Steps for the dissection of male *Spodoptera* moths (Lepidoptera: Noctuidae) and notes on distinguishing *S. litura* and *S. littoralis* from native *Spodoptera* species

Introduction

The purpose of this handout is to guide you in the dissection, screening, and identification of moths collected in *Spodoptera* surveys. These instructions will help you distinguish *Spodoptera litura* and *littoralis*, the targets of our surveys, from various native species, some of which are strongly attracted to the lures.

Part 1 introduces some genitalic terminology.

Part 2 describes and illustrates how to obtain the genitalia from specimens prepared with potassium hydroxide.

Part 3 examines genitalic characters of the target species.

Part 4 illustrates the genitalia of native species.
Part 1: Genitalic terminology

- **Valve**
- **Aedeagus**
  - Ampulla
  - Uncus
  - Cucullus
  - Coremata

**Spodoptera dolichos**

- **Right valve**
  - Juxta
  - Costal process
  - Clavus
  - Basal sclerite

**Spodoptera pulchella**

- **Aedeagus**
  - Vesica
Part 2: How to obtain genitalia from processed specimens

1. Place abdomens in dish. Place one abdomen at a time into a glass (or plastic) dish with alcohol for microscope examination. In time, you can place 10 or more specimens in one dish, occasionally replacing the alcohol when it becomes cloudy with scales.

2. Obtaining the genitalia. Hold the abdomen at the base with straight forceps and press it gently with the round end of curved-tipped forceps from base to apex to extrude the entire genitalia, being very careful not to damage the aedeagus by pressing too hard. A small hair brush can be used instead of forceps. If the genitalia do not exit though the apex, gently grab both valves and pull slowly. If the abdomen is inflexible, return it to KOH for further clearing. If the genitalia are obtained, but are not flexible, place the genitalia in the warm KOH solution for 5 or 10 more minutes.

![Image of genitalia extraction](image)

*Use round forceps to press on the abdomen*

*Genitalia extracted from the abdomen*
3. **Examining the coremata (an external structure), optional.** With the left straight forceps hold the genitalia, and with the back of curved-tipped forceps or using a brush remove some of the hairs on the outside of the valve to examine the coremata (=membranous lobes). Pull gently on the bottom and then on the top of the coremata to see if it has one or two lobes. If it only has one lobe, the specimen is neither *S. litura* nor *S. littoralis*. You may skip this step, but it is useful during screening.

4. **Opening the valves.** Grasp each valve on its side with forceps and gently open them, tugging a little so that they stay open. It may be helpful to remove entirely one valve so that it lies on its back without having to hold the other valve open.
5. **Examining inner genitalic structures.** Several structures need to be examined to screen the target species or to identify which *Spodoptera* species is at hand. They need to be examined from different angles. Refer to the terminology at the beginning of this section.

![Spodoptera dolichos](image)

Right valve removed
Part 3: Genitalic characters of the target species

*Spodoptera litura*

*Spodoptera litura* can be identified by the shape of the structures on the inner surface of the valve. The most important character to notice is a set of two “windows” separated by a right angle.

1. Two “windows”, one triangular (1a) and one rectangular (1b).
2. Right angle in the center of the valve.
3. Clavus small.
4. Costal process small, elongate, narrow, and curved.
5. Ampulla slightly curved.
6. Cucullus truncate (nearly square-edged).
7. Juxta triangular with a narrow base and a pointed process.
8. Coremata with two lobes.
Clavus (3)

Juxta (7)

Aedeagus

Costal process (4)

Coremata with two lobes (8)

From a permanent mount.
Modified from M. Pogue (2002).
Spodoptera littoralis

Spodoptera littoralis can be distinguished from native species by a combination of valve characters. It can easily be separated from S. litura by the absence of the two “windows” in the inner surface of the valves.

1. Large opening at the base of valve (similar to S. frugiperda).
2. Clavus in the shape of small bump.
3. Costal process small, elongate, narrow, and curved.
4. Ampulla elongate and curved.
5. Cucullus truncate (nearly square-edged).
6. Juxta quadrate (=squarish) with two ventrolateral projections. This is the most important character, but is difficult to see if it is folded or torn.
7. Coremata with two lobes.
Part 4: Genitalic characters of native species

*Spodoptera dolichos*

The male genitalia of *Spodoptera dolichos* are most easily distinguished by the shape of the clavus, which is similar to a bent thumb, and the shape of the basal sclerite.

1. Clavus shaped as a thumb.
2. Costal process small, elongate, narrow, and bent.
3. Ampulla elongate and curved.
5. Juxta broad, base concave.
6. Coremata with two lobes.
Spodoptera ornithogalli

The genitalia of *Spodoptera ornithogalli* are most easily distinguished by the shape of the clavus, which resembles a hairy toe. It is nearly identical to the genitalia of *S. pulchella*; notice that the coremata are of unequal size.

1. Clavus shaped as a hairy toe.
2. Costal process small, elongate, narrow, and slightly curved.
3. Ampulla elongate and curved.
4. Basal sclerite rounded.
5. Juxta triangular, with long dorsal process.
6. Coremata with two lobes.
Coremata with two lobes (6)
Spodoptera pulchella

The genitalia of *Spodoptera pulchella* are nearly identical to the genitalia of *S. ornithogalli*. A small spine in the vesica of the aedeagus is the distinguishing characteristic, but is difficult to find. Also, the coremata lobes are of nearly equal size. Fortunately, the wings are distinctive, plus, apparently, this species is found only in southern Florida (and the West Indies).

1. Clavus shaped as a hairy toe.
2. Costal process small, elongate, narrow, and either straight or slightly curved.
3. Ampulla elongate and curved.
4. Basal sclerite rounded.
5. Juxta narrow at base (concave) with broad process.
6. Coremata with two lobes.
7. Spine on vesica.

![Image of Spodoptera pulchella genitalia](image)
Ampulla (3)  Juxta (5)

Coremata with two long lobes (6)

Aedeagus  Spine on vesica present in *S. pulchella* and not in *S. ornithogalli* (7).

Cornutal patch on vesica.
Spodoptera latifascia

_Spodoptera latifascia_ is easily distinguished by the large clavus, costal process and ampulla.

1. Clavus club shaped.
2. Costal process large.
3. Ampulla elongate, broad, and curved.
4. Juxta deeply concave at base and with a dorsal process.
5. Coremata composed of two lobes.
**Spodoptera frugiperda**

The coremata of *Spodoptera frugiperda* are characterized by having a single lobe. The base of the valve resembles that of *S. littoralis*.

2. Costal process small, narrow, elongate, straight, inclined.
3. Ampulla slightly curved.
4. Juxta concave at base and with a dorsal process.
5. Coremata composed of a single lobe.

![Spodoptera frugiperda](image)

Costal process (2)  
Clavus (1)

Coremata with one lobe (5)
Spodoptera eridania

The coremata of *Spodoptera eridania* are characterized having a single lobe. The valve lacks a clavus.

1. Clavus absent.
2. Costal process short.
3. Ampulla short, curved, and with a thumb-shaped process.
4. Juxta angular at base with a dorsal process broad at base.
5. Coremata composed of a single lobe.
*Spodoptera albula*

*Spodoptera albula* is distinguished by a short, twisted ampulla with a thumb-like process on its side.

1. Clavus absent.
2. Costal process narrow and elongate.
3. Ampulla short and curved, with a thumb-shaped process.
4. Juxta angular at base and with a dorsal process.
5. Coremata composed of a single lobe.
Spodoptera exigua

Spodoptera exigua is distinguished by a long, thin, curved ampulla, and a rectangular opening at the base of the valve.

1. Clavus absent.
2. Costal process absent.
3. Ampulla elongate, thin, curved.
4. Juxta with base narrow, ventral margin convex and dorsal process narrow.
5. Coremata composed of a single lobe.
6. Large spine on vesica (“distal cornutus”).

![Image of Spodoptera exigua]

- Triangular opening
- Aedeagus with a prominent spine in the vesica
Acknowledgements: I thank Dr. Robert Meagher (USDA-ARS) for providing specimens. Terminology, morphological details, and some photos were taken from Dr. Michael Pogue’s (USDA-ARS-SEL) 2002 monograph titled “A World revision of the genus Spodoptera Guenée (Lepidoptera: Noctuidae)”, Memoirs of the American Entomological Society, Number 43, 202 p.

Photos taken by J.Brambila (USDA-APHIS-PPQ) unless otherwise indicated.