



Spodoptera spp

Identify

Spodoptera is a worldwide genus consisting of 30 described species mainly distinguished by larval morphological characteristics, body color, origin, and potentially host. Three species occur in Kenya;

Preferred Scientific Name: *Spodoptera exempta* Walker

Preferred Common Name: black armyworm

Other Scientific Names:

- *Agrotis exempta* Walker 1856
- *Caradrina exempta*
- *Laphygma exempta* Hampson 1909
- *Leucania exempta*

Preferred Scientific Name: *Spodoptera exigua* (Hübner)

Preferred Common Name: beet armyworm

Other Scientific Names:

- *Caradrina exigua* Hübner
- *Laphygma exigua* Hübner
- *Laphygma flavimaculata*
- *Noctua exigua* Hübner

Preferred Scientific Name: *Spodoptera littoralis*
(Boisduval)

Preferred Common Name: cotton leafworm

Other Scientific Names:

- *Hadena littoralis* Boisduval
- *Noctua gossypii*
- *Prodenia littoralis* (Boisduval)
- *Prodenia litura* Fabricius sensu auctorum

Hosts/species affected

S. exigua is a polyphagous pest which attacks most kinds of field crops and has commonly been recorded from grasses, maize, rice, sorghum, cotton, tobacco, groundnut, broad bean, sesame, jute, citrus, sugarbeet, lucerne, various vegetables and weed species. *S. littoralis* host range covers over 40 families, containing at least 87 species of economic importance. Hosts



Figure 1: *Spodoptera exigua* adult
Photo by IRAC



Figure 2: *S. exempta* adult
Photo by: Buck Richardson

of *S. exempta* are primarily plants of the Poaceae and Cyperaceae including barley, *Pennisetum typhoides*, *Eleusine coracana*, maize, oat, rice, sorghum, sugarcane, wheat and pasture grasses, especially *Cynodon* and *Pennisetum* species (CABI, 2016).

Biology and Ecology

Members of the genus *Spodoptera* undergo complete metamorphosis and pass through egg, larva (caterpillar), pupa and adult (moth) stages. *S. exigua* eggs are spherical which are usually laid in masses of 50-150 eggs in layers on the surface of the leaf. The egg mass is usually covered with a protective layer of grey-pink scales. Females lay between 500 and 1500 eggs depending on growth conditions and generation. Egg maturity takes 2-3 days at 20-30°C. Larvae are a light green to dark brown with longitudinal stripes. On hatching they are green.

Adults have light grey forewings with a small round, light orange spot in the middle beyond which a second smaller kidney-shaped spot is located. Hindwings are white to straw colour with dark brown veins and edges.

S. littoralis eggs are flattened and laid in clusters (20-1000 eggs) arranged in more or less regular rows in one to three layers, with hair scales. Usually whitish-yellow in colour, changing to black just prior to hatching.

Larvae are hairless, cylindrical and variable in colour (blackish-grey to dark green, becoming reddish-brown or whitish-yellow).



Figure 3: *S. littoralis* adult
Photo by: Bernard Fransen

Newly formed, pupae are green with a reddish colour on the abdomen, turning dark reddish-brown after a few hours. Adults are moths with grey-brown body, forewings grey to reddish brown with paler lines along the veins (in males, bluish areas occur on the wing base and tip. Emergence of adult moths occurs at night and they have a life span of 5-10 days.



Figure 4: *S. littoralis* larvae
Photo by K. Kiritani (JP)

The eggs of *S. exempta* are pale-yellowish, darkening through development until, just before hatching. Each egg is conical with a slightly rounded apex. Eggs are laid in batches of 10-600 which are covered by black scale-hairs. Larvae occur in two principle forms: the gregarious (gregaria) form characteristic of high- density populations and the solitary (solitaria) form found at low larval densities.

Gregarious larvae have a velvety-black upper surface with pale lateral lines, a green or yellow ventral surface, and no hairs on the body. The head is always shiny-black. Solitary larvae are cryptically coloured in a variety of shades of green-brown or pink, appear fat, and are extremely sluggish. They are difficult to distinguish from other grass-feeding caterpillars.

Pupa are mahogany-brown, 10-14 mm long, with a smooth, shiny surface. They are difficult to distinguish from pupae of other Spodoptera species.

Adult *S. exempta* are stout-bodied moths with the abdomen covered with pale grey-brown scales except for the tip in the female which has black hair-scales characteristic for this species. Forewings are dark-brown with distinctive grey-black markings.



Figure 5: *S. exempta* larvae
Photo by CABI

Solitaria-phase larvae may be difficult to distinguish from other grass-feeding caterpillars. Their green, pink or brown coloration is cryptic and the larvae hide in the grass mat during the day, emerging to feed at night. When found, they appear fat, are usually curled up, and behave very sluggishly.

Symptoms

Larvae prefer to feed on young, tender leaves. They may also feed on growing points, young shoots, stalks, bolls, buds, and fruits.

Young larvae of *S. exigua* feed on the under surface of leaves where they eat the lamina but often leave the upper epidermis and larger veins intact. Larger larvae make irregular holes in leaves and fully-grown larvae devour foliage completely, leaving only major veins. On tomato plants, buds and growing points may be eaten and fruits pierced.



Figure 6: *S. exigua* damage on cabbage
Photo by IRAC



Figure 7: *S. exigua* damage on tomato
Photo by IRAC

On most crops, *S. littoralis* damage arises from extensive feeding by larvae, leading to complete stripping of the plants. Maize stems are often mined by *S. littoralis* and young grains in the ear may also be damaged.

The symptom of *S. exempta* attack is gross feeding damage to foliage 'windowing', growing points and young stems. Severe infestation results in total defoliation or destruction of the plant to ground level.

Means of movement and dispersal

The moths naturally disperse through flight. They can accordingly fly quite long distances. The caterpillars can migrate over short distances (CABI, 2016).

Impact

S. littoralis is one of the most destructive agricultural lepidopterous pests within its subtropical and tropical range. It can attack numerous economically important crops throughout the year (EPPO, 1997) and is totally polyphagous (Brown and Dewhurst, 1975; Holloway, 1989). Losses to agricultural production due to *S. exempta* are frequently significant and intermittently devastating on a local, national and regional scale.

Movement in trade

Spodoptera are a regular annual migrant. In international trade, eggs or larvae may be present on planting material, cut flowers or vegetables. The pupae are long-lived and could be transported over a considerable distance if not crushed, but to establish a viable population several specimens of both sexes need to be transported (CABI, 2016).

Detection and inspection

Visual inspection is the best method to use when looking for eggs. Look for clusters of eggs covered with scales, on the underside of leaves near growing points of the host. *S. exempta* egg batches can be distinguished from those of all other *Spodoptera spp.* by the presence of a covering of black hair-scales.

Check leaves and flowers for young larvae and signs of feeding. Early instars are likely to be found on lower leaf surfaces during the day. Look at fruit or heads for gnawed, shallow holes or plant decay. Stir up the soil around the base of the plant to find larvae and pupae in the soil. These soil samples can be sieved to find late instars and pupae. Look for adults on the underside of leaves, on tree bark, or in herbaceous growth. Tapping foliage with an insect net

or similar object will often flush insects out of hiding places in brush. Use sticky wing traps baited with a pheromone lure to catch *Spodoptera* spp. Noctuidae are highly attracted to ultra-violet light. They are large, fast fliers and are unable to avoid entering the trap once they have flown sufficiently close for the light to repel them. Light traps using a 125-watt mercury-vapor bulb have been used to non-discriminately capture *Spodoptera*.

Phytosanitary significance

S. littoralis is listed as of quarantine significance by EPPO, CPPC, NAPPO and OIRSA (CABI, 2016). *S. exempta* is not listed as a quarantine pest by EPPO. However, effective forecasting and management of pests like *S. exempta*, whose long-range migrations result in the rapid spread of outbreaks from country to country, requires international cooperation. For planting material, EPPO recommends absence of the pests from the place of production during the last 3 months, or treatment of the consignment. For cut flowers, pre-export inspection is considered sufficient.

S. littoralis could also adversely affect access to foreign markets (EPPO, 1999).

Management

Prevention

Obtain planting material that is free from this pest. This includes strict phytosanitary measures when importing plant material from infested areas. Carefully inspect new plants on arrival, including any packaging material, to check for eggs and caterpillars and for signs of damage.

Mechanical

Physical destruction of insects and any plant material infested by this pest is recommended. Egg masses can be hand collected and destroyed.

Cultural Control is achieved by exposing larvae and pupae within the upper soil surface through weeding.

Biological Control

Predators and parasitoids of the pest have not adequately achieved natural control of these pests. Parasitoids like braconids, encyrtids, tachinids and ichneumonids and predators have been extensively documented following numerous studies.

Host-Plant Resistance

Avoid growing susceptible varieties to areas where probabilities of armyworm infestation are high.



Cold storage of chrysanthemum and carnation cuttings for at least 10 days at a temperature not exceeding 1.7°C will kill all stages of *S. littoralis*, but may damage the plants.

Chemical Control

Recommended insecticides for *Spodoptera spp.* include esfenvalerate, carbaryl, chlorpyrifos, malathion, permethrin and lambda-cyhalothrin. Numerous organophosphorus, synthetic pyrethroids and other insecticides have been used, with appearance of resistance and cross resistance in many cases for control of *S. littoralis*. Information on pest control products can be found on www.pcpb.org.

References

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