

*S. cerealella* is cosmopolitan and is widely distributed in mild and warm temperate to tropical regions. Heavy infestations have occurred in areas such as central and southern Europe and southern USA.

**References**

Aitken (1984), Cox and Bell (1991), Haines (1974, 1981, 1991), Ferguson (1987), Mound (1989) Solis (1999) and Weismann (1987).

**Pyralid moths**

(Family: Pyralidae)

<i>Cadra cautella</i> †	Almond moth, Warehouse moth
<i>Cadra figuillera</i> †	Raisin moth
<i>Corcyra cephalonica</i>	Rice moth
<i>Ephesia calicella</i>	Carob moth, Dried fruit moth
<i>Ephesia eluteella</i>	Tobacco moth
<i>Ephesia kuehniella</i> *	Mediterranean flour moth
<i>Plodia interpunctella</i>	Indian meal moth
<i>Pyralis farinalis</i>	Meal moth

(† sometimes included in genus *Ephesia*)  
 (\* also known as *Anagasta kuehniella*)

**Summary**

Feeding strategies	secondary pest, scavenger
Commodities attacked	grain and grain products, oilseeds, nuts, herbs and spices, dried fruit, tobacco
Distribution	worldwide
Economic importance	high – especially on processed foods
Eggs	laid in amongst commodity
Larvae	mobile, external feeders, produce large quantities of silk
Adults	short lived, do not feed on commodity, fly readily

**Introduction**

Pyralid moths occur worldwide and feed on dried and growing plant material in a wide range of environments. Members of several genera, notably *Cadra*, *Corcyra*, *Ephesia* and *Plodia* are important pests of a wide range of stored products, especially milled, processed and manufactured produce. *Pyralis farinalis* is a minor pest of mills and storage residues.

**Identification**

Fresh adults of *P. interpunctella* and *P. farinalis* are distinctive. *Cadra* and *Ephesia* species are superficially similar. Members of these genera are best identified by dissection and examination of genitalia, which is easiest in male specimens (see references). Larvae of pyralid moths can be identified to genus easily.

**Genus: *Corcyra* (Figures 192–194)**

**Adult**

- Fore wings (when fresh) grey with no markings (Figure 192). Fore wing 8–13 mm in length. Males much smaller than females. At rest, tip of fore wings appear more tapered than in *Cadra* and *Ephesia* spp.

Labial palps: female – long, curved downwards (Figure 194); male – short, hidden by scales (Figure 193).

**Larva**

- Full grown about 15–20 mm long, white in colour, rim of abdominal spiracles obviously thickened on one (rear) side.

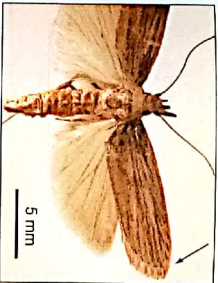


Figure 192 *Corcyra cephalonica*, adult, tapered fore wing, with lack of pattern

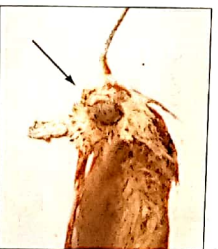


Figure 193 *Corcyra cephalonica*, head of male, labial palps short

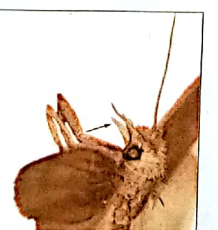


Figure 194 *Corcyra cephalonica*, head of female, labial palps long and pointing forward

**Genera: *Cadra* (Figures 195–197) and *Ephesia* (Figures 198–200)**

**Adult**

- Fore wings (when fresh) grey with vague darker markings (Figures 195, 198, 199). Fore wing 7–14 mm in length. Labial palps curved upwards (Figure 196).

**Larva**

- Full grown about 15–20 mm long, white to pink in colour, marked with black spots (each at base of a hair), rim of abdominal spiracles evenly thickened (Figure 197).



Figure 195 *Cadra cautella*, adult, live



Figure 196 *Cadra cautella*, adult, head showing labial palps curved upwards

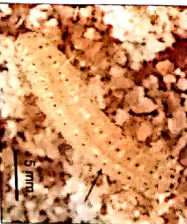


Figure 197 *Cadra cautella*, larva, live hairs on body each emerging from small dark spot

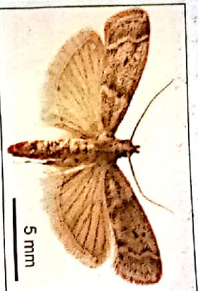


Figure 198 *Ephestia elutella*, adult

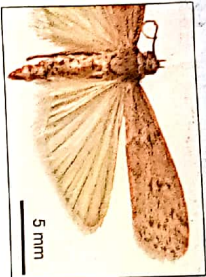


Figure 199 *Ephestia kuehniella*, adult

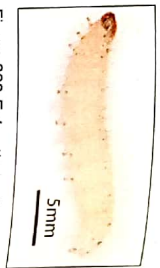


Figure 200 *Ephestia kuehniella*, larva, hairs on body each emerging from small dark spot

***Plodia interpunctella* (Figures 201–205)**

**Adult**

- Fore wings (when fresh) are bi-coloured cream and reddish brown. Fore wing about 7–9 mm in length (Figure 201–202).
- Labial palps point forwards (Figure 203).

**Larva**

- Full grown about 15 mm long, creamy white in colour, not marked with black spots, rim of abdominal spiracles evenly thickened (Figures 204–205).

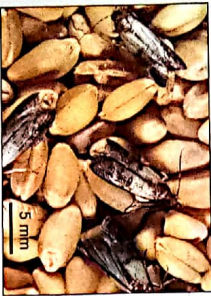


Figure 201 *Plodia interpunctella*, adult, live

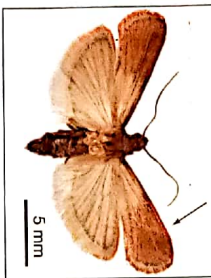


Figure 202 *Plodia interpunctella*, adult, bicoloured pattern of fore wing



Figure 203 *Plodia interpunctella*, adult, head showing labial palps pointing forwards



Figure 204 *Plodia interpunctella*, larva, no pigmented spots at base of hairs



Figure 205 *Plodia interpunctella*, larva, detail of abdomen

***Pyralis farinalis* (Figure 206)**

**Adult**

- Wings richly patterned. Fore and hind wing each with wavy white line across them, delineating basal (close to body) and apical (towards wingtip) purplish-brown regions. Central band pale brown (Figure 206).
- Fore wing broad and > 10 mm in length

**Larva**

- Full grown 20–25 mm long, creamy white in colour, not marked with black spot

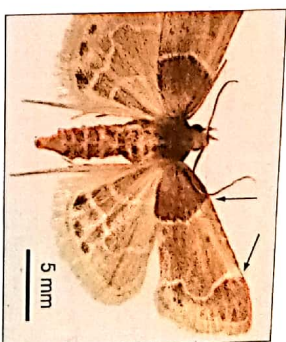


Figure 206 *Pyralis farinalis*, adult, pattern of fore wing

To identify specimens further to species, see Haines (1991), Ferguson (1987), Mound (1989), Solis (1999) and Weismann (1987).

**Life cycle**

Eggs are laid at random over the food material. Eggs of *Catena* and *Ephestia* are laid loose, those of *Plodia* are sticky and adhere to the food substrate. Some 150 to 200 eggs are produced during the short life of the adult. Eggs hatch in about three days at 30°C (*C. cauteilla*). Egg laying occurs at dusk or dawn when the moths are most active. Adult moths are able to follow odour trails from attractive foods and may fly in from some distance. Newly hatched larvae wander in search of food, and will readily enter minute imperfections in product packages. Larvae burrow into food bulks, lining and reinforcing their tunnels with silk as they go. In temperate regions, a combination of declining temperature and shortening day-length may cause mature larvae of *Catena*, *Ephestia* and *Plodia* to enter diapause. In this state they can suspend development for months, until conditions improve.

When mature, larvae tend to wander in search of a pupation site, during which time they frequently become obvious to workers having emerged from concealed feeding places. Prior to pupation, larvae spin a cocoon, less dense than one made for diapause. The pupal stage of *C. cauteilla* lasts about seven days at 30°C. Upon emergence, females emit a pheromone to which males are attracted and mating occurs shortly after emergence. Flight activity is highest at dusk with a smaller peak at dawn. During daylight hours moths usually rest. Moths are short lived and do not feed, but longevity and egg production are improved if females have access to water.

**Physical limits and optimum rate of multiplication**

Species	Conditions within which breeding takes place	Shortest development period, with optimum conditions	Maximum monthly rate of increase
<i>Cadra cautella</i>	17-37°C, r.h. > 20%	26 days at 30°C, 75% r.h.	60
<i>Cadra figuiliella</i>	15-35°C	27 days at 30°C, 70-90 % r.h.	20
<i>Corcyra cephalonica</i>	17-35°C, r.h. > 20%	27 days at 30°C, 75% r.h.	10
<i>Ephestia elutella</i>	10-30°C, r.h. > 25%	35 to 42 days at 25°C, 70% r.h.	15
<i>Ephestia kuehniella</i>	12-30°C, r.h. > 0%	40 days at 25°C, 75% r.h.	50
<i>Ephestia calidella</i>	15-35°C, r.h. > 20%	23 days at 30°C, 70% r.h.	
<i>Plodia interpunctella</i>	15-35°C, 25-90% r.h.	30 days at 30°C, 75% r.h.	60

*C. cautella*, *C. cephalonica* and *P. interpunctella* breed most rapidly under tropical conditions. Both *E. elutella* and *E. kuehniella* are able to breed at lower temperatures than other major pest species and caterpillars in diapause are sufficiently cold-hardy to survive winter unaided in cool temperate areas. Both *E. elutella* and *E. kuehniella* do not cope well with high temperatures, as above 30°C they become infertile. All species are tolerant of low humidities and foodstuffs with low moisture contents.

**Economic importance**

While these moths attack a wide range of dried food materials they are especially important pests of high value processed commodities which include cereal products, oilseeds, cocoa, chocolate, spices, tobacco, nuts and dried fruit. These moths are frequently encountered in mills, food processing plants, warehouses, shops and domestic premises. Populations usually survive in residues in structures and machinery.

In warm temperate to tropical regions, *C. cautella* is a major pest of mills and food processing plants. It is sometimes replaced in tropical areas by *C. cephalonica*. In temperate regions, *C. cautella* tends to be replaced by *E. kuehniella* and/or *E. elutella*. As an example, in southern Australia, *C. cautella* and *E. kuehniella* can both be found infesting cereal processing plants the former being mostly confined to warm or heated areas and the latter found in unheated facilities or areas exposed to ambient conditions. As well as being a pest of mills, *E. elutella* is also known as a pest of cured tobacco. *E. figuiliella* and *E. calidella* are relatively minor pests and typically infest dry and drying fruit - infestations can begin on the vine before harvest. *P. farinalis* is a minor pest of mills, usually associated with aged residues, sweepings and composting vegetable matter. *C. cautella* and *E. kuehniella* will also infest bulk and bag stored grain. Infestations of bulk grain tend to be restricted to surface layers.

In warm-temperate and sub-tropical climates such as found in Australia and the southern USA, *P. interpunctella* is by far the most important storage pest of processed, packaged and manufactured food and confectionary products in manufacturing, distribution, retail and domestic environments. As a result, *P. interpunctella* ranks as one of the most important storage pest in terms of its economic impact. In these regions it is also the storage pest that is most likely to be encountered in domestic and retail environments.

**Type of damage and symptoms**

When feeding on whole grain, larvae preferentially feed on the germ and bran layer. As they feed, caterpillars produce large quantities of silk which binds together and fouls the infested commodity. Large larvae may bore into neighbouring packages, especially when they are packed together close inside a shipping carton. Silk produced can block machinery and act as a harbourage for other insect pests. Infested food becomes contaminated with silk, frass, cast skins, pupal cases and dead moths. Adult moths do not feed on the commodity, having only sucking mouthparts.

**Ecology**

In addition to the storage environment, the pest species described above have been found in a wide range of non-storage habitats, including rotting plant material, wasp nests, bee hives, under bark and in rotting wood.

When in diapause, larvae can become much more tolerant to fumigants and pesticides than when they are active. The ability to enter diapause varies, with strains and species from cold climates having the greatest capability.

**Monitoring**

Trap systems baited with a synthetic sex pheromone are commercially available for *Cadra*, *Ephestia* and *Plodia* species. These traps are highly effective at attracting male moths and are in widespread use. While specific pheromone blends are marketed for target species there is considerable cross-sensitivity between these closely related genera and species. Walking around a facility with a pheromone bait will often rouse otherwise hidden moths, especially if the premises is not otherwise baited.

During the day, adult moths rest, often on walls, pillars etc. and can often be seen. Unlike many moth species, pyralid moths do not respond well to light traps.

Larvae of these moths wander when mature and will often pupate in piles of sacking or corrugated cardboard, especially if undisturbed for a while.

**Geographical distribution**

Species	Pest status	USA & Canada	Central & South America	Europe & N.Asia	Mediterranean basin	Africa	S. & SE. Asia	Australia & Oceania
<i>Cadra cautella</i>	●●●●	X	X	X	X	X	X	X
<i>Cadra figuiliella</i>	●	X			X	X		
<i>Corcyra cephalonica</i>	●●		X		X	X	X	X
<i>Ephestia calidella</i>	●				X	X		
<i>Ephestia elutella</i>	●●●	X	X	X	X	X	X	X
<i>Ephestia kuehniella</i>	●●●	X	X	X	X	X	X	X
<i>Plodia interpunctella</i>	●●●●	X	X	X	X	X	X	X
<i>Pyralis farinalis</i>	●	X	X	X	X	X	X	X

Pest status: ● minor to ●●●● major pest  
X: recorded

Major pest species are cosmopolitan. *C. cautella* and *P. interpunctella* are most often found in warm-temperate to tropical regions. *C. cephalonica* is restricted to tropical and sub-tropical regions. *E. kuehniella* and *E. clutella* are most prevalent in temperate regions. *E. calidella* and *E. figulilella* are largely restricted to areas with warm-temperate and Mediterranean climates. *P. farinalis* is widespread in temperate regions.

### References

Aitken (1984), Cox and Bell (1991), Haines (1974, 1981, 1991), Ferguson (1987), Mound (1989), Solis (1999) and Weismann (1987).

## Tineid moths

(Family: Tineidae)

<i>Nemapogon granella</i>	European grain moth
<i>Tinea</i> spp.	Case-bearing clothes moths
<i>Tineola bisselliella</i>	Clothes moth

### Summary

Feeding strategies	secondary pest, scavenger
Commodities attacked	damp grain and grain products, clothes, carpets, upholstery made from animal fibres, occasionally dried meat
Distribution	mainly temperate regions
Economic importance	low on stored food, high on textiles and woollen goods
Eggs	laid on cracks and crevices
Larvae	active, external feeders
Adults	short lived, do not feed on commodity, can fly

### Introduction

Larvae of moths of the family Tineidae feed wholly or mostly on dried material of animal origin. As a result, many are associated with the nests of rodents and birds where they feed on dried remains, hair and feathers. *Tinea* spp. and *Tineola bisselliella* are pests of products containing natural fibres such as wool. Another species, *Nemapogon granella*, is found in association with dried material of vegetable origin and is a minor pest of stored grain.

### Identification

The heads of tineid moths are covered in rough erect scales which give a hairy appearance (Figure 207). Labial palps are short and not curved upwards. When fresh, fore wings of *N. granella* are about 7 mm long and are distinctively marked with dark brown/black blotches on a lighter background (Figure 208). In nature, adults of *Tinea* spp. and *T. bisselliella* are rarely seen and are undistinguished light to dark brown coloured moths (Figure 209). Fore wings of *Tinea* spp. are 4.5–8 mm long and are darker and/or patterned. Feeding damage caused by *Tinea* spp. or *T. bisselliella* can be used to identify infestations to genus, (see 'Type of damage and symptoms', below).