

Integrated Pest Management of Insect Pests in Pulse Crops Lentil & Chickpea

**Janet J. Knodel, Extension Entomologist
and
Patrick Beauzay, Research Specialist
Department of Entomology
NDSU, Fargo**



Insect Pests of Pulse Crops

◆ Lentils

- Cutworms
- Grasshoppers
- Lygus bugs
- Pea aphids

◆ Chickpeas

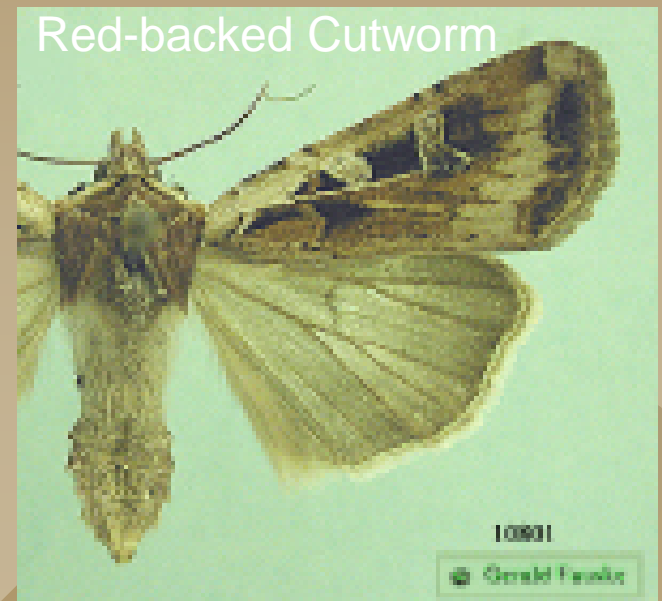
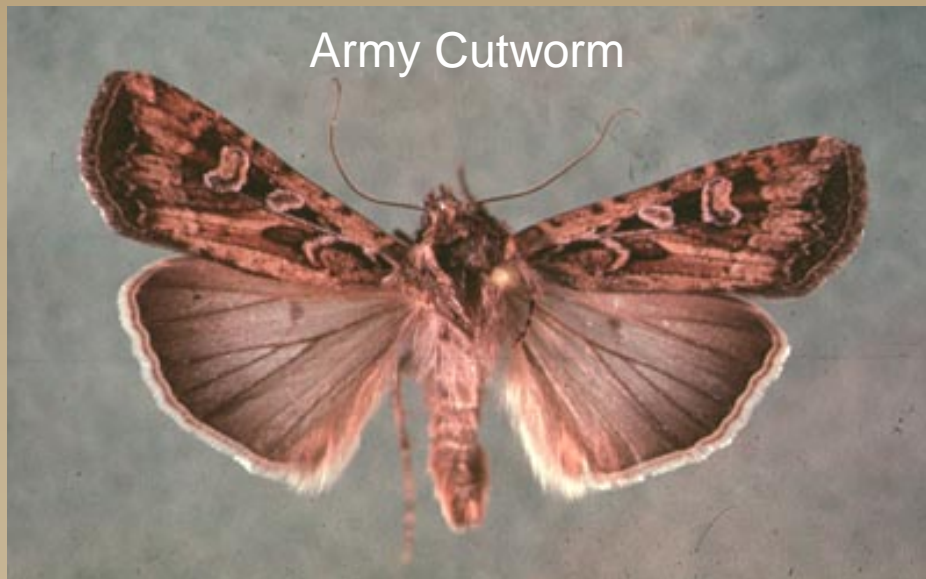
- Grasshoppers



Cutworm Identification

◆ Adult

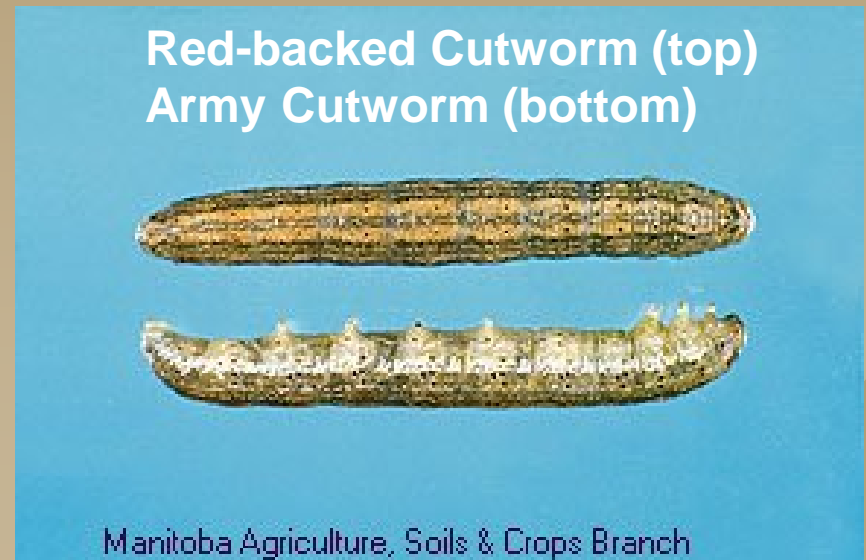
- Very robust
- Brown or black moths showing various spots or stripes in shades of gray, brown, black or white.



Cutworm Identification

◆ Larvae

- stout, smooth, soft-bodied, plump caterpillars
- Brown to tan to pink, green or gray and black



NDSU - Moth Identification Website



NORTH DAKOTA STATE UNIVERSITY FARGO, N.D.

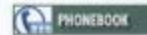
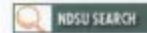


Photo Gallery

If you are unfamiliar with the major groupings of moths, it is strongly recommended that you narrow your choice to family by using the keys or moth families portions of this website, otherwise you will be potentially dealing with hundreds of names and pictures.

The photo gallery is divided into five sections. Section I is a gallery of moth images, each image is linked to an information page for that species. Section II is a gallery of larvae, again each is linked to an information page. Section III is a roster of species information pages completed as part of *Moths of North Dakota*. Each name is a link to its information page. Section IV allows one to jump to a particular portion of the gallery, and Section V is a roster of common and Economically important moths, again with links to their particular information pages.

Moth
Images



Larvae
Images



Species
List



Images
by Family



Pest
species &
Common
moths



Euxoa auxiliaris (Grote 1873)

Common name: Army cutworm

Hodges #: 10731.

Identification: Rfw 19.1 mm, a polychromic species— see illustrations, fw narrower than most other cutworm moths (wing shape similar to 10924), antemedial line 'zig-zag' extending as far out on A_{1+2} as tip of claviform spot; hw under good light with pink reflection as in 10915; male harpe very short and rounded, sacculus extension angled upward and spatulate at apex.

Similar species: 10723, 10730, 10801.

Distribution: northern Canada to northern Mexico and from the Pacific coast to the Great Lakes region, Missouri, and Texas.

Hosts: Larvae are cutworms on a variety of crops and are economically important on varieties of wheat, oats, and barley. Natural hosts are members of the Poaceae— grasses.

Note: This species is migratory, flying into the Rockies in early summer and aestivating at high elevations, moving back on to the plains in fall for egg laying.



SD, Minnehaha Co., Sioux Falls, 20- VI- 1976, yd. lt. coll. G. Fauske.



ND, Cass Co., Fargo. 13- V- 1956, UV lt. trap.

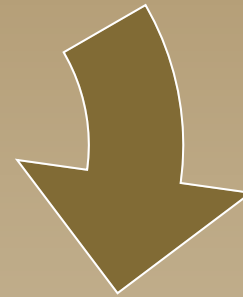
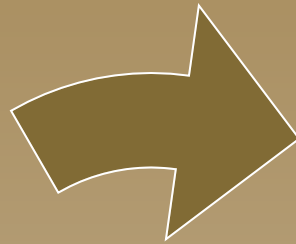


SD, Minnehaha Co., Sioux Falls, 21- VI- 1985, UV lt. trap, coll. G. Fauske.

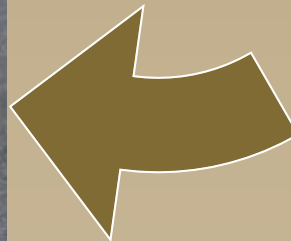
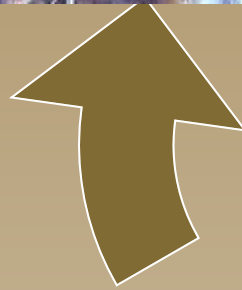


Life Cycle of Cutworm

One generation per year



Overwinter as
partial mature
larvae or eggs



Cutworm Damage

- ◆ Larvae = Chewing mouthparts
- ◆ Cut off shoots below or above ground
- ◆ Destroy more of plant than eat
- ◆ Injury plants in 4 major ways:
 - Solitary surface cutworms
 - ◆ Black, Bronzed, Clay-backed, Dingy cutworms
 - Climbing species
 - ◆ Variegated, spotted, W-marked cutworms
 - Subterranean species
 - ◆ Pale western and glassy cutworms
 - “Marching” in great numbers
 - ◆ Army cutworms



Field Scouting & Economic Threshold

- ◆ **Pheromone traps for adults**
 - Army cutworm
 - Pale Western cutworm
 - Black cutworm
 - Western bean cutworm
- ◆ **Field sampling for larvae**
 - Trowel
 - Dig under soil and freshly cut plants
 - Active feeding at night
- ◆ **Economic Threshold in lentils**
 - 2 to 3 cutworms per square meter



Insecticide Recommendations

Labeled for use on Cutworms in ND

Lentils



Pyrethroids:

Esfenvalerate - Asana XL*

Beta-cyfluthrin - Baythroid XL*

Bifenthrin – Capture*, Brigade*, Sniper*

Cyfluthrin – Tombstone*,

Tombstone Helios*, Renounce*

Zeta-cypermethrin – Mustang Max*

Gamma-cyhalothrin – Proaxis*

Lambda-cyhalothrin – Taiga Z*,

Lambda-Cy*, Warrior*, Silencer*

Always Read
Labels.

* Restricted use pesticide

Insecticide Recommendations (continued)

NDSU

Labeled for use on Cutworms in ND

Lentils



Carbamates:

Carbaryl (Sevin)

Botanical Insecticide:

**Azadirachtin – Azatin XL,
Aza-Direct**

**Always Read
Labels.**

* Restricted use pesticide

Common Grasshoppers

Red-legged grasshopper



Differential grasshopper



Two-striped grasshopper

Young Grasshoppers or Nymphs

- ◆ Look like adults
- ◆ Smaller than adults
- ◆ Wing pad instead of wings
- ◆ 5-6 nymphal stages or instars
- ◆ 4th or 5th instars present, hatch is winding down



Grasshopper Life Cycle

EARLY
SPRING



1st Instar



Eggs hatch

LATE-
JULY



Surviving females lay eggs

SCOUT
NOW!

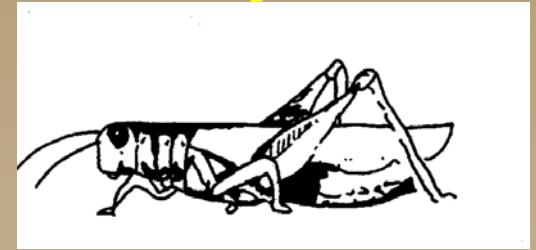


2nd Instar



3rd Instar

Grasshoppers molt 5 times



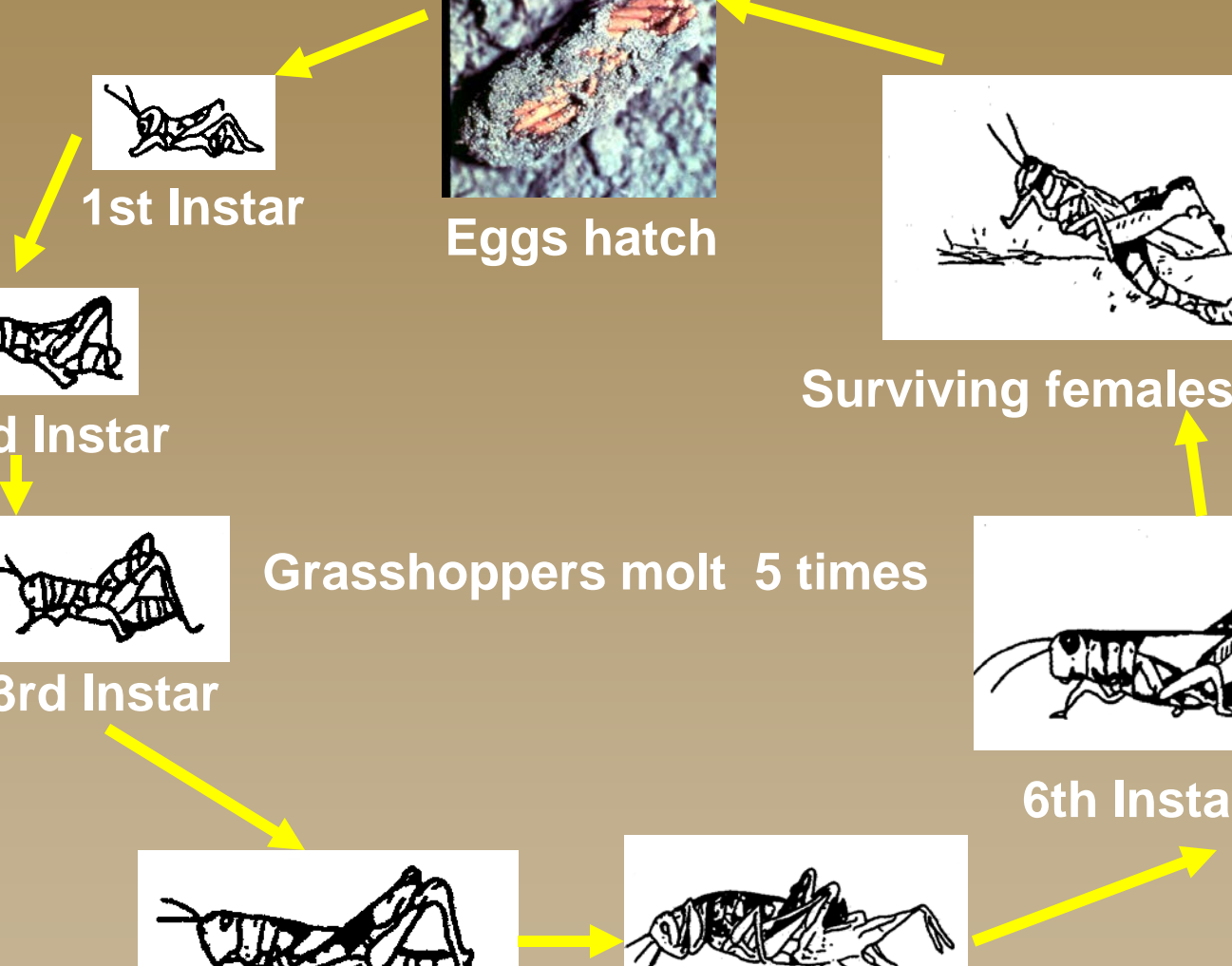
6th Instar ADULT



4th Instar

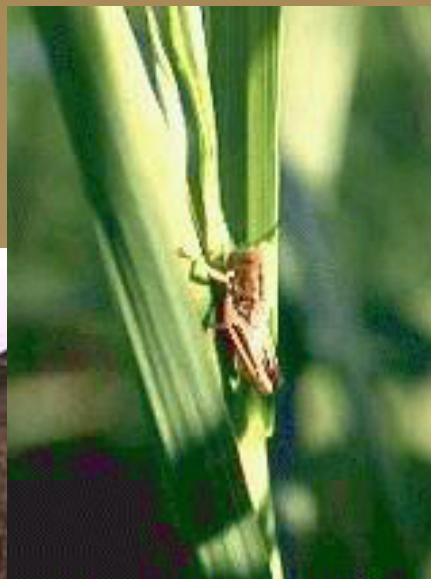


5th Instar

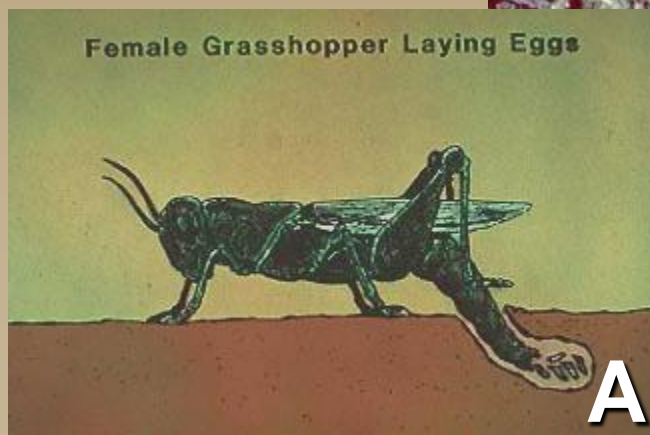




May - June



July - August



Female Grasshopper Laying Eggs

August - Sept

Grasshoppers



- Eggs are laid in the fall;
- Embryos develop while temperatures are favorable . . . There are wide ranges of development;
- This makes it difficult to predict hatch.

Lilac as an indicator:

10 days after common lilac flowered, 75% of grasshoppers were first stage

Grasshopper Egg Laying

Start in late July through fall

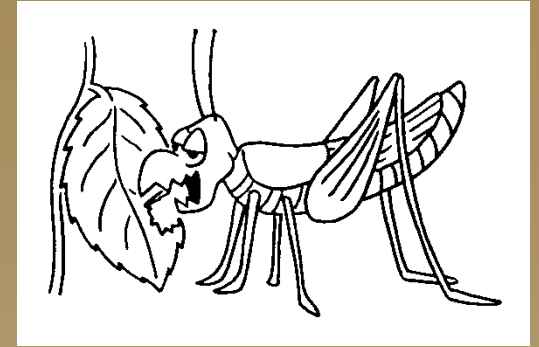
Each female = 8-25 egg masses



Each egg pod =
20-120 eggs



How Grasshopper Outbreak Develop?



- ◆ Weather dependant
 - hot, dry summers and warm falls
 - ◆ Several years of gradual increase
 - LOW YEAR = 1 GH per square yard
 - FAVORABLE YEAR = 2 GH per square yard
 - ANOTHER YEAR = 4 GH per square yard
 - ANOTHER YEAR = 8 GH per square yard
 - ONE MORE = 24+ GH per square yard
- !!OUTBREAK!!**

How Temperature Affects Grasshoppers

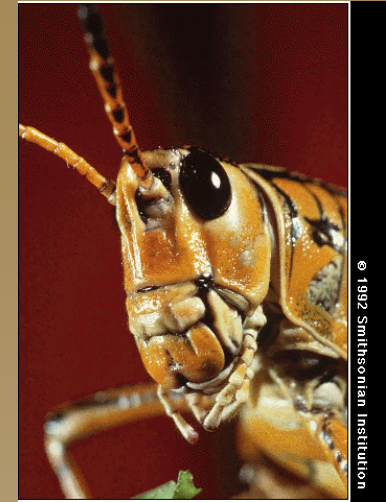
- ◆ High temperature in summer-fall
 - Early maturity
 - Long egg laying period
- ◆ Warm spring
 - Early hatch, followed by:
 - ◆ <70°F - No feeding, high mortality
 - ◆ Warm and dry - Good start for hoppers



How Rainfall Affects Grasshoppers

- ◆ Cloudy, wet weather for 1+ weeks
 - Promotes fungal pathogens
- ◆ Heavy rains during emergence
 - Kills young grasshoppers
 - ◆ Embeds young in soil
 - ◆ Physically wash them away + drown
- ◆ Extreme drought
 - Poor egg hatch
 - Hoppers starve from lack of food
 - Low egg production by adults

Grasshopper Damage



- ◆ Chewing mouthparts
 - Lentils:
 - ◆ Do not prefer lentil foliage
 - ◆ Consume flower buds and early pods
 - ◆ Flower bud and pod feeding cause yield loss
 - Chickpeas:
 - ◆ Glandular hairs on chickpea leaves/pods contain malic acid, which deters insect attack
- ◆ High populations and scarce food plants
 - Migrate --- "Migratory Locusts"
 - "Eat almost any plant they come upon"



Grasshopper - Economic Thresholds

◆ Lentils

- 2 adults per square yard from early bud stage through pod development

◆ Chickpeas

- No threshold
- Not a preferred host, like cereal grains



Cultural Techniques

◆ Early seeding

- Established, vigorously growing plants can tolerate more damage than younger plants
- Risk of late season migration of adult grasshoppers is less
- Not option for late-seeded crops
 - ◆ sunflower
 - ◆ dry beans
 - ◆ safflower

◆ Early harvest

Crop Rotation

- ◆ Crops should not be planted in fields with severe egg infestations
- ◆ Attractive fields = late season crops
 - dry beans
 - soybeans
 - sunflower
 - flax
 - corn



Impact of Tillage

- ◆ Little value to destroy eggs directly
- ◆ Early spring tillage **before** egg hatch
 - Starve nymphs
- ◆ Late summer tillage
 - Destroys vegetation making area less attractive for feeding and egg laying



Insecticide Recommendations

Labeled for Grasshopper Control in ND

Lentils



Always Read
Labels.

Pyrethroids:

Esfenvalerate - Asana XL*

Beta-cyfluthrin - Baythroid XL*

Bifenthrin – Capture*, Brigade*, Sniper*

Cyfluthrin – Tombstone*,

Tombstone Helios*, Renounce*

Zeta-cypermethrin – Mustang Max*

Gamma-cyhalothrin – Proaxis*

Lambda-cyhalothrin – Taiga Z*,

Lambda-Cy*, Warrior*, Silencer*

* Restricted use pesticide

Insecticide Recommendations (continued)

NDSU

Labeled for Grasshopper Control in ND

Lentils



Carbamates:

Carbaryl (Sevin)

Botanical Insecticides:

Pyrethrin - Evergreen

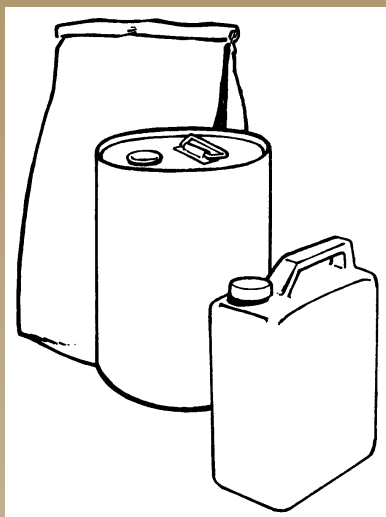
**Always Read
Labels.**

* Restricted use pesticide

Insecticide Recommendations

Labeled for Grasshopper Control in ND

Chickpeas



Pyrethroids:

Esfenvalerate - Asana XL*, Adjourn*

Beta-cyfluthrin - Baythroid XL*

Bifenthrin – Capture*, Bridage*,
Sniper*

Cyfluthrin – Tombstone*,

Tombstone Helios*, Renounce*

Zeta-cypermethrin – Mustang Max*

Always Read
Labels.

* Restricted use pesticide

Insecticide Recommendations (continued)

NDSU

Labeled for Grasshopper Control in ND

Chickpeas



**Always Read
Labels.**

Pyrethroids (continued)

Gamma-cyhalothrin – Proaxis*

Lambda-cyhalothrin – Taiga Z*,

Lambda-Cy*, Warrior*

Zeta-cypermethrin + bifenthrin –
Hero

Organophosphates:

Acephate - Orthene

Dimethoate - Dimate 4 EC, Digon 400,
Dimethoate 400, ...

* Restricted use pesticide

Lygus Bug on Pea and Lentils

- Small (1/4 inch), cryptically colored insects
- Distinctive yellow triangle or “V”
- Pale green to reddish-brown
- Immatures (Nymphs) look like aphids
- Adult overwinter
- Feed on over 385 crops and weeds



Lygus Bug

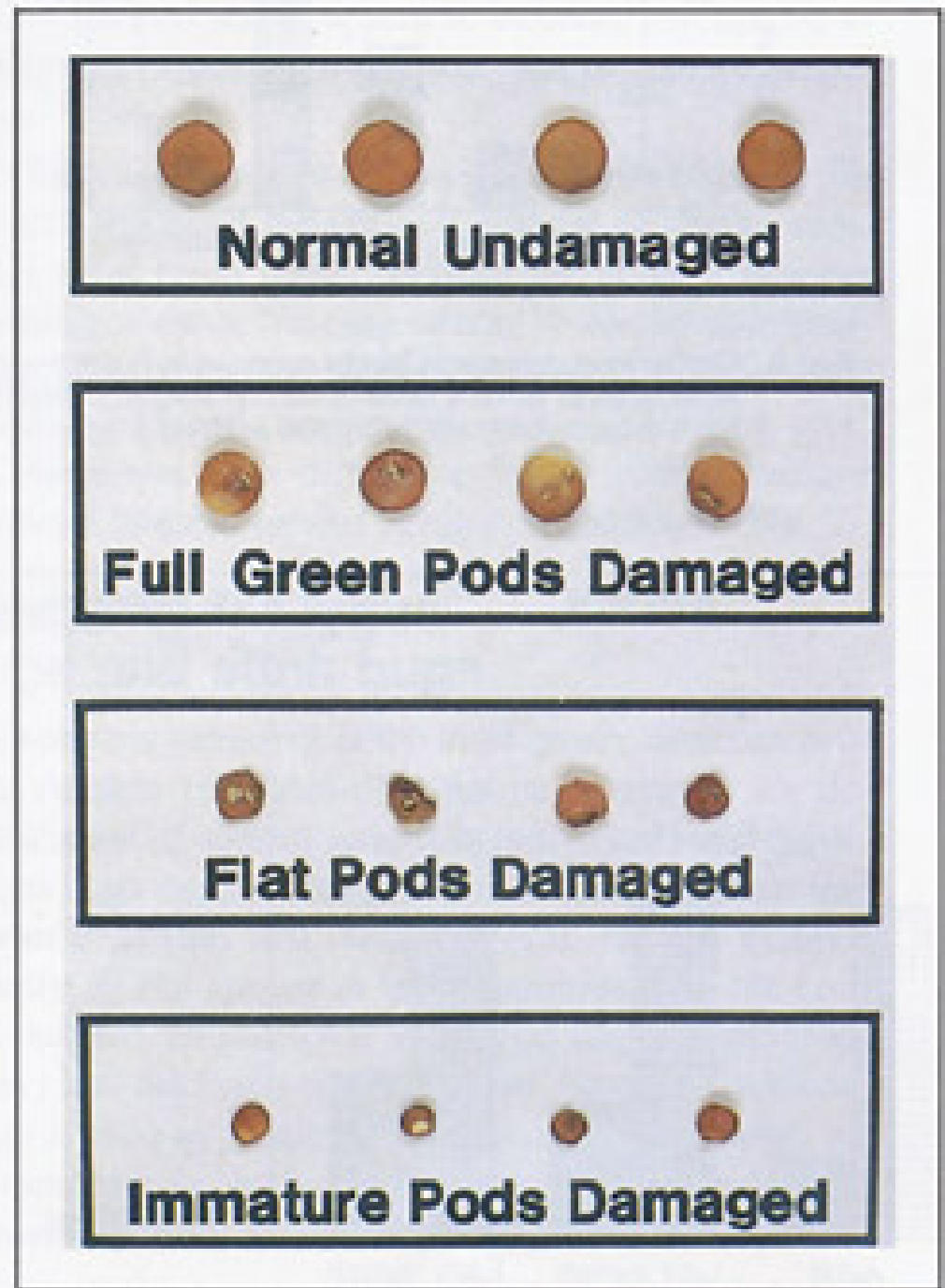
- ◆ Moves from alfalfa, CRP, roadside that are being hayed or cut or other crops (canola, sunflower)
- ◆ Adults enter lentils at bloom stage to feed and lay eggs
- ◆ Piercing-sucking mouth parts
- ◆ Older nymphs and adults suck out the contents of developing seeds and inject a toxic saliva into plant
- ◆ Hot, dry weather increases populations



Photo courtesy of: Manitoba Agriculture
Soils and Crops Branch

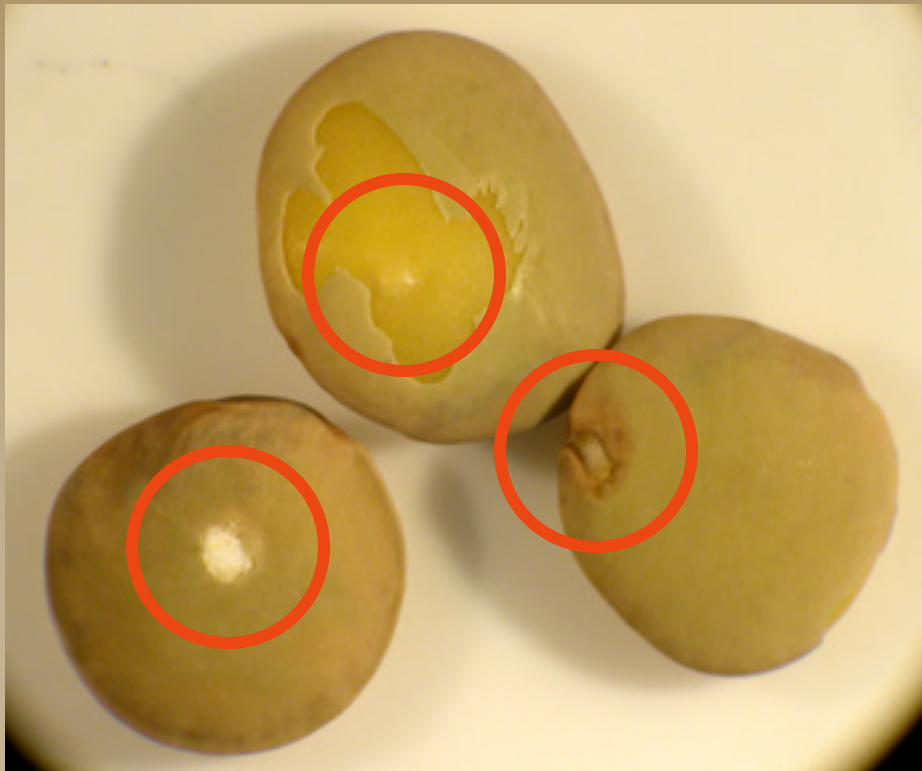
Lygus Bug Damage on Lentils

- Chalk spot
- Pitted depression
- Downgraded to lower grade
- Deteriorate faster in storage
- Reduced germination
- Damage caused by adult and nymph life stages



Chalk Spot on Lentils

Damaged Lentils

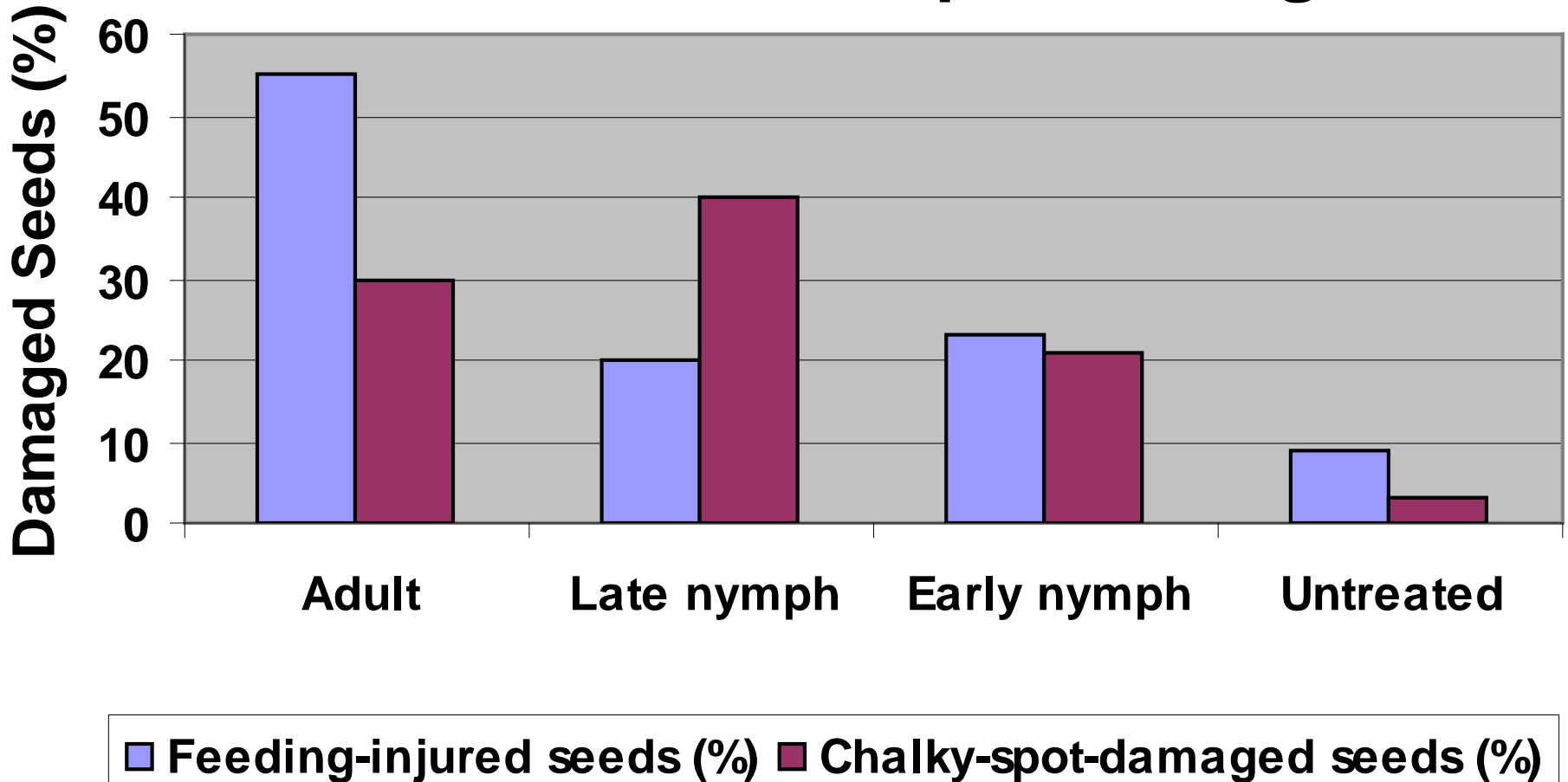


Grades, Grade Requirements, and Grade Designations

Grading Factors	U.S. Grade 1	U.S. Grade 2	U.S. Grade 3
Pea damaged (chalk spot)	1.0	1.5	2.0
Lentils defective*	2.0	3.5	5.0

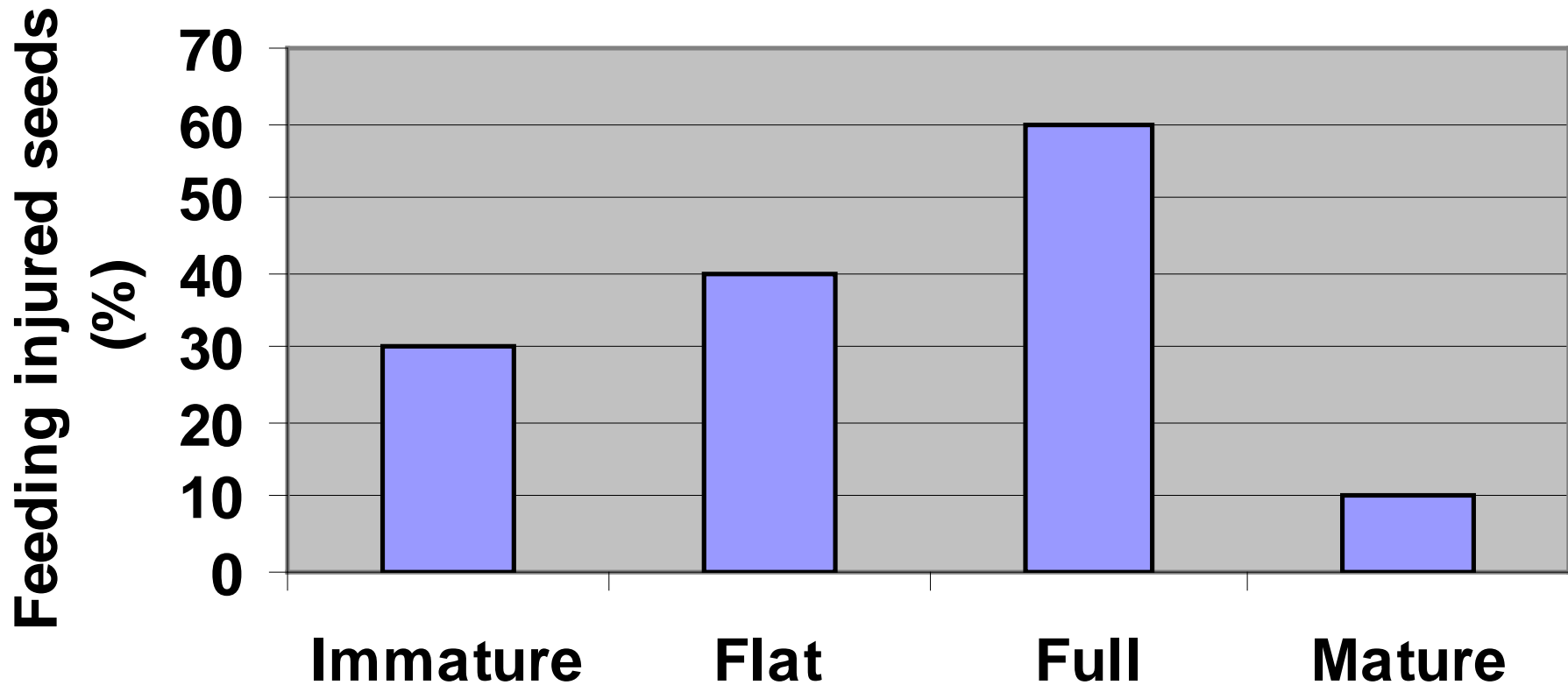
* Includes weevil-damaged and heat-damaged lentils.

Lentil damage by Lygus Bug at various insect development stages



Source: Keeffe et al. 1991. Chalky spot damage to Lentils. Univ. ID. Series No. 894.

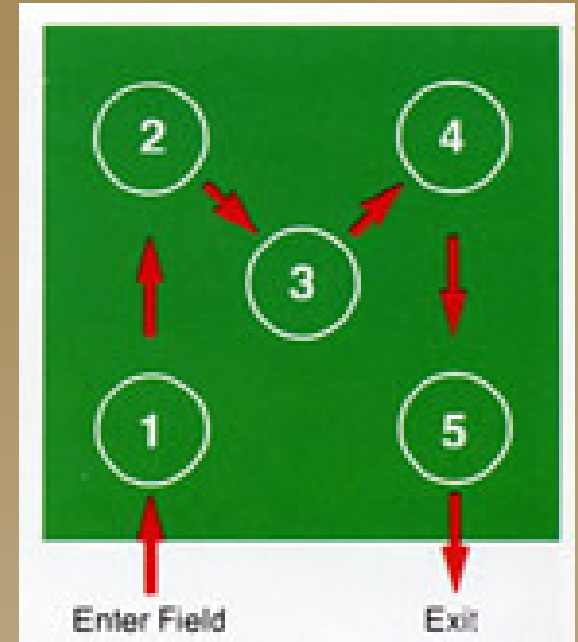
Feeding Injury in Lentils exposed to Lygus bugs at various pod development stages



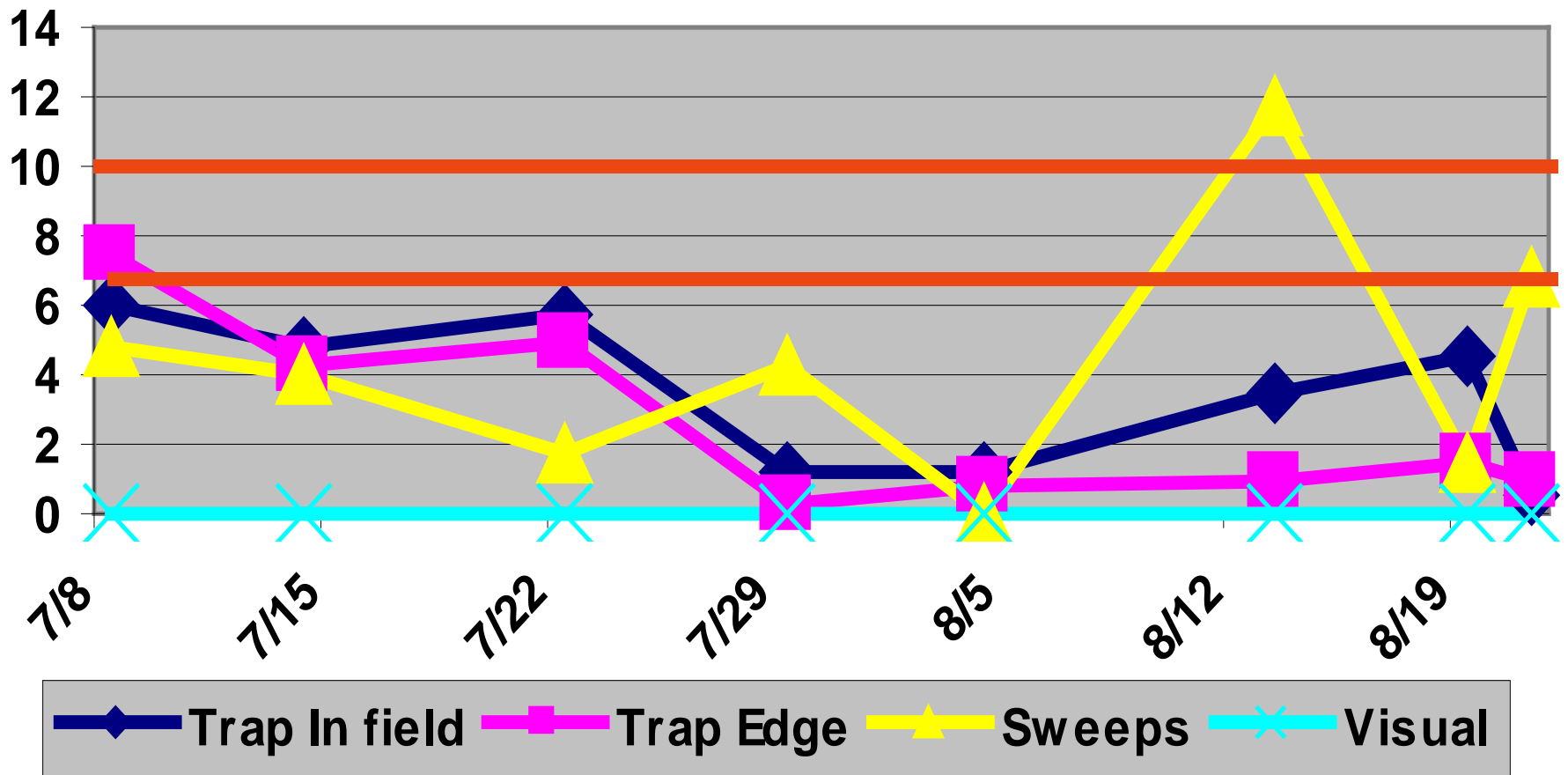
Source: Keeffe et al. 1991. Chalky spot damage to Lentils. Univ. ID. Series No. 894.

Lygus Bug Monitoring Economic Thresholds

- ◆ When to Monitor fields
 - Sweep fields during bloom-pod
 - Warm, sunny 2-6 PM
 - 5 locations in the field
 - 25 - 180 degree sweeps with the net in the canopy. (Not just the top of the canopy with net.)
- ◆ Economic Threshold =
7-10 Lygus bugs/25 sweeps



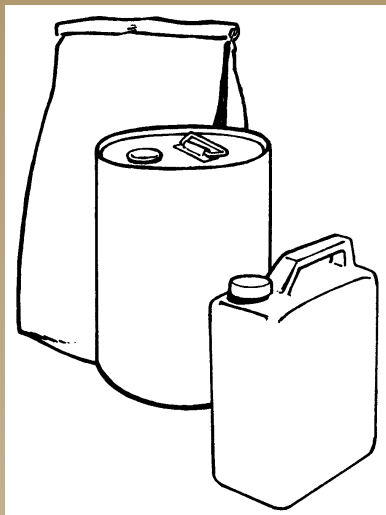
2003 Adult Lygus bug Counts in Lentils McKenzie County, Keene, Jellsted farm



Insecticide Recommendations

Labeled for Lygus bug Control in ND

Lentils



Pyrethroids:

Beta-cyfluthrin - Baythroid XL*

Cyfluthrin – Tombstone*,

Tombstone Helios*, Renounce*

Gamma-cyhalothrin – Proaxis*

Lambda-cyhalothrin – Taiga Z*,

Lambda-Cy*, Warrior*, Silencer*

Always Read
Labels.

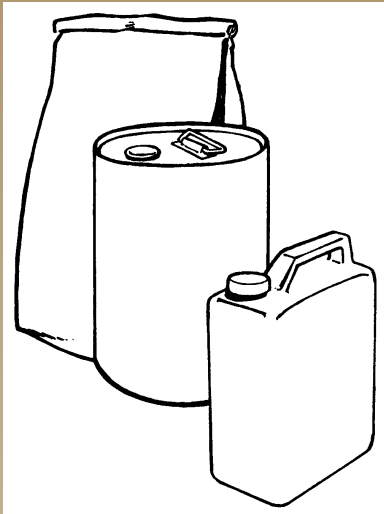
* Restricted use pesticide

Insecticide Recommendations (continued)

NDSU

Labeled for Lygus bug Control in ND

Lentils



Carbamates:

Carbaryl (Sevin)

Organophosphates:

**Dimethoate (Digon 400, Dimate 4EC,
Dimethoate 400, ...)**

Neonicotinoid:

Imidacloprid – Nuprid 2F

**Always Read
Labels.**

* Restricted use pesticide

Pea Aphid

- ◆ Common insect pest in lentils
- ◆ Description
 - Small, about $\frac{1}{8}$ inch long
 - Pale green
- ◆ Damage
 - Aborted flowers
 - Reduced seed formation and seed size
 - Reduced yield



Pea Aphid in Lentils

Economic Thresholds

- ◆ Insecticide treatment for pea aphid control should be considered when:
 - 30-40 aphids are collected per 180° sweep of a 15-inch diameter sweep net
 - When few natural enemies are present
 - When aphid numbers do not decline over a 2-day period



IPM - Pea Aphid

- ◆ Natural control with predators & parasitoids
 - Ladybird beetles
 - Lacewings
 - Syrphid flies
 - Parasitoids
- ◆ Wet weather favor epizootics outbreaks
 - Fungal diseases
 - Heavy rains



Ladybird Beetles - Aphid Predators



larva



Parasitic Wasps

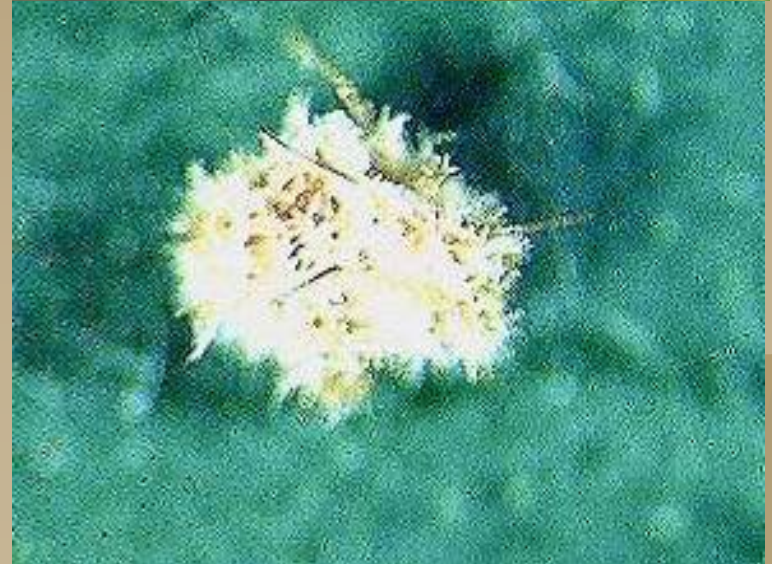
Lay eggs in the
aphid



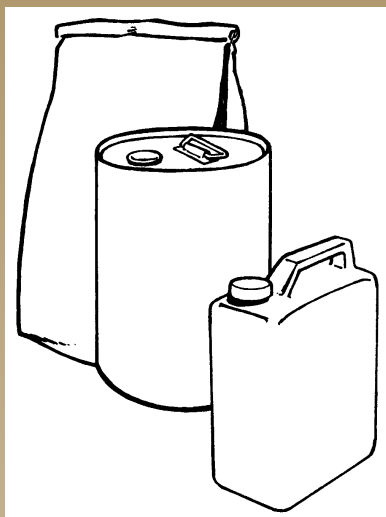
“mummy” . . .
empty shell of
aphid after
parasite leaves

Natural Controls for Aphids

- ◆ Fungal diseases
- ◆ Epizootics outbreaks can decline aphid populations!



Lentils



**Always Read
Labels.**

Pyrethroids:

Esfenvalerate - Asana XL*

Beta-cyfluthrin - Baythroid XL*

Cyfluthrin – Tombstone*,

Tombstone Helios*, Renounce*

Zeta-cypermethrin – Mustang Max*

Gamma-cyhalothrin – Proaxis*

Lambda-cyhalothrin – Taiga Z*,

Lambda-Cy*, Warrior*

* Restricted use pesticide

Insecticide Recommendations (continued)

NDSU

Labeled for Aphid Control in ND

Lentils



**Always Read
Labels.**

Organophosphates:

Dimethoate (Digon 400,
Dimethoate 400, ...)

Malathion 57 EC

Neonicotinoid:

Imidacloprid – Nuprid 2F

Botanical Insecticide:

Azadirachtin – Aza-Direct, Ecozin

* Restricted use pesticide

NDSU

Extension Service
North Dakota State University

