



Food and Agriculture
Organization of the
United Nations



International
Plant Protection
Convention



Survey Guidance for
Spodoptera frugiperda



Survey Guidance for *Spodoptera frugiperda*

Scientific Name

Spodoptera frugiperda (Smith, 1797)

Common Name

Fall armyworm, corn leafworm, southern grass worm, grass worm

Type of Pest

Moth, foliage feeder

Known Hosts

Preferred hosts

Spodoptera frugiperda has a wide host range but prefers grasses (Family: Poaceae). Preferred crop hosts include: *Zea mays* (maize), *Oryza sativa* (rice), *Sorghum bicolor* (sorghum), and *Saccharum officinarum* (sugarcane).

Other hosts

Other hosts are numerous, including *Medicago sativa* (alfalfa), *Gossypium* spp. (cotton), *Hordeum vulgare* (barley), *Cynodon dactylon* (Bermudagrass), *Lolium* spp. (ryegrass), and *Triticum* spp. (wheat).

Survey Protocol

Surveys should focus on detecting adult moths using pheromone traps. Host plants can be surveyed for the presence of eggs and larvae or evidence of feeding.

Target Life Stage:

- Adult moth, using pheromone traps
- Eggs and larvae, visual survey

Time of year to survey:

Survey can be continuous whenever the host crop is in the field.

Visual Survey:

Visual surveys for eggs and larvae on host plants (**Fig. 2**) as well as the evidence of their feeding on host plants (**Fig. 3**). Egg masses of up to 200 eggs are generally laid on the underside of the leaves of host plant (**Fig. 2A**) and covered with gray scales from the female's body (**Fig. 2B**). Eggs may also be deposited on poles and other structures when populations are high.



Figure 1. Adult male *Spodoptera frugiperda* moth (Image courtesy of Lyle Buss, University of Florida, Bugwood.org, CC BY 3.0 US)

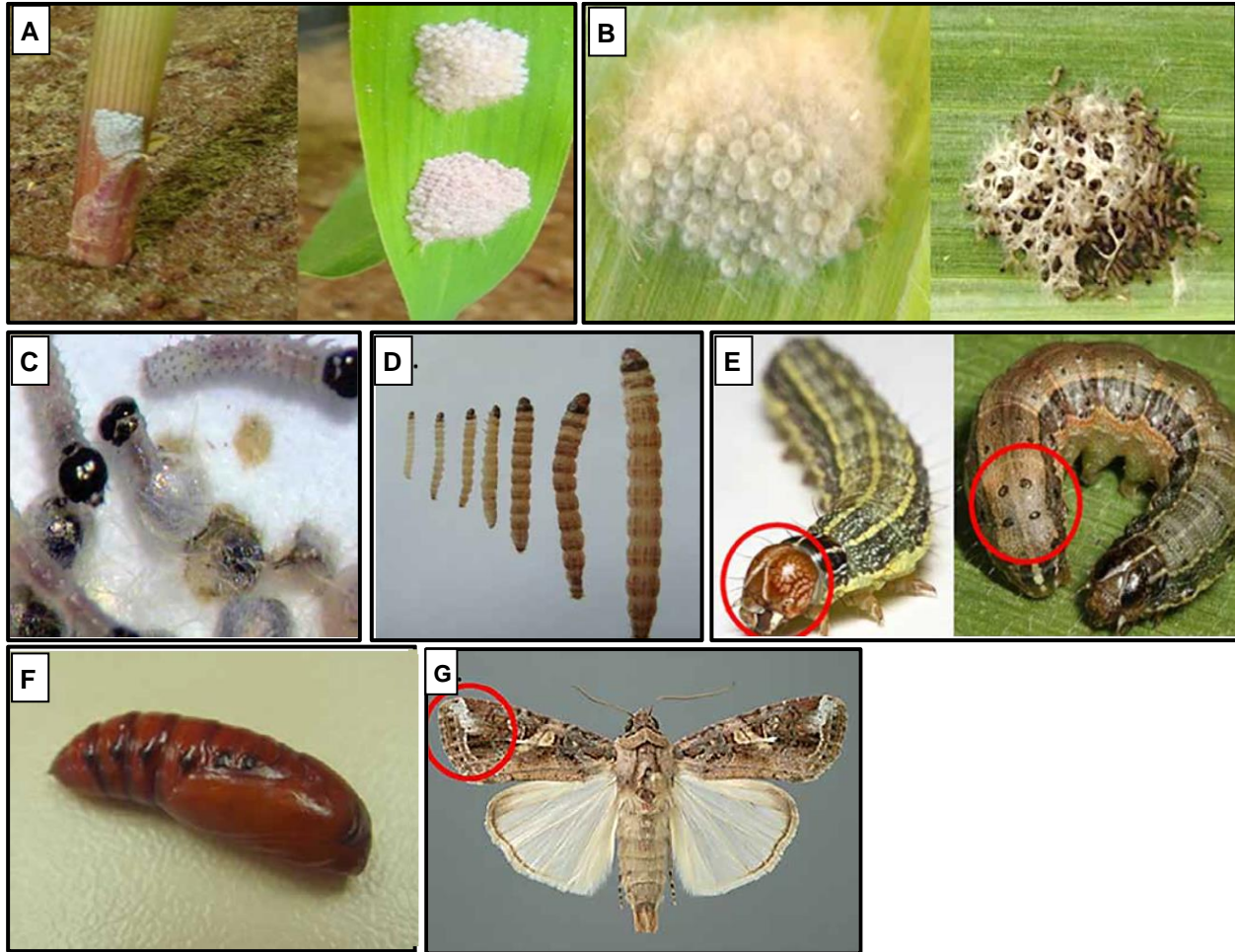


Figure 1. Life stages of fall armyworm (A) Egg mass placed on stem (left) or leaf (right) at early stage of maize plant, (B) egg mass (left) and larvae hatching three days after oviposition (right), (C) Black-headed larvae emerging out of egg mass, (D) Larval growth stages (1 mm to 45 mm), (E) Distinguishing marks on medium to large-sized larvae, (F) Reddish-brown pupae, (G) Male moth with conspicuous white spot on tip of forewing (Images courtesy of Ivan Cruz, Embrapa, from B.M. Prasanna, Joseph E. Huesing, Regina Eddy, Virginia M. Peschke (eds). 2018. Fall Armyworm in Africa: A Guide for Integrated Pest Management, First Edition. Mexico, CDMX: CIMMYT)

Larvae can be found on seedlings or mature plants. Larvae create holes in leaves or ragged edges. In maize, *S. frugiperda* feeding damage creates a distinct pattern with rows of holes in the leaf due to infestation and feeding in the whorl stage (**Fig. 3**). This pest also bores into the side of the ears damaging the kernels and can destroy tassels. Frass from larval feeding is also a sign of presence.



Figure 3. Damage from *Spodoptera frugiperda* on maize
 (Images courtesy of Brianna Flonc, Penn State University, 2018; <https://www.invasive-species.org>)

Trapping

Survey Site Selection

Surveys should target primarily maize but can include rice and sorghum.

Recommended Traps

- Bucket trap (Fig. 4)
- Delta sticky trap (Fig. 5)

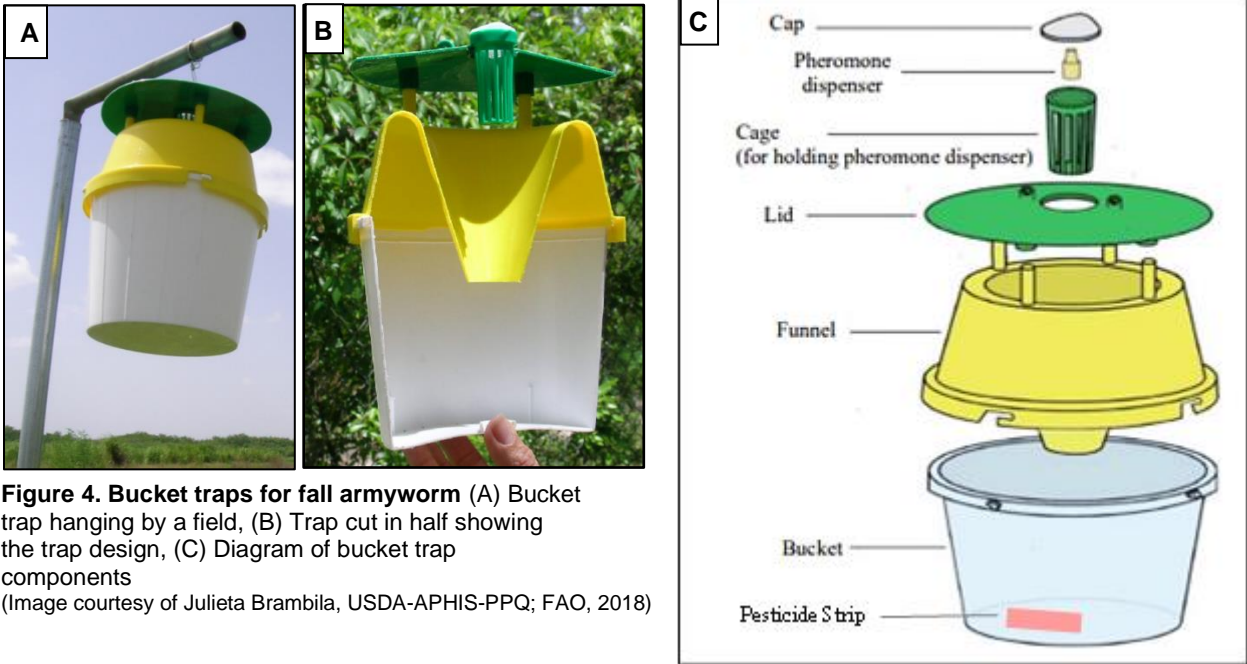


Figure 4. Bucket traps for fall armyworm (A) Bucket trap hanging by a field, (B) Trap cut in half showing the trap design, (C) Diagram of bucket trap components
 (Image courtesy of Julieta Brambila, USDA-APHIS-PPQ; FAO, 2018)



Figure 5. Delta sticky traps. Traps being assembled (left) with lure (see arrow); Traps hanging from trees (right) (Image courtesy of Terry S. Price, Georgia Forestry Commission, Bugwood.org CC BY 3.0 US; Alpha Schents, Inc)

Recommended Lures

- Standard FAW lure (four-component lure)
- Three-component FAW lure
- Two-component FAW lure

All three of these lures are effective, but there may be local differences that should be explored.

Trap Placement and Spacing

- Pheromone traps should be placed at the edge of the field suspended on poles or hangers at a height of 1.5 m.
- Pheromone traps can also be suspended 20 to 70 cm above the top of the plants.
- Traps should always be spaced at least 50 m apart.
- For detection, use one trap per square kilometer.

Trap Servicing

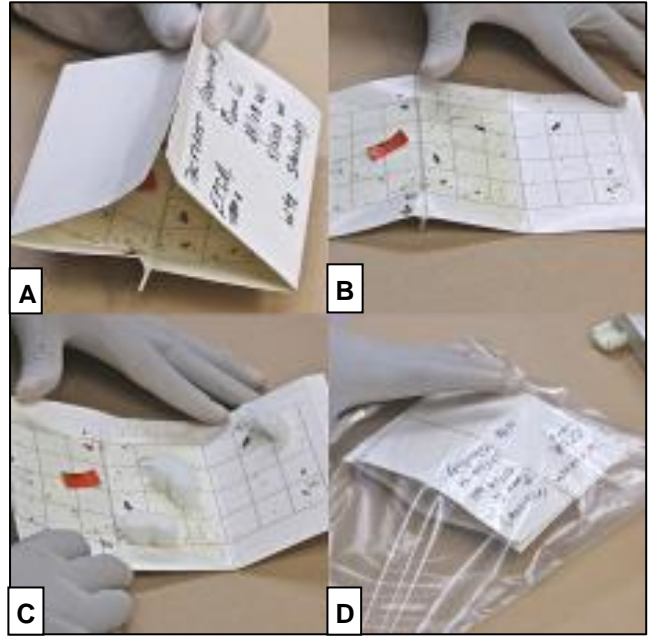
- Traps should be checked every one to two weeks.
- Lures should be replaced once every four weeks.
- Pesticide strips should be replaced every 60 days.
- If using sticky traps, remove any leaves or debris or replace if it is no longer sticky
- If possible, photograph any specimens you find inside.

Sample Collection

Moths captured in bucket traps can be placed in a labeled vial, or other container, and stored in a cool, dry place until they are submitted for identification. Make sure moths are dry before transferring to a container to prevent molding.

Moths cannot be removed from sticky traps without damaging the specimens. When suspect moths are captured, either the entire sticky trap/insert or an excised portion of the sticky trap containing the suspect moth can be submitted to an expert for identification.

Figure 6. Recommended packing method for shipment of sticky traps. (A) and (B) open and unfold trap; (C) place 2 to 3 packing peanuts (or something similar) in areas of trap with no moths; (D) fold trap, secure with rubber band, and place in plastic bag if samples are dry, otherwise store/ship in a paper bag so specimens can dry and do not rot. (Images courtesy of E. LaGasa, WSDA)



Pest Identification and Diagnostics

Pest Description

Spodoptera frugiperda is a foliage feeding pest in its larval stage (**Figs. 2, C-E**). It is a tropical and subtropical pest that does not enter diapause and cannot survive winter in temperate areas. However, the adult moth is highly migratory and can travel hundreds of kilometers during favorable weather. The life cycle can be completed in 30 to 90 days depending on temperature. Upon hatch, neonate larvae can disperse quickly on nearby plants by “ballooning” onto nearby plants using silken threads. There are usually six larval instars and pupation takes place in the soil.

Both morphological and molecular identification methods are available to identify. Morphologically, the face of mature larvae have a white inverted ‘Y’ shaped marking (**Fig. 2E**). Unlike other members of the genus *Spodoptera*, *S. frugiperda* has a distinct diagnostic character that will separate it from other caterpillars found on agricultural crops. The 2nd and 3rd segments behind the head have raised plates (pinacula) with a keyhole shaped depression on each side (**Fig. 7**). Specimens exhibiting this character are unlikely to be confused with other taxa. Note that this character may be hard to see in younger larvae. Adult males have somewhat distinctive white markings at the tips of their forewings (**Fig. 8A**), but the wings of female moths do not have distinctive markings. Morphological confirmation of both males and females requires dissection of the genitalia. Suspect moths should be submitted to an expert for identification.



Figure 7: Lateral view of the anterior segment of a *Spodoptera frugiperda* caterpillar. Red arrows point to plate with keyhole like depression (Image courtesy of Jim Young, USDA)

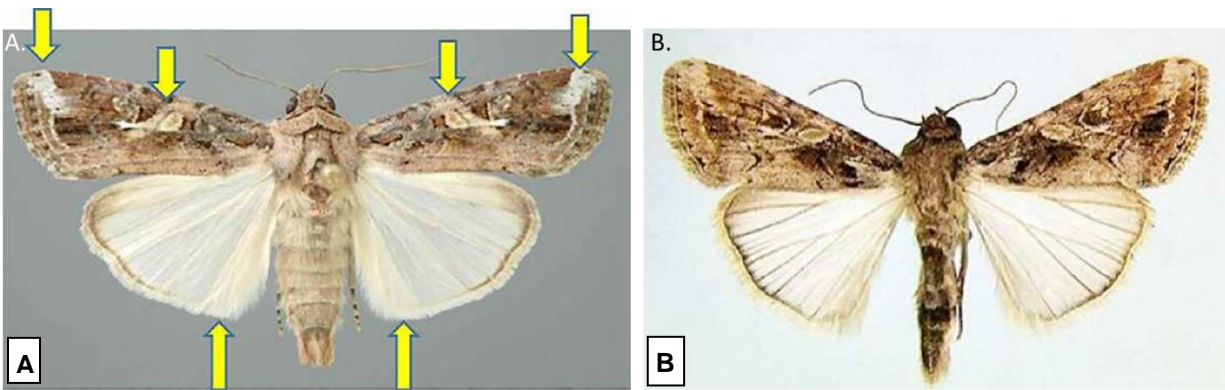


Figure 8. Male *Spodoptera frugiperda* versus male *S. exempta*. (A) Male *Spodoptera frugiperda*, with arrows showing somewhat distinctive characteristics, including a conspicuous white patch at the tip and in the middle of the forewings and white veins at the bottom edge of the hindwings, that can help distinguish the species. (B) Male of *S. exempta* (Walker, 1856) lacking these characteristics. (Images courtesy of A. L. Buss, University of Florida, Bugwood.org, CC BY 3.0 US, B. Georg Goergen, IITA; adapted from B.M. Prasanna, Joseph E. Huesing, Regina Eddy, Virginia M. Peschke (eds). 2018. Fall Armyworm in Africa: A Guide for Integrated Pest Management, First Edition. Mexico, CDMX: CIMMYT)

Easily Mistaken Species

Other species of *Spodoptera* may look superficially similar (**Fig. 8B**), and some relatives will appear in pheromone-baited traps. Non-target species of noctuid moths caught in *S. frugiperda* traps in Africa include *Leucania curvula* Walker, 1856, *L. loreyi* Duponchel, 1827, and *Spodoptera trituratora* Walker, 1856. The closely related species *Spodoptera exempta*, *S. exigua*, and *S. littoralis* also occur in Africa and may be difficult to distinguish from *S. frugiperda*.

Identification and Diagnostic Resources:

European and Mediterranean Plant Protection Organization (EPPO):

Diagnostics for *Spodoptera littoralis*, *S. litura*, *S. frugiperda*, and *S. eridania*

https://www.eppo.int/media/uploaded_images/ACTIVITIES/plant_quarantine/short_note_s/pm7-124-1-en.pdf

USDA Identification Technology Program-LepIntercep
Resource for intercepted Lepidoptera larvae. Page on Spodoptera:
<http://idtools.org/id/lepintercept/spodoptera.html>

Pogue, M., 2002. A World Revision of the Genus *Spodoptera* Guenée (Lepidoptera:
Noctuidae) American Entomological Society. Philadelphia, PA, USA.
<https://archive.org/details/memoirsofameric432002amer/>

The United States Department of Agriculture developed this datasheet in support of the
Africa Phytosanitary Program (2023)

International Plant Production Convention Secretariat
ippc@fao.org | www.ippc.int

Food and Agriculture Organization of the United Nations
Rome, Italy