneum Peggy Greb, USDA Agricultural Research Service, Bugwood.org

Adult 3.5 mm-long, reddish brown with antennae ending in a 3-segmented club

Attracted to lights and can fly (major difference between confused and red)

Life cycle 40-90 days

Feeds on flour, cereals, pet foods, whole grains infested by other stored product beetles

Warmer climates, more common in southern U.S.

Scavengers

Confused Flour beetle

Tribolium confusum

Tribolium confusum Natasha Wright, Florida Department of Agriculture and Consumer Services, Bugwood.org

3.5 mm

Reddish brown with antennae ending in a 4 segmented club

Cannot fly

Life cycle 40-90 days

Feed on flour, cereals, pet foods, whole grains infested by other stored product beetles

Cooler climates, more common in northern U.S.

Red & confused flour beetle antennae

Tribolium castaneum Pest and Diseases Image Library, Bugwood.org

Tribolium confusum Pest and Diseases Image Library, Bugwood.org

Distinguishing flour beetles and Lyctid powderpost beetles

FB has distinct 3-segmented club, PPB has 2-segmented club

PPB has globular eyes, FB has wrap-around eyes

FB has enlarged hind coxae, PPB does not

PPB tarsal formula is 4-4-4, FB 5-5-4 (need microscope)

Lyctus sp. (left), *Tribolium castaneum* (right) Mike Merchant, Texas AgriLife Extension

Secondary Feeders

Spider beetles

Family Anobiidae: subfamily Ptininae. Genera Gibbium, Mezium and Ptinus

Small, spider-like beetles

Tolerant of extreme conditions of temperature, desiccation

Do not fly

Scavengers on nuts and grains, animal skins, beans, bones, flour and meal, dried fruit, dead insects, rodent and bird excrement (dried), feathers, spices, many others.

Secondary Feeders

Yellow & dark mealworms

Tenebrio molitor, Tenebrio obscurus

Dark mealworm,Tenebrio obscurus Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org

13 mm (1/2-5/8 inch), shiny/dull dark brown or black (dark mealworm is dull and larvae are darker in color)

Larvae used as fish bait, pet food

Not attracted to lights

Cannot fly

Life cycle over 365 days

Infest moldy grain products

Secondary Feeders

Foreign grain beetle

Ahasverus advena

Tiny, reddish-brown beetles (2 mm-long)

Clubbed antennae, notches in square pronotum

3 to 4-week generation time in warm conditions

Feeds on molds and mildews associated with grain products, new housing

Key Elements of Control

Education

Inspection & Identification

Exclusion

Landscaping

Lighting

Trapping & Monitoring

Sanitation

Rotation of goods

Physical control

Chemical control

Key elements of control

Physical Control

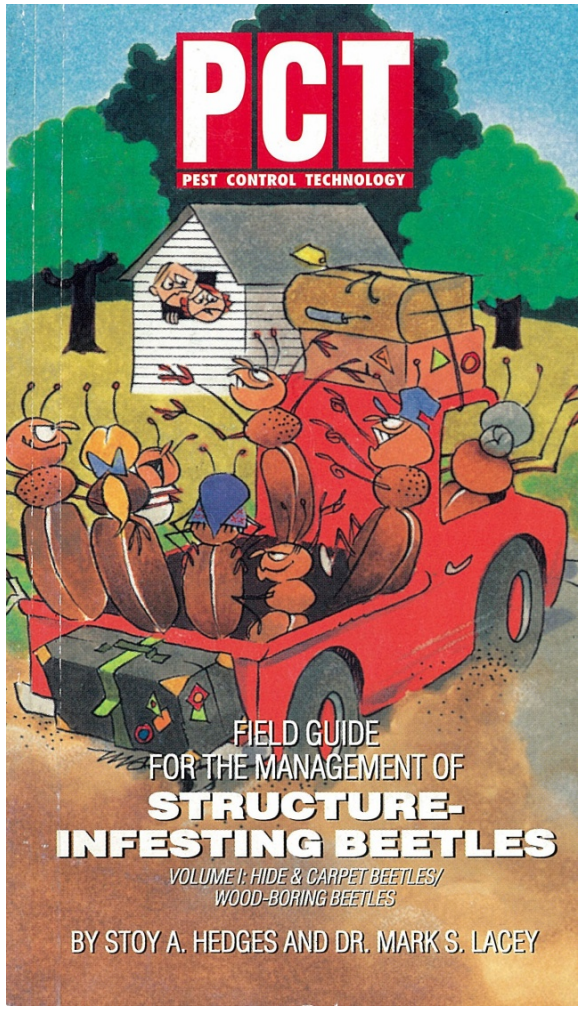
Heat – 120 F for 60 minutes kills all insect life stages (120º to 150º for 24 hours for buildings; 120º F for 60-90 minutes for individual cereal packages)

Cold – 7-14 days in deep freeze (-4º F) will kill most insects, including hardiest stored product pests

- for best results drop temperatures quickly
- reduce time by cooling, thawing, refreezing

Locating & disposing of infested material

Pet food: bagged, spilled
Organic fertilizers
Potpourri, dried flowers
Old rodent baits
Improperly stored cigars/cigarettes
Food products left in coats/clothes
Bee, rodent, bird nests



Good references

Which of the following is true of Indian meal moth, but not Angoumois grain moth?

Pheromone trap available

Nocturnal, attracted to lights

Secondary pest of grains

Silk often associated with infested foods

Which of the following beetle larvae is about ½ inch (12 mm) long, banded in appearance, hairy and has two small hooks on the end of the body?

Hide beetle (Dermestes sp.)

Foreign grain beetle (Ahasverus advena)

Cigarette beetle (Lasioderma serricorne)

Red flour beetle (Tribolium castaneum)

Which of the following beetles have adults with clubbed antennae?

Warehouse beetle (Trogoderma variabile)

Confused flour beetle (Tribolium confusum)

Drugstore beetle (Stegobium paniceum)

All of the above

What type of metamorphosis do spider beetles have?

No metamorphosis

Gradual metamorphosis

Incomplete metamorphosis

Complete metamorphosis

Questions?