EPPO Datasheet: *Spodoptera eridania*

Last updated: 2023-03-15

IDENTITY

Preferred name: *Spodoptera eridania*
Authority: (Stoll)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Lepidoptera: Noctuidae
Other scientific names: *Laphygma eridania* (Stoll), *Phalaena eridania* Stoll, *Prodenia eridania* (Stoll), *Xylomyges eridania* (Stoll)
Common names: semitropical armyworm, southern armyworm
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EPPO Categorization: A1 list
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EU Categorization: Quarantine pest ((EU) 2019/2072 Annex II A)
EPPO Code: PRODER



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Notes on taxonomy and nomenclature

Pieter Cramer is often attributed as the author of the taxonomic work describing *S. eridania* (as *Phalaena eridania*), however, Caspar Stoll continued the taxonomic work after Cramer's death and should be attributed as the author (Cramer & Stoll, 1782; Stoll, 1780). Pogue (2002) lists all synonyms.

HOSTS

Spodoptera eridania is a polyphagous generalist feeder recorded on 202 different wild hosts and crops, including many grasses and dicotyledonous plants (Montezano *et al.*, 2014). Crops damaged include aubergine, beets (*Beta vulgaris vulgaris* var. *altissima*, and var. *cicla*), sweet pepper (*Capsicum annuum*), cassava, cotton, several Brassicaceae, a wide range of legumes, maize and other Poaceae, potatoes, sweet potatoes, tobacco, tomatoes, yams, and many ornamental pot plants and species intended for the cut flower market.

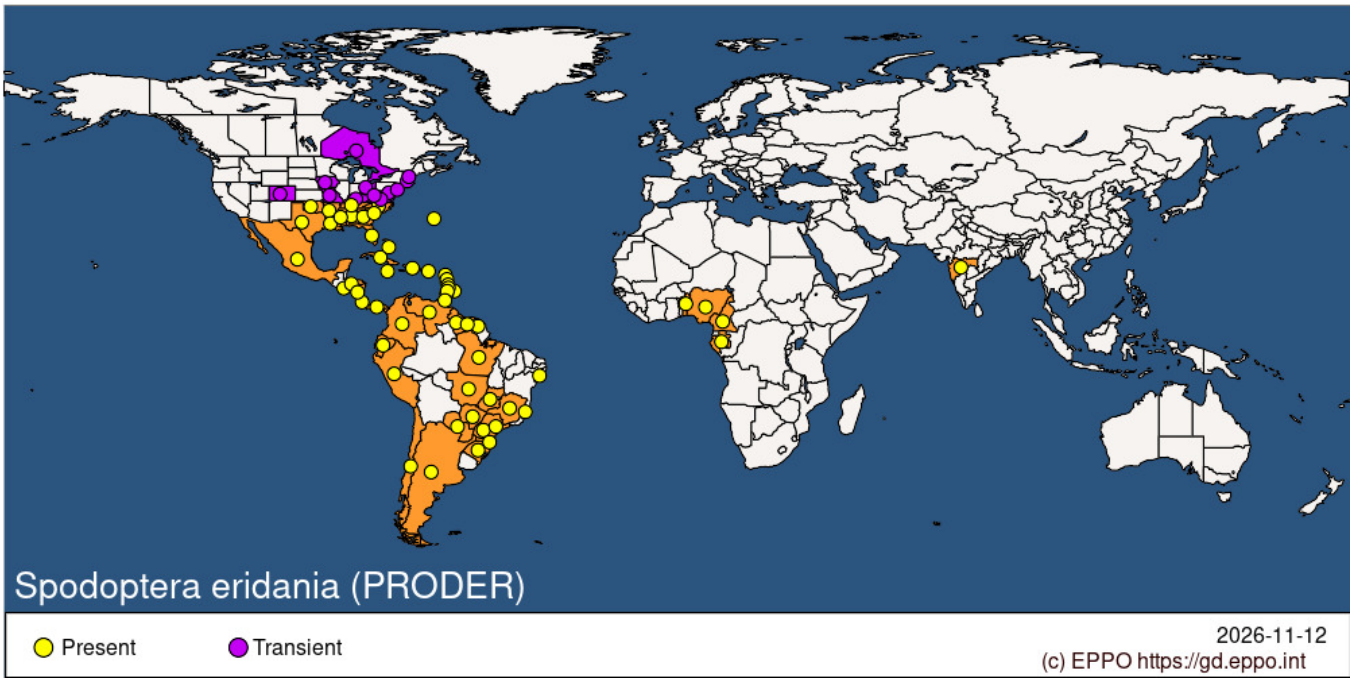
The EPPO region is home to numerous potential host plants and especially the south of the region grows many crop host species (Montezano & Specht, 2022).

Host list: *Abelmoschus esculentus*, *Acaciella glauca*, *Achyranthes aspera*, *Alcea rosea*, *Allium cepa*, *Allium fistulosum*, *Allium sativum*, *Alpinia purpurata*, *Amaranthus deflexus*, *Amaranthus hybridus*, *Amaranthus quitensis*, *Amaranthus retroflexus*, *Amaranthus spinosus*, *Amaranthus viridis*, *Antirrhinum majus*, *Apium graveolens*, *Arachis hypogaea*, *Artemisia absinthium*, *Asparagus officinalis*, *Baccharis genistelloides*, *Bacopa stricta*, *Begonia rex*, *Beta vulgaris subsp. vulgaris var. cicla*, *Beta vulgaris*, *Bidens pilosa*, *Brassica napus*, *Brassica nigra*, *Brassica oleracea var. capitata*, *Brassica oleracea var. viridis*, *Camellia japonica*, *Capsicum annuum*, *Carica papaya*, *Cayaponia americana*, *Cayaponia racemosa*, *Cecropia peltata*, *Celosia argentea*, *Cenchrus purpureus*, *Centrosema pubescens*, *Cestrum macrophyllum*, *Chenopodium quinoa*, *Chrysanthemum x morifolium*, *Cicer arietinum*, *Citharexylum spinosum*, *Citrullus lanatus*, *Citrus maxima*, *Citrus x aurantium var. sinensis*, *Citrus x limon*, *Clibadium erosum*, *Clidemia eggersii*, *Coffea arabica*, *Commelina diffusa*, *Crotalaria breviflora*, *Crotalaria spectabilis*, *Cucumis melo*, *Cucumis sativus*, *Cucurbita maxima*, *Cynodon nlemfuensis*, *Daucus carota*, *Desmodium adscendens*, *Dianthus caryophyllus*, *Digitaria ischaemum*, *Digitaria sanguinalis*, *Dioscorea polygonoides*, *Eclipta prostrata*, *Elaphoglossum sp.*, *Erechtites valerianifolius*, *Erigeron bonariensis*, *Erigeron canadensis*, *Eruca vesicaria subsp. sativa*, *Eucalyptus sp.*, *Fragaria vesca*, *Geranium sp.*, *Gerbera jamesonii*, *Glycine max*, *Gonzalagunia spicata*, *Gossypium herbaceum*, *Gossypium hirsutum*, *Hamelia patens*, *Helianthus annuus*, *Helianthus sp.*, *Hibiscus cannabinus*, *Hibiscus rosa-sinensis*, *Hydrocotyle ranunculoides*, *Ichnanthus pallens*, *Impatiens walleriana*, *Ipomoea alba*, *Ipomoea batatas*, *Ipomoea fastigiata*, *Ipomoea grandiflora*, *Ipomoea purpurea*, *Lactuca sativa*, *Lagerstroemia indica*, *Laportea aestuans*, *Lavandula angustifolia*, *Lepidium didymum*, *Linum usitatissimum*, *Lobelia portoricensis*, *Lolium perenne*, *Lonicera japonica*, *Ludwigia sp.*, *Malus domestica*, *Malva parviflora*, *Manihot esculenta*, *Medicago sativa*, *Melinis minutiflora*, *Melissa officinalis*, *Mentha arvensis var. piperascens*, *Mentha sp.*

, Mentha spicata, Mentha x piperita, Mikania cordifolia, Mimosa pudica, Mimosa scabrella, Morus alba, Mucuna pruriens, Nasturtium officinale, Nerium oleander, Neurolaena lobata, Nicotiana alata, Nicotiana tabacum, Ocotea sp., Odontonema tubaeforme, Oryza sativa, Passiflora edulis, Passiflora sexiflora, Pavonia fruticosa, Pelargonium x hortorum, Pentas sp., Persea americana, Persicaria hydropiperoides, Persicaria segetum, Phaseolus lunatus, Phaseolus polystachios, Phaseolus vulgaris, Phyllanthus urinaria, Phytolacca americana, Phytolacca dioica, Phytolacca rigida, Phytolacca rivinoides, Piper umbellatum, Pisum sativum, Plantago major, Portulaca grandiflora, Portulaca oleracea, Pseudelephantopus spicatus, Psidium guajava, Psychotria berteroana, Pyrus communis, Rajania cordata, Rheum rhabarbarum, Ricinus communis, Rosa sp., Rubus idaeus, Rubus rosifolius, Rumex crispus, Rumex obtusifolius, Rumex sp., Salix sp., Sanchezia speciosa, Sanguinaria canadensis, Sapium glandulosum, Sauvagesia erecta, Schefflera morototoni, Schinus terebinthifolia, Sicyos edulis, Sida rhombifolia, Solanum acerifolium, Solanum americanum, Solanum jamaicense, Solanum lycopersicum, Solanum melongena, Solanum peruvianum, Solanum rugosum, Solanum torvum, Solanum tuberosum subsp. andigenum, Solanum tuberosum, Sonchus oleraceus, Sonchus sp., Spermacoce ocymifolia, Spinacia oleracea, Stenotaphrum secundatum, Taraxacum officinale, Teliostachya alopecuroidea, Trifolium sp., Tripogandra serrulata, Urera baccifera, Vaccinium macrocarpon, Vernicia fordii, Vernonanthura tweedieana, Vicia faba, Vigna unguiculata, Viola tricolor, Vitis labrusca, Vitis vinifera, Xanthosoma sp., Zea mays

GEOGRAPHICAL DISTRIBUTION

S. eridania occurs throughout most tropical and subtropical countries in South and Central America, as well as Southern USA and the Caribbean Islands. It is thought to originate in these areas of the Americas. The species also occurs on the Galápagos Islands where it was most likely introduced. *S. eridania* was first discovered across the Atlantic Ocean in Nigeria, 2016, as a pest in cassava, and later in Benin, Cameroon and Gabon. It is unclear when *S. eridania* first appeared on the African continent as it is easily confused with other *Spodoptera* species already present (Goergen, 2018). The species is also reported from India where it was found on soybean in 2019. However, it was no longer found in the area in 2020 and 2021 (Gaikwad, 2021).



Africa: Benin, Cameroon, Gabon, Nigeria
Asia: India (Maharashtra)
North America: Canada (Ontario), Mexico, United States of America (Alabama, Arkansas, Colorado, Florida, Georgia, Iowa, Kentucky, Louisiana, Maryland, Massachusetts, Mississippi, Missouri, New Hampshire, New Jersey, North Carolina, Ohio, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia)
Central America and Caribbean: Antigua and Barbuda, Bahamas, Barbados, Bermuda, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Honduras, Jamaica, Martinique, Nicaragua,

Panama, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago
South America: Argentina, Brazil (Alagoas, Espirito Santo, Goias, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Para, Parana, Rio Grande do Sul, Santa Catarina, Sao Paulo), Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela

BIOLOGY

Eggs are laid in large batches on the leaves of the host plant, protected by a layer of abdominal bristles. Eggs hatch usually within 4 to 8 days, depending on climatic conditions. Eggs do not develop at temperatures above 34°C. Larvae, like those of sibling species and some other noctuids, are gregarious and remain together on the leaf for the first two instars. The result of this early larval damage is typically the complete skeletonization of leaves. The third instar larvae disperse and become more solitary and nocturnal. During the day caterpillars hide in the leaf litter or plant foliage, and emerge to feed on the leaves at night. Larval development usually takes 14-18 days but the developmental and survival rates of larvae are affected by the quality of the diet and prevailing temperatures. Caterpillars can sometimes swarm and migrate to adjacent fields when food is scarce, hence the common name ‘armyworm’. Occasionally large larvae have been recorded boring into and feeding on fruits, tubers and young stems. Larvae go through six instars, rarely seven, before digging down in the soil near the host plant. Pupation takes place at a depth of 5–10 cm in an earthen cell and pupal development typically takes 9–12 days at 25°C and 70% RH. Adults are nocturnal.

S. eridania is essentially a subtropical species and so a development temperature of 20–25°C is preferred. The total generation time is estimated to be around one month but the time needed to complete a life cycle, as well as larval survivability, depends on the host plant and temperature (Sampaio *et al.*, 2021; Silva *et al.*, 2018). Individuals raised on clover leaves completed their life cycle in 30 days and had a viability of 54.3% whereas only 23% of the individuals fed apple leaves survived and needed 63 days to complete development (Silva *et al.*, 2018). Under laboratory conditions, *S. eridania* fails to complete its life cycle at temperatures below 15°C and above 32°C with development times at both extremes differing by 95 days (120.1 days at 15°C to 24.6 days at 32°C) (Sampaio *et al.*, 2021). The species does not diapause. Consequently, under favourable local conditions (of which temperature and food availability are most important), development continues throughout the year, resulting in continuous generations (e.g. see Mitchell & Tumlinson, 1994). As the species is highly polyphagous, it is easy to rear, and as a result the species is used in many feeding experiments detailing the response of the larvae to different plant species and pest control agents such as *Bacillus thuringiensis* (*Bt*) (e.g. see Rabelo *et al.*, 2020; Scriber, 1981; Silva *et al.*, 2017).

DETECTION AND IDENTIFICATION

Symptoms

Larvae mainly cause damage to leaves, which usually results in skeletonization or can lead to complete defoliation in extreme cases. The first two instars are gregarious and diurnal and are thus relatively easily observed as clusters of small caterpillars on leaves. Large larvae may bore into some fruits (such as tomato) or cotton bolls. When there is a lack of adequate leaf material, larvae may feed on small apical branches, bore into the stem of the host plant or attack tubers that are close to the soil surface.

Morphology

Eggs

Subspherical in shape, 0.45 mm in diameter, laid in clusters on the plant foliage, usually covered with a layer of grey bristles (scales) from the abdomen of the female. Like in other *Spodoptera* species, the number of ribs on the eggs varies widely (between 46–54 according to Rolim *et al.*, 2013), with too much overlap between species to allow for reliable identification beyond genus level. The micropyllar rosette is flat. Eggs are greenish at first and become tan as they develop.

Larva

There are usually six instars. First instar larvae are 1–2.5 mm long, fully grown caterpillars measure 35–40 mm. Young larvae are black with yellow lateral lines and look similar to other *Spodoptera* species. During early development, the first dorsal pinacula on abdominal segments 1 and 8 become larger and darker. Older instars have a variable ground colour, generally rather grey to greenish-grey, but a brown larval form also exists. Later-stage larvae have a reddish-brown head capsule with a Y-shaped-marking and longitudinal bands made up of black, white and red. Fully grown larvae have a dark lateral spot on the first abdominal segment, which passes through and breaks up, the yellowish spiracular line. The larva usually has a dorsal row of paired dark, often triangular patches, the ones on abdominal segments 1 and 8 always being the largest.

Pupa

A typical noctuid pupa, shiny brown, and 19-20 mm long, cremaster with two small spines. This trait is shared with at least *S. littoralis*, *S. litura* and *S. frugiperda*. *Spodoptera exigua* has an extra pair of smaller spines anterodorsally of the cremaster. The spines that make up the cremaster are variable in size, fragile and prone to breakage.

Adult

Moth with a wingspan of 28-40 mm. The forewings are cream to grey with a characteristic dark streak near the wing base and sometimes a central dark spot or bar. The hindwings are white with no contrasting veins. Several *Spodoptera* species are hard to distinguish from *S. eridania* based on external morphological features. Dissection of the male genitalia allows for distinction between *S. eridania* and other common *Spodoptera* pests. Male and female genitalia of *S. eridania* and closely related species are described in the EPPO Standard PM 7/124(1) (EPPO, 2015).

For more information on the morphological discrimination between the common *Spodoptera* pest species and a detailed description of the different stages, see the EPPO Standard PM 7/124 (EPPO, 2015). Pogue (2002) reviews the *Spodoptera* genus as a whole.

Detection and inspection methods

Trapping adults is an effective method to survey Lepidoptera. The composition of female sex pheromones of *S. eridania* is described and often used to attract moths to baited sticky traps. Adults are nocturnal and therefore difficult to detect during the day. Eggs and early larval stages can be found on host plants, but may be overlooked. Feeding damage to the leaves is easily detected, and on some occasions fruits, young branches and tubers can show feeding damage. Older larvae become solitary, hide near the host plants in the leaf litter during daytime and feed on leaves during the night. Pupae cannot be detected on the plant since pupation takes place in the soil. Reliable morphological identification of immature stages either requires additional information (e.g. origin and host plant) or molecular analysis (van de Vossenberg & van der Straten, 2014).

PATHWAYS FOR MOVEMENT

S. eridania is not known to engage in long-distance migrations. It is therefore unlikely that the recent introduction to West- and Central Africa is the consequence of an active transatlantic migration by adults. Unlike *S. frugiperda*, range expansion of *S. eridania* following its introdution to Africa seems to be slow. Human-assisted dispersal is considered the most likely pathway through which the species can colonize new areas. Eggs and larvae are easily transported with plants for planting or cut flowers, pupae could be transported along with soil. The species is regularly intercepted on imported plants from South and Central America. These interceptions usually comprise larvae or eggs being found on the foliage of host plants.

PEST SIGNIFICANCE

Economic impact

Usually, *S. eridania* is only a minor pest on most of its host crops in its native range, but it may occasionally cause serious damage when infestations become large. The species is most notably damaging to tomato (Price & Poe,

1977), sweet potato (Zeddam *et al.*, 1999), alfalfa (Aguilera & Vasquez, 1974) and soybean (Specht *et al.*, 2018) in the Americas including in the Caribbean Islands, sometimes resulting in significant losses. Due to its polyphagous nature many vegetables and flowers can be attacked. Leafy vegetables and ornamentals are especially prone to incur economic losses due to this pest. In Africa, the species caused severe defoliation in cassava fields and it also infested tomato crops (Goergen, 2018). In India, larvae skeletonized soybean leaves and fed on the seed pods (Gaikwad, 2021).

Control

Conventional chemical insecticides are usually effective at controlling *S. eridania*; the species is not known to have developed strong resistances to foliar insecticides.

There are several studies assessing the effectiveness of alternative pest control methods. Commercially available neem-based biopesticides can induce antifeedant behaviour and result in up to 20% larval mortality but the effectiveness depends on the product and timing of administration (Shannag *et al.*, 2015). Larvae are susceptible to certain *Bacillus thuringiensis* (*Bt*) strains, most notably Cry2Aa, whereas they are highly tolerant to Cry1Ac and Cry1Fa (Rabelo *et al.*, 2020). The entomopathogenic fungus *Beauveria bassiana* has proven somewhat effective in controlling the pest in cabbage (Michereff?Filho *et al.*, 2008). Wasp parasitoids and tachinid predators, often associated with other Lepidoptera, are also able to control *S. eridania* populations. Studies on the biological control of egg parasitoids such as *Telenomus remus* (Pomari *et al.*, 2013) and predators such as *Podisus nigrispinus* (Romário de Carvalho *et al.*, 2020) also show promise as effective control agents against *S. eridania* but it is unclear whether these species are already in practice in the field. Alternative methods such as adding sterile (irradiated) adult males to the population, which has been tested on other *Spodoptera* pests (Seth *et al.*, 2016), might also be effective against *S. eridania* but studies are needed. Since *S. eridania* is usually a minor pest, control is only occasionally required.

Phytosanitary risk

As an essentially subtropical species (temperature optima between 20 and 25°C) that cannot withstand extended periods of freezing temperatures, potential establishment outdoors in the EPPO region may be limited to small areas which have a subtropical climate. These regions grow several potential host plants as crops which could sustain the pest. *S. eridania* is not specifically reported as a pest of protected cultivation in its native range, but it remains unclear whether the species would be able to establish itself in glasshouses in colder climates in the EPPO region. In its introduced range (i.e. in West and Central Africa since 2016 and India in 2019), the larvae caused significant damage to crops. It is unclear whether the presence of other (native) *Spodoptera* species with similar host plants in those areas could limit the spread of *S. eridania*. More details on the risk of introduction into the EPPO region can be found in the EFSA Pest Categorization (EFSA, 2020).

PHYTOSANITARY MEASURES

The introduction of *S. eridania* into the EPPO region is to be avoided regardless of the host plant(s) concerned. Import of soil from countries where *S. eridania* is present is prohibited. The pest can be controlled in the producing country through conventional insecticide treatment or biological pest control. Surveys with pheromone traps and visual inspection for leaf damage could help verify the presence or absence of the pest. Plants for planting, that are potential host plants of *S. eridania*, should come from a production location that is inspected and found free of the pest for at least 3 months prior to import. Certain types of plants (e.g. cuttings) may be treated by being held at low temperatures (< 1.7°C for 2-4 days, followed by fumigation). More details on potential measures can be found in the EFSA Pest Categorization (EFSA, 2020).

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Datasheet history

This datasheet was first published in 1997 in the second edition of 'Quarantine Pests for Europe, and revised in 2023. It is now maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', ‘Hosts’, and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

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