Spodoptera litura

Scientific Name
Spodoptera litura Fabricius

Synonyms:
Mamestra albisparsa,
Noctua elata,
Noctua histrionica,
Noctua litura,
Prodenia ciligera,
Prodenia declinata,
Prodenia evanescens,
Prodenia glaucistriga,
Prodenia litura,
Prodenia littoralis,
Prodenia subterminalis,
Prodenia tasmanica,
Prodenia testaceoides,
Spodoptera littoralis

Common Name
Cotton cutworm, rice cutworm, taro caterpillar, tobacco budworm, cotton leafworm, cluster caterpillar, cotton worm, Egyptian cotton leafworm, tobacco caterpillar, tobacco cutworm, tobacco leaf caterpillar, and common cutworm

Type of Pest
Moth

Taxonomic Position
Class: Insecta, **Order:** Lepidoptera, **Family:** Noctuidae

Figure 1. (A) Eggs covered with hairy scales (Merle Shepard, Gerald R.Carner, and P.A.C Ooi, Insects and their Natural Enemies Associated with Vegetables and Soybean in Southeast Asia, Bugwood.org) (B) Emerging larvae (Amy Carmichael, Queensland University of Technology, PaDIL).

Reason for Inclusion in Manual
CAPS Target: AHP Prioritized Pest List – 2009 though 2014

Pest Description
The two Old World cotton leafworm species, *Spodoptera litura* and *S. littoralis*, are allopatric, their ranges covering Asia and Africa, Europe and the Middle East, respectively. Many authors have regarded them as the same species, but they have been differentiated based on adult genitalia (Mochida, 1973; CABI, 2009).

Eggs: Spherical, somewhat flattened, sculpted with approximately 40 longitudinal ribs, 0.4 to 0.7 mm (<1/16 in) in diameter; pearly green, turning black with time, laid in batches covered with pale orange-brown or pink hair-like scales from the females body (Pearson, 1958; CABI, 2009).

Larvae: Newly hatched larvae are tiny, blackish green with a distinct black band on the first abdominal segment. Fully grown larvae are stout and smooth with scattered short setae. Head shiny black, and conspicuous black tubercules each with a long hair on each segment. Color of fully grown larvae not constant, but varies from dark gray to dark brown, or black, sometimes marked with yellow dorsal and lateral stripes of unequal width. The lateral yellow stripe bordered dorsally with series of semilunar black marks. Mature larvae are 40 to 50 mm (approx. 1 9/16 to 2 in). Two large black spots on first and eight abdominal segments (Hill, 1975; USDA, 1982; CABI, 2009).

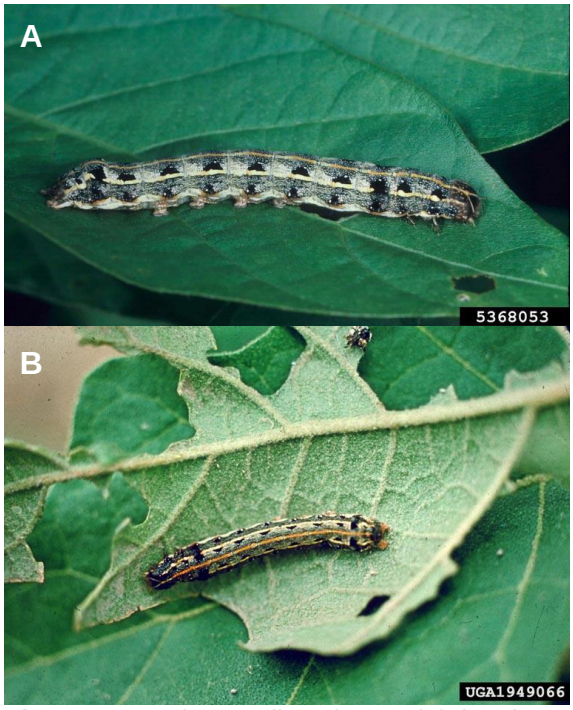

Figure 2. *Spodoptera litura* larvae (A) (Merle Shepard, Gerald R.Carner, and P.A.C Ooi, Insects and their Natural Enemies Associated with Vegetables and Soybean in Southeast Asia, Bugwood.org) (B) K. Kiritani, Bugwood.org).

Pupae: Reddish brown in color, enclosed inside rough earthen cases in the soil, 18 to 22 mm (approx. 11/16 to 7/8 in) long, last abdominal segment terminates in two hooks (USDA, 1982; CABI, 2009).

Adults: Body whitish to yellowish, suffused with pale red. Forewings dark brown with lighter shaded lines and stripes. Hind wings whitish with violet sheen, margin dark brown and venation brown. Thorax and abdomen orange to light brown with hair-like tufts on dorsal surface. Head clothed with tufts of light and dark brown scales. Body length 14 to 18 mm (approx. 9/16 to 11/16 in), wing span 28 to 38 mm (approx. 1 1/8 to 1 1/2 in) (Hill, 1975; USDA, 1982).

See Schmutterer (1969), Cayrol (1972), and Brown and Dewhurst (1975) for additional information.

Biology and Ecology

Two to five days after emergence, female moths lay 50 to 300 eggs in masses on the lower surface of leaves (preferred). The eggs hatch in three to four days (Chari and Patel, 1983). A single female can lay a total of 1,500 to 2,500 eggs in about six to eight days. Castor bean is the most preferred host for ovipositing females (Chari and Patel, 1983). Freshly irrigated fields are also very attractive to ovipositing females. Three

peak periods of egg laying have been observed in the third weeks of June, July, and in mid-August. Groups of freshly hatched larvae feed on the epidermis of the leaf. If the population density is high or the host is not suitable, the young larvae will hang on silken threads and migrate to other leaves or preferred hosts. *Spodoptera litura* larvae generally pass through six instars. First to third instars generally remain on the underside surface of leaves. The fourth to sixth instars drop onto the ground, root around to loosen the surface of the soil, and bite out soil particles to form a clay cell or cocoon in which to pupate (Chari and Patel, 1983).

Figure 3. *Spodoptrea litura* adults (A) (K. Kiritani, Bugwood.org) (B) (Natasha Wright, Florida Department of Agriculture and Consumer Services, Bugwood.org).

Ahmed et al. (1979) showed that *S. litura* adults developed from first instar larvae in 23.4 days at 28°C (82°F). Mean female longevity was 8.3 days and mean fecundity was 2,673 eggs. Mean male longevity was 10.4 days. Male and female moths do not mate on the night of emergence; maximum mating response occurred on the second night after emergence (Yamanaka et al., 1975; Ahmed et al., 1979). According to Yamanaka et al. (1975), the female continues to lay eggs in egg masses over a period of 5 days at 25°C (77°C).

Fecundity is adversely affected by high temperature and low humidity (about 960 eggs laid at 30°C and 90% RH and 145 eggs at 35°C (95°F) and 30% RH) (EPPO/CABI, 1997). Maximum fecundity for *S. litura* was observed at 27°C (81°F) under 12 hours per 24 hours of light (Hasmat and Khan, 1977; 1978). Temperatures between 24 and 30°C (75 and 86°F) were also favorable for fecundity and fertility. At 33 and 39°C (91 and 102°F), both fecundity and fertility were decreased, and in the latter, fertility was completely inhibited (Hasmat and Khan, 1977). Parasuraman and Jayaraj (1983a) noted that 25°C (77°F) and 75% relative humidity were favorable for development of *S. litura* and resulted in a shorter larval period, 100% pupation, a shortened pupal period, and 100% adult emergence.

The eggs hatch is about four days in warm areas or up to 11 to 12 days in winter (EPPO/CABI, 1997). Ranga Rao et al. (1989) reported that an average of 64 degree-days (DD) above a threshold of 8°C (46°F) was required for oviposition to egg hatch. The larval period required 303 DD, and the pupal stage required 155 DD above a 10°C (50°F) threshold. Females needed 29 DD above a 10.8°C (51°F) threshold from

emergence to oviposition. The upper developmental threshold temperature of all stages was 37°C (99°F); 40°C (104°F) was lethal.

The pre-pupal and pupal period of *S. litura* is spent in earthen cells or cocoons in the soil and lasts about 11 to 13 days at 25°C (77°F). In India, Parasuraman and Jayaraj (1983b) found pupation was maximal under fallen leaves, especially in wet sandy loam soil. Although the depth of pupation varied, no pupation was observed beyond 12 cm (4.7 in.) deep. Most larvae pupated at a 4 cm (1.6 in.) depth across soil types.

Damage

On most crops, damage arises from extensive feeding by larvae, leading to complete stripping of the plants. Larvae are leaf eaters but sometimes act as a cutworm with crop seedlings. If heavy feeding on a young plant occurs, it may lead to stunted development and fruit may be small or late to develop (USDA, 2005).

Figure 4. *Spodoptera litura* damage on persimmon leaf (Yuan-Min Shen, Taichung District Agricultural Research and Extension Station, Bugwood.org).

Spodoptera litura feeds on the underside of leaves causing feeding scars and skeletonization of leaves. Early larval stages remain together radiating out from the egg mass. However, later stages are solitary. Initially there are numerous small feeding points, which eventually spread over the entire leaf. Because of this pest's feeding activities, holes and bare sections are later found on leaves, young stalks, bolls, and buds. Larvae mine into young shoots. In certain cases, whole shoot tips wilt above a hole and eventually die (Hill, 1975; USDA, 1982). Feeding damage can also occur as tunnels in compact foliage such as cabbage hearts (Waterhouse and Norris, 1987). Damage is mainly to foliage, however, fruit can also be damaged (Waterhouse and Norris, 1987).

Large batches of up to 300 eggs may be found on the underside of the host leaves (USDA, 2005); while pupae can be found underground (Waterhouse and Norris, 1987).

On corn: Corn stems are often mined by *S. litura* and young grains in the ear may also be damaged (EPPO/CABI, 1997).

On cotton: The pest may cause considerable damage by feeding on leaves and bolls. Leaves are heavily damaged and bolls have large holes. Yellowish-green to dark green larval excrement may surround bore holes in bolls (EPPO/CABI, 1997).

On grape: larvae scrape the leaf tissue and cause 'drying of the leaves' (Balasubramaniam et al., 1978). The larvae damage the growing berries and cause defoliation. Balikai et al. (1999) also showed that later instar larvae cut the rachis of

grape bunches and petioles of individual berries during the night hours leading to fruit drop.

On tobacco: Leaves develop irregular, brownish-red patches and the stem base may be gnawed off (EPPO/CABI, 1997).

On tomato: Larvae cause significant damage to both the foliage and developing fruits of field grown tomatoes (Muthukumaran and Selvanarayanan, 2008).

Pest Importance

Spodoptera litura is an extremely serious pest, the larvae of which can defoliate many economically important crops. It is seasonally common in annual and perennial agricultural systems in tropical and temperate Asia. This noctuid is often found as part of a complex of lepidopteran and non-lepidopteran foliar feeders but may also injure tubers and roots. Hosts include field crops grown for food and fiber, plantation and forestry crops, as well as certain weed species (CABI, 2010).

Most studies on the economic impact of *S. litura* have been conducted in India, where it is a serious pest of a variety of field crops. It has caused 12 to 23% loss to tomatoes in the monsoon season, and 9 to 24% loss in the winter (Patnaik, 1998). In a 40- to 45-day-old potato crop, damage ranged from 20 to 100% in different parts of the field depending on moisture availability. Larvae also attacked exposed tubers when young succulent leaves were unavailable (CABI, 2007). On tobacco in India, it was estimated that two, four, and eight larvae per plant reduced yield by 23 to 24, 44.2 and 50.4%, respectively (Patel et al., 1971). Larvae (2.3 and 1.5) reduced yield of aubergines (eggplant) and *Capsicum*, respectively in glasshouses by 10% (Nakasuji and Matsuzaki, 1977). On *Colocasia esculenta* (taro), an average of 4.8 4th instar larvae per plant reduced yield by 10%. Aroid tuber crops (including taro) suffered yield losses of up to 29% as a result of infestation by *S. litura*, *Aphis gossypii* (cotton or melon aphid), and spider mites (Pillai et al., 1993).

Spodoptera litura is also a pest of sugarbeet, with infestations presenting in March and peaking in late March and April (Chatterjee and Nayak, 1987). Severe infestations in beet lead to the skeletonization of leaves, as well as feeding holes in roots that render the crop ‘virtually unfit for marketing’. Late harvested crops were most severely affected and, in extreme cases, 100% of the roots were damaged, leading to considerable yield reduction.

Spodoptera litura is also a member of a complex that causes extensive defoliation of soybean (Bhattacharjee and Ghude, 1985). Defoliation as severe as 48.7% during the pre-bloom stage of growth caused no ‘marked’ difference from a control treatment in which defoliation was prevented by repeated insecticide application. Number and weight of pods and grains per plant were, however, reduced when defoliation occurred at or after blooming. In controlled experiments on soybeans in India, crops chemically protected from *S. litura* and other pests yielded over 42% more than crops that were not sprayed (Srivastava et al., 1972).

Spodoptera litura is responsible for brown flag syndrome in banana (Ranjith et al., 1997) and 5 to 10% fruit damage in grapes (Balikai et al., 1999).

Insecticide resistance has been reported in India (Armes et al., 1997; Kranthi et al., 2001) and Pakistan (Ahmad et al., 2007).

Known Hosts

The host range of *S. litura* covers at least 120 species (Venette et al., 2003). Among the main crop species attacked by *S. litura* in the tropics are taro, cotton, flax, peanuts, jute, alfalfa, corn, rice, soybeans, tea, tobacco, vegetables, aubergine (eggplant), *Brassica* spp. (mustards), *Capsicum* spp. (peppers), cucurbits, bean, potato, sweet potato, grape, and cowpea. Other hosts include ornamentals, wild plants, weeds, and shade trees (for example, *Leucaena leucocephala,* a shade tree of cocoa plantations in Indonesia). Balasubramanian et al. (1984) found better larval growth and higher adult fecundity when reared on castor bean compared to tomato, sweet potato, okra, cotton, sunflower, eggplant and alfalfa.

Major hosts

Abelmoschus esculentus (okra), *Acacia mangium* (brown salwood), *Allium cepa* (onion), *Amaranthus* spp. (grain amaranth), *Arachis hypogaea* (peanut), *Beta vulgaris* subsp. *vulgaris* (sugarbeet), *Boehmeria nivea* (ramie), *Brassica* spp., *Brassica oleracea* var. *botrytis* (cauliflower), *Brassica oleracea* var. *capitata* (cabbage), *Camellia sinensis* (tea), *Capsicum frutescens* (chili), *Castilla elastica* (castilloa rubber), *Cicer arietinum* (chickpea), *Citrus* spp., *Coffea* spp. (coffee), *Colocasia esculenta* (taro), *Corchorus* spp. (jutes), *Corchorus olitorius* (jute), *Coriandrum sativum* (coriander), *Crotalaria juncea* (sunn hemp), *Cynara cardunculus* subsp. *cardunculus* (=*C. scolymus*) (artichoke), *Erythroxylum coca* (coca), *Fabaceae* (leguminous plants), *Foeniculum vulgare* (fennel), *Fragaria* x *ananassa* (strawberry), *Gladiolus* hybrids (gladiola), *Glycine max* (soybean), *Gossypium* spp.(cotton), *Helianthus annuus* (sunflower), *Hevea brasiliensis* (rubber), *Ipomoea batatas* (sweet potato), *Jatropha curcas* (Barbados nut), *Lathyrus odoratus* (sweet pea), *Lilium* spp. (lily), *Linum usitatissimum* (flax), *Malus domestica* (apple), *Manihot esculenta* (cassava), *Medicago sativa* (alfalfa), *Morus alba* (mulberry), *Musa* spp. (banana), *Nicotiana tabacum* (tobacco), *Oryza sativa* (rice), *Papaver* spp. (poppies), *Paulownia tomentosa* (paulownia), *Phaseolus* spp. (beans), *Piper nigrum* (black pepper), *Poaceae* (grasses), *Psophocarpus tetragonolobus* (winged bean), *Raphanus sativus* (radish), *Ricinus communis* (castor bean), *Rosa* spp. (roses), *Sesbania grandiflora* (agati), *Solanum lycopersicum* (tomato), *Solanum melongena* (aubergine, eggplant), *Solanum tuberosum* (potato), *Sorghum bicolor* (sorghum), *Syzygium aromaticum* (clove), *Tectona grandis* (teak), *Theobroma cacao* (cocoa), *Trifolium* spp. (clover), *Trigonella foenum-graecum* (fenugreek), *Vigna mungo* (black gram), *Vigna radiata* (mung bean), *Vigna unguiculata* (cowpea), *Vitis vinifera* (grape), *Zea mays* (corn), and *Zinnia elegans* (zinnia).

For a complete listing of hosts see Venette et al. (2003).

Pathogens or Associated Organisms Vectored

Spodoptera litura is not a known vector and does not have any associated organisms.

Known Distribution

Spodoptera litura is widely distributed throughout tropical and temperate Asia, Australasia, and the Pacific Islands (Kranz et al., 1977).

Asia: Afghanistan, Bangladesh, Brunei, Cambodia, China (including Hong Kong, Macau, and Taiwan), Christmas Island, Cocos Islands, India, Indonesia, Iran, Japan, Korea, Laos, Lebanon, Malaysia, Maldives, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Syria, Thailand, and Vietnam; **Europe:** Russia; **Africa:** Réunion; **Oceania:** American Samoa, Australia, Cook Islands, Federated states of Micronesia, Fiji, French Polynesia, Guam, Hawaii, Kiribati, Marshall Islands, Midway Islands, New Caledonia, New Zealand, Niue, Norfolk Island, Northern Mariana Islands, Palau, Papua New Guinea, Pitcairn Islands, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, Wake Island, and the Wallis and Futuna Islands.

Pathway

This species can move readily through international trade. This species has been intercepted at U.S. ports of entry over 700 times. Most interceptions originated on material from Thailand (595), Singapore (24), and Malaysia (21). *Spodoptera litura* was most commonly intercepted on the following material: *Oncidium* sp. (355), *Dendrobium* sp. (193), and Orchidaceae (46). Interceptions occurred mostly on permit cargo (650), baggage (32), and general cargo (25) (AQAS, 2012; queried August 31, 2012).

Potential Distribution within the United States

The pest has been present in Hawaii since 1964 (CABI, 2010). *Spodoptera litura* was identified in a sample from a Miami-Dade County, Florida nursery in April 2007. Pheromone traps have been placed over a nine square mile area and have yielded no additional finds.

Survey

CAPS-Approved Method*:

The CAPS-approved method is a trap and lure. The trap is a plastic bucket trap [unitrap] with dry kill strip is the approved trap for *Spodoptera litura*. The lure is effective for 84 days (12 weeks).

The Lure Product Name is "*Spodoptera litura* Lure".

Method Notes: The plastic bucket trap (also known as the Universal moth trap or unitrap) should have a green canopy, yellow funnel, and white bucket and should be used with dry kill strip. For instructions on using the bucket trap, see: http://caps.ceris.purdue.edu/dmm/398.

Lure Notes: When trapping for more than one species of moth, separate traps for different moth species by at least 20 meters (65 feet). *S. litura* and *S. littoralis* lures should be placed in different traps and separated by at least 20 meters (65 feet).

Though the lures for *Spodoptera litura* and *S. littoralis* are composed of the same two compounds (Z,E,9,11-14:AC and Z,E,9,12-14:AC), the compounds are loaded into the lure dispensers in different amounts depending on the target species. Therefore, it is necessary to use the specific lure for each of the two targets.

Trap Spacing: When trapping for more than one species of moth, separate traps for different moth species by at least 20 meters (65 feet).

IMPORTANT: Do not place lures for two or more target species in a trap unless otherwise recommended.

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at http://caps.ceris.purdue.edu/.

Literature-Based Methods: (From Venette et al. 2003; CABI, 2010)
Trapping: The identification of a male sex pheromone of *S. litura*, (Z,E)-(9,11)-tetradecadienyl acetate and (*Z,E*)-(9,12)-tetradecadienyl acetate by Tamaki (1973) has enabled effective monitoring of this species for several years. One milligram of a 10:1 mixture of these two compounds in a rubber septum attracted a comparable number of males as 10 caged virgin females in the field (Yushima et al., 1974). Yang et al. (2009) successfully used (*Z,E*)-(9,11)- tetradecadienyl acetate and (*Z,E*)-(9,12)-tetradecadienyl acetate in a 10:1 ratio for trapping *S. litura* in China. The compounds are most effective in a ratio between 4:1 and 39:1 (Yushima et al., 1974). The two components in a ratio of 9:1 are available commercially as Litlure in Japan (Yushima et al., 1974) and in China in a 10:1 ratio from NewCon Incorporated (Yang et al., 2009). For early detection sampling, traps should be placed in open areas with short vegetation (Hirano, 1976). Krishnananda and Satyanarayana (1985) found that trap catches at 2.0 m (6.56 ft.) above the ground level caught significantly more male *S. litura* than those placed at higher or lower heights [ranging from 0.5 to 4.0 m (1.64 to 13.12 ft.)]. Ranga Rao et al. (1991) suggest trap placement at 1 m (3.3 ft.).

A standard sex pheromone trap (plastic dry funnel trap and pheromone septa) has been developed at the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) (Pawar et al., 1988; Singh and Sachan, 1993; Ranga Rao et al., 1991). Water traps baited with synthetic pheromone, box traps with rectangular windows, and cylindrical traps equipped with a blowing fan (to suck the males into a bag attached to bottom of the cylinder) have been used in Japan (Yushima et al., 1974; Hirano, 1976; Hirano, 1977; Nakamura and Kawasaki, 1977; Oyama, 1977). Kamano et al. (1976) also mentioned a trap composed of two cylindrical parts and four cones made of wire screen that open to the outside. Krishnanda and Satyanarayana (1985) used a dry trap that incorporated a tin sheet for the trap head to which a polythene sleeve (45 x 10 cm; 17.7 x 3.9 in.) was attached. A small cylindrical polythene vial with 2.5 mg of

pheromone was fastened to a small hook inside the dome. Rango Rao et al. (1991), however, found that at night many moths escaped from 'sleeve' traps and recommended either single or double funnel traps.

Survey Site Selection:
Surveys should occur in areas with the greatest risk of pest establishment. The pest has been present in Hawaii since 1964 (CABI, 2009). This species is highly polyphagous. The host range of *S. litura* covers at least 120 species (Venette et al., 2003). Economically important crop species include alfalfa, beans, mustards (*Brassica* spp.), peppers (*Capsicum* spp.), corn, cotton, cucurbits, eggplant, grape, peanuts, potatoes, rice, soybeans, sweet potatoes, and tobacco. Surveys should be conducted in areas where host plants are abundant. This can be in agricultural settings, nursery settings, or around ports of entry.

Trap placement:
Traps should be placed approximately 1.2 m (4 ft) off of the ground. Traps should not be placed under trees. When checking traps, make sure that the funnel is open and the entrance is unblocked.

Time of year to survey:
Four generations occur between May and October in Japan (Nakasuji, 1976). In the seasonal tropics, several generations occur during the rainy season with the dry season survived by the pupal stage (EPPO, n.d.).

Visual survey: Visual survey can be used to determine the presence of *S. litura*. The presence of newly hatched larvae can be detected by the 'scratch' marks they make on the leaf surface. Particular attention should be given to leaves in the upper and middle portion of the plants (Parasuraman, 1983). The older larvae are night-feeders, feeding primarily between midnight and 3:00 am and are usually found in the soil around the base of plants during the day. They chew large areas of the leaf, and can, at high population densities, strip a crop of its leaves. In such cases, larvae migrate in large groups from one field to another in search of food. *Spodoptera litura* may be detected any time the hosts are in an actively growing stage with foliage available, usually spring and fall. Check for 1st and 2nd instar larvae during the day on the undersurface of leaves and host plants. Watch for skeletonized foliage and perforated leaves. If no larvae are obvious, look in nearby hiding places. Third instar larvae rest in upper soil layers during the day. Sweep net for adults and larvae at dawn or dusk. Look for external feeding damage to fruits. Watch near lights and light trap collections for adult specimens. Submit similar noctuid moths in any stage for identification (USDA, 1982).

Not recommended: Light traps have been used to monitor *S. litura* populations (Vaishampayan and Verma, 1983). Capture of *S. litura* moths was affected by the stage of the moon, with the traps being least effective during the full moon and most effective during the new moon (Parasuraman and Jayaraj, 1982).

Key Diagnostics/Identification

CAPS-Approved Method*:

Confirmation of *Spodoptera litura* is by morphological identification. The forewing color pattern of male *Spodoptera litura* is similar to the pattern of male *Spodoptera ornithogalli* and nearly indistinguishable from that of *Spodoptera littoralis* (Brambila, 2008). It is difficult to distinguish them without close examination of the genitalia. Examination of various characters in the valvae is needed for identification. The shape of the juxta is also diagnostic. When dissecting *Spodoptera litura* suspects, the aedeagus does not need to be everted (J. Brambila, personal communication, 2014).

For field level screening, use:
Brambila, J. 2008. Rice Cutworm, Field Diagnostics - *Spodoptera litura.* http://caps.ceris.purdue.edu/dmm/555.

Brambila, J. 2008. Rice Cutworm, Wing Diagnostics - *Spodoptera litura*. http://caps.ceris.purdue.edu/dmm/556.

To distinguish the two exotic species, *Spodoptera litura* and *S. littoralis*, from native species, using wing characteristics, use:
Brambila, J. 2013. Identification notes for *Spodoptera litura* and *Spodoptera littoralis* (Lepidoptera: Noctuidae) and some native *Spodoptera* moths

For instructions on performing dissections, images of genitalia, and important identifying characters, use:
Brambila, J. 2009. Steps for the dissection of male *Spodoptera* moths (Lepidoptera: Noctuidae) and notes on distinguishing *S. litura* and *S. littoralis* from native *Spodoptera* species.

For additional information, consult Mochida (1973), Todd and Pool (1980), and Pogue (2002).

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at http://caps.ceris.purdue.edu/.

For additional images, including photos of host damage see http://www.padil.gov.au/pests-and-diseases/Pest/Main/136292.

Easily Confused Species

Adult *S. litura* closely resembles *Spodoptera ornithogali* (yellowstriped armyworm), a pest in the United States. It is also similar in appearance to *S. dolichos*, *S. pulchella* and *S. latifascia,* which are found in the United States. See Brambila (2013) for additional information and images to differentiate between these similar species.

Spodoptera litura is often confused with *S. littoralis*, which is not currently present in the United States. Examination of adult genitalia is the only certain method to separate the

two species. For more information on morphological discrimination between the adult, pupal, and larval stages of the two species, refer to Mochida (1973) and Pogue (2002).

Commonly Encountered Non-targets

In the United States, traps for *Spodoptera litura* frequently capture *Spoodoptera ornithogalli* and *S. pulchella,* though the latter occurs only in southern Florida. *Spoodoptera ornithogalli* and *S. pulchella* are very similar-looking to *S. litura* and require dissection (J. Brambila, personal communication, 2014). Occasionally other native *Spodoptera* species are trapped, including *S. albula, S. eridania, S. exigua,* and, more frequently, *S. frugiperda.* However, the wing coloration and size of these moths is very different from *S. litura;* these four species are smaller than *S. litura* and lack the bold wing markings typical of *S. litura* (J. Brambila, personal communication, 2014). *Spodoptera latifasacia* is also an occasional capture and is very similar to *S. litura;* dissection is required for distinguishing them.

References

Ahmed, A. M., M. Etman, and G. H. S. Hooper. 1979. Developmental and reproductive biology of *Spodoptera litura* (F.) (Lepidoptera: Noctuidae). J. Aust. Ent. Soc. 18: 363–372.

Ahmad, M., M. Iqbal Arif, and M. Ahmad. 2007. Occurrence of insecticide resistance in field populations of *Spodoptera litura* (Lepidoptera: Noctuidae) in Pakistan. Crop Protection 26: 809–817.

AQAS. 2012. *Spodoptera litura* interceptions. Last accessed August 31, 2012 from: https://mokcs14.aphis.usda.gov/aqas/HomePageInit.do#defaultAnchor.

Armes, N. J., J. A. Wightman, D. R. Jadhav, and G. V. Ranga Rao. 1997. Status of insecticide resistance in *Spodoptera litura* in Andhra Prades, India. Pesticide Science 50: 240–248.

Balasubramanian, G., S. Chellia, and M. Balasubramanian. 1984. Effect of host plants on the biology of *Spodoptera litura* Fabricius. Indian J. Agric. Soc. 54(12): 1075–1080.

Balasubramanian, M., S. Murugesan, and S. Parameswaran. 1978. Beware of cutworm on grapes. Kisan World 5(6): 51-52.

Balikai, R. A., A. N. Bagali, and Y. H. Ryagi. 1999. Incidence of *Spodoptera litura* Fab. on grapevine, *Vitis vinifera* L. Insect Environment 5: 32.

Bhattacharjee, N. S. and D. B. Ghude. 1985. Effect of artificial and natural defoliation on the yield of soybean. Indian Journal of Agricultural Sciences 55: 427–429.

Balikai, R. A., A. N. Bagali, and Y. H. Ryagi. 1999. Incidence of *Spodoptera litura* Fab. on grapevine, *Vitis vinifera* L. Insect Environment, 5:32.

Brambila, J. 2008. Rice Cutworm, Wing Diagnostics - Spodoptera litura. http://caps.ceris.purdue.edu/webfm_send/556.

Brambila, J. 2009. Steps for the dissection of male *Spodoptera* moths (Lepidoptera: Noctuidae) and notes on distinguishing *S. litura* and *S. littoralis* from native *Spodoptera* species. USDA-APHIS-PPQ.

http://caps.ceris.purdue.edu/webfm_send/2150

Brambila, J. 2014. Identification methods and resources for *Spodoptera litura*. Personal communication to L. D. Jackson on January 6, 2014 from J. Brambila (USDA-APHIS-PPQ).

Brown, E. S. and C. F. Dewhurst. 1975. The genus *Spodoptera* (Lepidoptera, Noctuidae) in Africa and the Near East. Bulletin of Entomological Research, 65:221-262.

CABI. 2007. Crop protection compendium: global module. Commonwealth Agricultural Bureau International, Wallingford, UK. http://www.cabi.org/compendia/cpc/.

CABI. 2009. Crop protection compendium: global module. Commonwealth Agricultural Bureau International, Wallingford, UK. http://www.cabi.org/compendia/cpc/.

CABI. 2010. Crop protection compendium: global module. Commonwealth Agricultural Bureau International, Wallingford, UK. http://www.cabi.org/compendia/cpc/.

Cayrol, R. A. 1972. Famille des Noctuidae. In: Balachowsky AS, ed. Entomologie appliquée à l'agriculture. Vol. 2. Paris, France: Masson, 1411-1423.

Chari, M. S. andS. N. Patel. 1983. Cotton leaf worm *Spodoptera litura* Fabricius its biology and integrated control measures. Cotton Dev. 13(1): 7–8.

Chatterjee, P. B. and D. K. Nayak. 1987. Occurrence of *Spodoptera litura* (Fabr.) as a new pest of sugarbeet in West Bengal. Pesticides 21: 21–22.

EPPO. No date. Data Sheets on Quarantine Pests, *Spodoptera littoralis* and *Spodoptera litura*. CABI/EPPO. 7 pp.

EPPO/CABI. 1997. *Spodoptera littoralis* and *Spodoptera litura*. *In:* Smith IM, McNamara DG, Scott PR, Holderness M, eds. Quarantine pests for Europe. 2nd edition. Wallingford, UK: CAB International, 518–525.

Hashmat, M. and M. A. Khan. 1977. The effect of temperature on the fecundity and fertility of*Spodoptera litura* (Fabr.) (Lepidoptera: Noctuidae). J. Anim. Morphol. Physiol. 24(2): 203–210.

Hashmat, M. and M. A. Khan. 1978. The fecundity and the fertility of *Spodoptera litura* (Fabr.) in relationto photoperiod. Z. Angew. Entomol. 85(2): 215–219.

Hill, D. S. 1975. Agricultural insect pests of the tropics and their control. Cambridge Univ. Press, London.

Hirano, C. 1976. Effect of trap location on catches of males of *Spodoptera litura* (Lepidoptera: Noctuidae) in pheromone baited traps. Appl. Entomol. Zool. 11(4): 335-339.

Hirano, C. 1977. Efficiency of water pan trap baited with synthetic sex pheromone in attracting male *Spodoptera litura* (Lepidoptera: Noctuidae). Jap. J. Appl. Entomol. Zool. 21(4): 216–219.

Kamano, S., S. Wakamura, and M. Oyama. 1976. Applications of synthetic sex pheromone and its components for manipulating *Spodoptera litura*. Proceedings of the International Symposium on Insect Pheromones and their Applications. Pgs. 135–144.

Kranthi, K. R., D. R. Jadhav, R. R. Wajari, S. S. Ali, and D. Russell. 2001. Carbamate and organophosphate resistance in cotton pests in India, 1995 to 1999. Bull. Ent. Res. 91: 37–46.

Kranz, J., H. Schumutterer, and W. Koch. eds. 1977. Diseases Pests and Weeds in Tropical Crops. Berlin and Hamburg, Germany: Verlag Paul Parley.

Krishnananda, N. and S. V. V. Satyanarayana. 1985. Effect of height of pheromone trap on the catch of *Spodoptera litura* moths in tobacco nurseries. Phytoparasitica 13(1): 59-62.

Maheswara Reddy, A. 1983. Observations on the mating behaviour of tobacco cut worm, *Spodoptera litura* (F.). Madras Agric. J. 70(2): 137–138.

Mochida, O. 1973. Two important insect pests, *Spodoptera litura* (F.) and *S. littoralis* (Boisd.) (Lepidoptera: Noctuidae), on various crops - morphological discrimination of the adult, pupal and larval stages. Applied Entomology and Zoology, 8: 205-214.

Muthukumaran, N. and V. Selvanarayanan. 2008. Resistance in hybrid derivatives of *Lycopersicon* accessions against leaf caterpillar, *Spodoptera litura* Fab. Insect Science 15:141-146.

Nakamura, K. and K. Kawasaki. 1977. The active space of the *Spodoptera litura* (F.) sex pheromone and the pheromone component determining this space. Appl. Entomol. Zool. 12(2): 162–177.

Nakasuji, F. 1976. Factors responsible for change in the pest status of the tobacco cutworm *Spodoptera litura*. Physiology and Ecology Japan 17: 527-533.

Nakasuji, F. and T. Matsuzaki. 1977. The control threshold density of the tobacco cutworm *Spodoptera litura* on eggplants and sweet peppers in vinylhouse. Applied Entomology and Zoology 12: 184–189.

Oyama, M. 1977. Pheromone trap equipped with a blowing electric fan for *Spodoptera litura*. Jap. J. Appl. Entomol. Zool. 21(2): 103–105.

Parasuraman, S. 1983. Larval behaviour of *Spodoptera litura* (F.) in cotton agro-ecosystem. Madras Agric. J. 70(2): 131-134.

Parasuraman, S. and S. Jayaraj. 1982. Studies on light trap catches of tobacco caterpillar *Spodoptera litura* (F.). Cotton Dev. 13(1): 15-16.

Parasuraman, S. and S. Jayaraj. 1983a. Effect of temperature and relative humidity on the development and adult longevity of the polyphagous *Spodoptera litura* (Fabr.) (Lepidoptera: Noctuidae). Indian J. Agric. Soc. 53(7): 582–584.

Parasuraman, S. and S. Jayaraj. 1983b. Pupation behaviour of *Spodoptera litura* (F). Madras Agric. J. 69(12): 830–831.

Patel, H. K., N. G. Patel, and V. C. Patel. 1971. Quantitative estimation of damage to tobacco caused by the leaf-eating caterpillar, *Prodenia litura*. PANS 17S: 202–205.

Patnaik, H. P. 1998. Pheromone trap catches of *Spodoptera litura* F. and extent of damage on hybrid tomato in Orissa. Advances in IPM for horticultural crops. Proceedings of the First National Symposium on Pest Management in Horticultural Crops: environmental implications and thrusts, Bangalore, India, 15 17 October 1997, 68–72.

Pawar, C. S., S. Sithanantham, V. S. Bhatnagar, C. P. Srivastava, and W. Reed. 1988. The development of sex pheromone trapping of *Heliothis armigera* at ICRISAT, India. Tropical Pest Management 34: 39–43.

Pearson, E. O. 1958. The insect pests of cotton in tropical Africa. Commonwealth Inst. Entomol., London.

Pillai, K. S., M. S. Palaniswami, P. Rajamma, C. Mohandas, and C. A. Jayaprakas. 1993. Pest management in tuber crops. Indian Horticulture 38: 20–23.

Pogue, M. G. 2002. A world revision of the genus *Spodoptera* guenee (Lepidoptera: Noctuidae). Mem. American Entomol. Soc. 43: 1-202.

Ranga Rao, G. V., J. A. Wightman, and D. V. Ranga Rao. 1989. Threshold temperatures and thermal requirements for the development of *Spodoptera litura* (Lepidoptera: Noctuidae). Environmental Entomology 18(4): 548–551.

Ranga Rao, G. V., J. A. Wightman, and D. V. Ranga Rao. 1991. Monitoring *Spodoptera litura* (F.) (Lepidoptera: Noctuidae) using sex attractant traps: Effect of trap height and time of the night on moth catch. Insect. Sci. Applic. 12(4): 443-447.

Ranjith, A. M., B. Haseena, and S. S. Nambiar. 1997. *Spodoptera litura* causes brown flag syndrome in banana. Insect Environment 3: 44.

Schmutterer, H. 1969. Pests of crops in Northeast and Central Africa. Stuttgart, Germany: Gustav Fischer Verlag, 186-188.

Singh, K .N. and G. C. Sachan. 1993. *Spodoptera litura* male moth catches in pheromone traps and their relationship with oviposition in groundnut field at Pantnagar, India. Insect. Sci. Applic. 14(1): 11–14.

Singh, O. P., S. M. Matkar, and G. M. Gangrade. 1975. Sex identification of *Spodoptera* (*Prodenia*) *litura* (Fabricius) by wing coloration. Curr. Sci. 44(18): 673.

Srivastava, O. S., D. S. Malik, and R. C. Thakur. 1972. Estimation of losses in yield due to the attack of arthropod pests in soybean. *Indian Journal of Entomology* 33: 224–225.

Tamaki, Y. 1973. Sex pheromone of *Spodoptera litura* (F.) (Lepidoptera:Nocutidae): isolation, identification, and synthesis, Appl. Entomol. Zool. 8(3): 200-203.

Todd, E. L. and R. W. Poole. 1980. Keys and illustrations for the armyworm moths of the Noctuidae genus Spodoptera *guenee* from the Western Hemisphere. Ann. Entomol. Soc. Am. 73: 722-738.

USDA. 1982. Pests not known to occur in the United States or of limited distribution: Rice cutworm. USDA-APHIS-PPQ.

USDA. 2005. New Pest Response Guidelines, *Spodoptera*. United States Department of Agriculture, Animal and Plant Health Inspection Service. 82 pp.

Vaishampayan, S. Y. and R. Verma. 1983. Comparative efficiency of various light sources in trapping adults of *Heliothis armigera* (Hubn.), *Spodoptera litura* (Bois.) and *Agrotis ipsilon* (Hufn.) (Lepidoptera: Noctuidae). Indian J. Agric. Sci. 53(3): 163-167.

Venette, R. C., E. E. Davis, J. Zaspel, H. Heisler, and M. Larson. 2003. Mini-risk assessment: Rice cutworm, *Spodoptera litura* Fabricius [Lepidoptera: Noctuidae].

Waterhouse, D. F. and K. R. Norris. 1987. Biological Control, Pacific Prospects. Australian Centre for International Agricultural Research.

Yamanaka, H., F. Nakasuji, and K. Kiritani. 1975. Development of the tobacco cutworm *Spodoptera litura* in special reference to the density of larvae. Bull. Koch. Inst. Agric. For Sci. 7: 1–7. (English summary).

Yang, S., S. Yang, W. Sun, J. LV, and R. Kuang. 2009. Use of sex pheromone for control of *Spodoptera litura* (Lepidoptera: Noctuidae). Journal of the Entomological Research Society 11(1): 27–36.

Yushima, T., Y. Tamaki, S. Kamano, M. Oyama. 1974. Field evaluation of synthetic sex pheromone 'Litlure' as an attractant for males of *Spodoptera litura* (F.) (Lepidoptera: Noctuidae). Applied Entomology and Zoology 9:147-152.

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Revisions

April 2014
1) Revised the **Key Diagnostics/Identification** section. Added:

- Brambila, J. 2013. Identification notes for *Spodoptera litura* and *Spodoptera littoralis* (Lepidoptera: Noctuidae) and some native *Spodoptera* moths.
- Brambila, J. 2009. Steps for the dissection of male *Spodoptera* moths (Lepidoptera: Noctuidae) and notes on distinguishing *S. litura* and *S. littoralis* from native *Spodoptera* species.

2) Revised the **Easily Confused Species** section.
3) Added the **Commonly Encountered Non-targets** sections.

July 2016
1) NAPPFAST map removed.
2) Screening aid links updated.