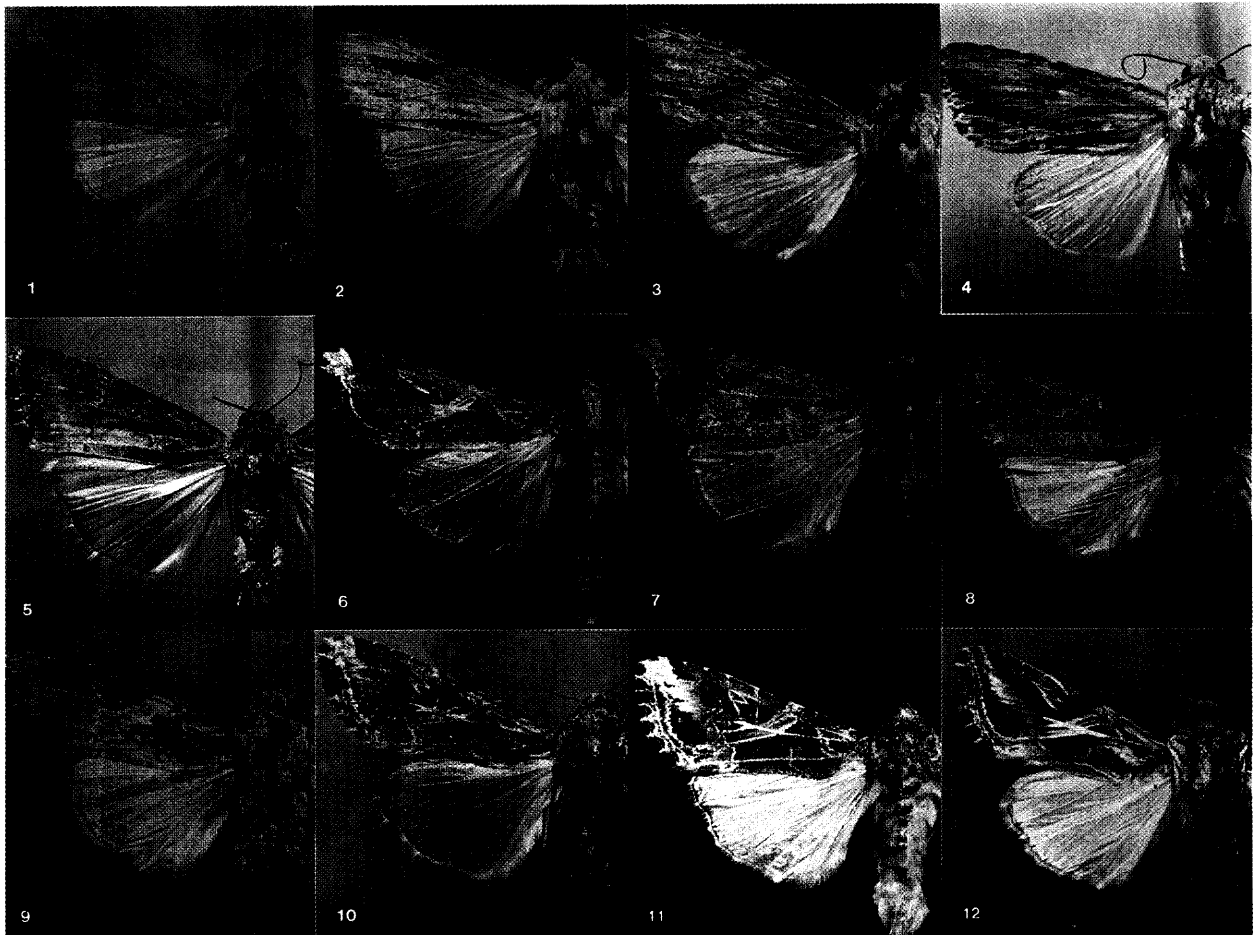


Spodoptera Armyworms in Florida (Lepidoptera: Noctuidae)¹

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Figs. 1-12. *Spodoptera* species in Florida: 1) *S. albula* (Walker); 2-4) *S. eridania* (Cramer) ♂ and two ♀ forms; 5) *S. exigua* (Hübner); 6) *S. dolichos* (Fabricius); 7-8) *S. frugiperda* (J. E. Smith) ♂ and ♀; 9-10) *S. latifascia* (Walker) ♂ and ♀; 11) *S. ornithogalli* (Guenée); 12) *S. pulchella* (Herrich-Schäffer) (photographed by H. O. Hilton).

INTRODUCTION: The armyworms of the genus *Spodoptera* include 10 species in North America. All are found in Florida except for *Spodoptera praeifica* (Grote) which only occurs in the far western states (Heppner 1995). Older literature often has the *Spodoptera* listed under the synonyms *Laphygma* and *Prodenia*. The "armyworm" is *Pseudaletia unipuncta* (Haworth), not in the genus *Spodoptera*. The *Spodoptera* armyworms can be very destructive, especially to gardens and field crops. The hostplant range is exceedingly large for the northern species, most having more than 30 recorded hostplants. The strictly Neotropical species are more restricted in hostplant range, and are not known to be of economic importance. However, some *Spodoptera* species in the Old World tropics, especially in Africa, are serious pests (see Brown and Dewhurst 1975).

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IDENTIFICATION: The *Spodoptera* species in Florida are similar in appearance in both maculation types found: 1) the more nondescript type includes *S. albula*, *S. eridania*, and *S. exigua*; and 2) the more contrastingly marked type includes the remaining species, with *S. frugiperda* somewhat mixed since its female usually has the markings more subdued. Careful study of the illustrations and use of the key to adults will allow identification. However, forms can be found that may be difficult to determine, in which case a genitalic examination may be needed to confirm the species. The larval key is more tentative since larvae of two species remain undescribed.

BEET ARMYWORM – *Spodoptera exigua* (Hübner) (Fig. 5)

The beet armyworm is a well-known pest of vegetable crops. It is most similar to the fall armyworm, but is paler and differs most in the forewing round orbicular spot colored with pale-yellow. In the fall armyworm the orbicular spot is more oval and oblique, with a dark center. The white contrasting markings of the forewings are absent in beet armyworm, while females of the fall armyworm have the markings in a subdued white pattern. Males and females of beet armyworm are rather similar and not as dimorphic as some of the other species. The species ranges through most of the United States, getting into northern areas and southern Canada as a summer migrant, and occurs south as far as Dominica in the Caribbean and Nicaragua in Central America (Todd and Poole 1980).

FALL ARMYWORM – *Spodoptera frugiperda* (J. E. Smith) (Figs. 7-8)

The fall armyworm is a serious pest (see Luginbill 1928; Rings 1977a). Females resemble the beet armyworm but have more contrasting maculation, while males are more like the more well-marked *Spodoptera* species. The forewing orbicular spot in the male is oval and oblique, while in similar species this marking is more narrowly linear. Fall armyworm males most resemble the garden armyworm, but the forewings are more rounded and the subterminal white line is more curved than in the garden webworm. The fall armyworm is very widespread throughout the Western Hemisphere, occurring from southern Canada to Chile and Argentina. Seasonal occurrences further north may be possible during warm summers. An introduction of the species into Israel has occurred.

GARDEN ARMYWORM – *Spodoptera latifascia* (Walker) (Figs. 9-10)

The garden armyworm is common in Florida. It is most similar to *S. ornithogalli*, but generally larger. Females are noted by the subterminal crescents near the tornus being adnate (touching). The males have the distinctive large whitish area near the forewing termen, as well as a light yellowish area midwing near the inner margin. The garden armyworm occurs only along the Gulf Coast, straying north to South Carolina and Arkansas, then south throughout the Caribbean and into Central and South America.

SOUTHERN ARMYWORM – *Spodoptera eridania* (Cramer) (Figs. 2-4)

The southern armyworm is a well-known destructive pest of vegetable crops. It is among the lighter marked species of *Spodoptera* and has in the past been placed in the genus *Xylomyges*. Forewings are grey-brown, without the bright white markings of the more strongly marked *Spodoptera* species. There are a number of variations in maculation in both sexes of *S. eridania*, although males tend to match the usual form illustrated herein (Fig. 2). The reniform mark (near apex of forewing; see Fig. 2) is usually a dark streak in males, and less evident in females. The southern armyworm can only be confused with *S. albula*, but the latter is generally much lighter in coloration and lacks distinct brown markings. The southern armyworm is generally distributed in the American tropics, getting into our area only in the southeastern quarter of the United States, as far north as Maryland in the east and Kansas in the Plains states, occasionally straying somewhat further north (to New Hampshire) during warm summers.

SWEETPOTATO ARMYWORM – *Spodoptera dolichos* (Fabricius) (Fig. 6)

The sweetpotato armyworm has a shorter list of known hostplants than the other pest species of *Spodoptera*, favoring sweetpotatoes in particular. It is strongly marked on the forewings and is most easily distinguished by the dark brown longitudinal stripes on the dorsum of the thorax. The range is widespread throughout the American tropics, south to Brazil, and north to Florida and Texas; it strays north to Wisconsin and Maine during warm summers.

TROPICAL ARMYWORMS – *Spodoptera albula* (Walker), *Spodoptera androgea* (Stoll), *Spodoptera pulchella* (Herrich-Schäffer)

These species are not often encountered or are strays from the Caribbean, occurring also in southern Florida and the Keys, but can stray northward somewhat. *S. albula* ranges to Central Florida. *Spodoptera androgea* (illustrated by Dickel 1991)

is a stray once found in the Keys; it is most like *S. dolichos*, but is overall much darker on the forewings and lacks the thoracic lines of *S. dolichos*. The other two species, *S. albula* and *S. pulchella* (Fig. 12), are of little economic importance. Older papers list *S. albula* as *S. sunia* (Guenée), but this is a misidentification. The true "*S. sunia*" is in an unrelated genus as *Neogalea sunia*, a tropical species of Central and South America that also occurs in Florida and along the Gulf Coast (Poole 1989). Distinctions for *S. albula* involve the overall light coloration of the forewings, similar only to some forms of *S. eridania*. For *S. pulchella*, the forewing marking near the middle of the inner margin, a white line with upturned ends, is distinctive among all our *Spodoptera*. Ranges for the species are similar for the tropics, with *S. albula* and *S. pulchella* more restricted to the Caribbean region. The more tropical species range from Central to South America, as well as the Caribbean, with *S. androgea* straying into our area in southernmost Florida.

YELLOW-STRIPED ARMYWORM – *Spodoptera ornithogalli* (Guenée) (Fig. 11)

The yellow-striped armyworm is a common pest in the eastern United States. It is among the *Spodoptera* having well-marked forewings and is most similar to *S. pulchella* and the garden armyworm. In *S. ornithogalli*, forewings have the subterminal crescent marks separated from opposing markings, while in *S. latifascia* these markings touch (adnate) near the tornus. Males of *S. ornithogalli* also resemble some males of *S. frugiperda*, but in the latter the termen of the forewing is more brown, while in *S. ornithogalli* the termen has considerable suffusion of white scales over a large area. In *S. pulchella*, the forewing has a distinct curved white line (with upturned ends) near the middle of the inner margin, while in *S. ornithogalli* this marking is absent. Although wide-ranging, *S. ornithogalli* seems less common than some of the other species in eastern North America. It occurs in the eastern part of southern Canada, south to Florida and most of the Greater Antilles. It also occurs to southern Arizona and southern California in the Southwest, then south through Mexico, possibly as far as Costa Rica (Todd and Poole 1980).

KEY TO SPODOPTERA ADULTS IN FLORIDA

(modified from Todd and Poole 1980)

- 1. - Orbicular (midwing) spot of forewings circular, usually centered with pale yellow *S. exigua*
- Orbicular (midwing) spot of forewings, if conspicuous, not round 2
- 2(1) - Ordinary transverse lines of forewing obsolescent; postmedial band as a series of dark points on veins; white patch absent from forewing apex to upper third of postmedial line 3
- Ordinary transverse lines of forewing present (sometimes indistinct); white patch present from forewing apex to upper third of postmedial line 4
- 3(2) - Forewing with a short, fine and dark longitudinal basal dash; maculation lacks brown *S. albula*
- Forewing lacking a basal dash; maculation with brown markings *S. eridania*
- 4(2) - Forewing entirely dark brown lacking distinct contrasting markings *S. frugiperda* ♀
- Forewing not entirely dark brown and with some contrasting markings 5
- 5(4) - Forewing usually brown, costal area usually darker than inner margin area; forewing length usually less than 15 mm; forewing subterminal line usually fading out about halfway to inner margin *S. frugiperda* ♂
- Forewing usually dark brown, costal area usually darker than inner margin; forewing length normally greater than 15 mm; forewing subterminal line usually reaching 2/3 or more to inner margin 6
- 6(5) - Forewing with prominent white curved line or patch from near basal third of costal margin to postmedial base (usually not divided); white distal element of forewing reniform spot between veins M₁ and M₂ larger and more conspicuous than corresponding element between R₅ and M₁ 7
- Forewing with less prominent white curved line or patch from near basal third of costal margin to postmedial base (usually divided into 2 or 3 streaks before postmedial band); white distal element of forewing reniform spot between veins M₁ and M₂ not larger or more conspicuous than corresponding element between R₅ and M₁ 8
- 7(6) - Prominent longitudinal dark streaks on thoracic dorsum *S. dolichos*
- Thoracic dorsum uniformly grey or reddish, without contrasting darker streaks *S. androgea*
- 8(6) - Crescent-shaped marks of forewing terminal and adterminal lines adnate, forming spindle-shaped spots, especially near tornus *S. latifascia*
- Crescent-shaped marks of forewing terminal and adterminal lines not adnate, separate and not forming spindle-shaped spots 9

- 9(8) - Forewing with a curved white line present in median area, its basal and apical ends originating on inner margin at the antemedial and postmedial bands, respectively *S. pulchella*
- Forewing without such a curved white line in median area *S. ornithogalli*

KEY TO LAST INSTAR SPODOPTERA LARVAE IN FLORIDA

(modified from Levy and Habeck 1976)³

- 1 - Dorsal pinacula conspicuous, diameter equal to or greater than width of spiracle *S. frugiperda*
- Dorsal pinacula absent or inconspicuous, diameter never greater than ½ width of spiracle 2
- 2(1) - Most abdominal segments with dark subdorsal markings, more or less triangular; mature larvae to 50 mm long 3
- Abdominal segments without dark subdorsal markings, or if present then irregularly shaped and never triangular; mature larvae not more than 25-30 mm long *S. exigua*
- 3(2) - Abdominal segments with a prominent yellowish subspiracular line interrupted by a dark spot on the 1st abdominal segment; head usually yellowish-brown with some lighter reticulations *S. eridania*
- Abdominal segments without a prominent yellowish subspiracular (if present then line extends anteriorly without interruption through the 1st abdominal segment); head variously colored (usually not uniform), with some dark areas 4
- 4(3) - Dark abdominal subdorsal markings with a distinct white spot or notch *S. albula*
- Dark abdominal subdorsal markings without a distinct white spot or notch 5
- 5(4) - Mesothorax with dark subdorsal markings more or less triangular; abdominal dark subdorsal markings with a white line passing through; head dark brown to black *S. ornithogalli*
- Mesothorax with dark subdorsal markings semicircular or trapezoidal; abdominal dark subdorsal markings without a white line passing through; head brown to dark brown 6
- 6(5) - Mesothorax dark subdorsal markings semicircular and distinctly smaller than markings on abdominal segment 8 *S. latifascia*
- Mesothorax dark subdorsal markings trapezoidal and approximately as large as markings on abdominal segment 8 *S. dolichos*

³ Larvae of *S. androgea* and *S. pulchella* are unknown or have not been associated with adults.

DISTRIBUTION: All the *Spodoptera* armyworms of eastern North America are found in Florida. These species are distributed throughout Florida except for the more tropical species (*S. albula*, *S. androgea*, and *S. pulchella*), which are found in extreme southern Florida, although *S. albula* ranges north to Central Florida. Further distribution notes have been noted above for each species (see also Todd and Poole 1980).

HOSTPLANTS: *Spodoptera* armyworms are general feeders that impact agriculture principally in their extensive list of vegetable crop hosts. All major vegetable and garden crops can be attacked by armyworms. Favorite hosts include onions (*Allium*), celery (*Apium*), peanuts (*Arachis*), asparagus (*Asparagus*), beets (*Beta*), cabbages (*Brassica*), peppers (*Capsicum*), watermelon (*Citrullus*), cucumbers (*Cucumis*), pumpkin and squash (*Cucurbita*), carrots (*Daucus*), strawberries (*Fragaria*), soybeans (*Glycine*), cotton (*Gossypium*), sweet potato (*Ipomoea*), lettuce (*Lactuca*), tomatoes (*Lycopersicon*), alfalfa (*Medicago*), tobacco (*Nicotiana*), beans (*Phaseolus*), peas (*Pisum*), eggplant (*Solanum*), sorghum (*Sorghum*), clover (*Trifolium*), blueberries (*Vaccinium*), cowpeas (*Vigna*), grapes (*Vitis*), and corn (*Zea*). Ornamentals attacked include amaranths (*Amaranthus*), chrysanthemums (*Chrysanthemum*), dahlias (*Dahlia*), gardenias (*Gardenia*), gladiolas (*Gladiolus*), hibiscus (*Hibiscus*), oleander (*Nerium*), geranium (*Pelargonium*), petunias (*Petunia*), roses (*Rosa*), schefflera (*Schefflera*), and zinnias (*Zinnia*). Even citrus (*Citrus* spp.) has been recorded as occasional hosts of various *Spodoptera* in Florida. Alternate hosts include dozens of other ornamental and native plants in Florida, such as umbrella tree (*Brassaia*), black olive (*Bucida*), Natal plum (*Carissa*), hickory (*Carya*), treebine (*Cissus*), ti plant (*Cordyline*), sycamore (*Platanus*), azaleas (*Rhododendron*), mahogany (*Swietenia*), wisteria (*Wisteria*), and various grasses. Some *Spodoptera* are more partial to particular hosts: e.g., the fall armyworm prefers grasses and various vegetables; the sweetpotato armyworm prefers sweet potatoes and related vegetables.

BIOLOGY: The *Spodoptera* species have a similar biology. Larvae are generally night feeders, thus often unseen during the day when they rest in the ground or secluded hiding places. Being tropical species, they generally will overwinter only in the southern portions of the United States, then migrate north during the warmer summer; they can have summer generations in northern regions. Eggs are laid at night in clusters on host leaves. Caterpillars devour most any part of the hostplant, consuming leaves, fruits and even stems in such soft hosts as corn. The name "armyworm" comes from the habit of larvae during mass outbreaks to migrate to nearby fields in search of more hostplants. In warm regions like Florida, *Spodoptera* species will have near continuous generations throughout the year with about one every 7-8 weeks under optimal conditions. In northern regions of the United States, populations build up from migrant females and outbreaks tend to occur more in late summer; this is the reason the fall armyworm has this common name, since the caterpillars are most common in northern states during late summer and early autumn before the first frosts. Pupation for all *Spodoptera* is in the ground, about 1-2 inches into the soil. Further biological notes can be found in Crumb (1927), Luginbill (1928, 1950), Passoa (1991), Rings (1977a,b), and Rings and Musick (1976).

CONTROL: Armyworms can be controlled by the use of the caterpillar bacteria, *Bacillus thuringiensis*. More immediate results are possible with applications of various pesticides (Insect Control Guide 1994, for current recommendations). Spraying at dusk will possibly give better results, since caterpillars are active at night. The timing of control measures can also benefit reduction of the numbers of armyworms by cultural methods like rolling a heavy lawn roller over grass to crush pupae in the ground, or using various tilling procedures after a crop has been destroyed or harvested to destroy the larvae or pupae in the ground (Luginbill 1950).

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