

Task number 7 (Fastidious Flour Moth)

The answer from the Republic of Moldova's Team

General information about the flour moth:

The term flour moth refers to certain small moths of the family Pyralidae (snout moths, waxmoths), whose caterpillars are a pest of flour:

- *Ephestia kuehniella* (Mediterranean Flour Moth, Indian Flour Moth)
- *Plodia interpunctella* (Indianmeal Moth)

These two are closely related. They can easily be distinguished by their forewing coloration: the Mediterranean Flour Moth has light grey forewings with tiny dark specks, appearing uniformly grey from a distance. The Indianmeal Moth has bicolored forewings, with the proximal part light grey and the distal part dark or reddish grey.

Metamorphosis of a Moth

Moth larvae, or caterpillars, make cocoons from which they emerge as fully grown moths with wings. Some moth caterpillars dig holes in the ground, where they live until they are ready to turn into adult moths.

1. Eggs



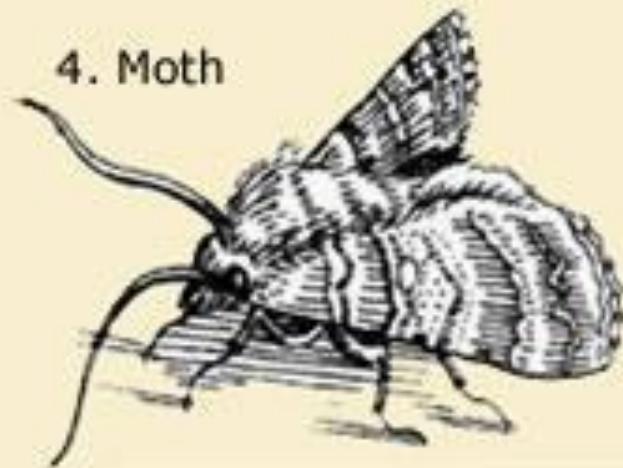
2. Caterpillar



3. Pupae



4. Moth



Caterpillars

Caterpillars are the larval form of members of the order Lepidoptera (the insect order comprising butterflies and moths). They are mostly herbivorous in food habit. Caterpillars have been called "**eating machines**", and eat leaves voraciously. Most species shed their skin four or five times as their bodies grow, and they eventually pupate into an adult form. Caterpillars grow very quickly. An adaptation that enables them to eat so much is a mechanism in a specialized midgut that quickly transports ions to the lumen (midgut cavity), to keep the potassium level higher in the midgut cavity than in the blood.

Larva (*Ephestia kuehniella*)

The larva (caterpillar) is off-white with a darker head and about 12 mm long when mature.



Ephestia kuehniella (Mediterranean Flour Moth, Indian Flour Moth)

The adult moth is pale gray and up to 12 mm long, with dark bands. The wingspan is between 16-20 mm.



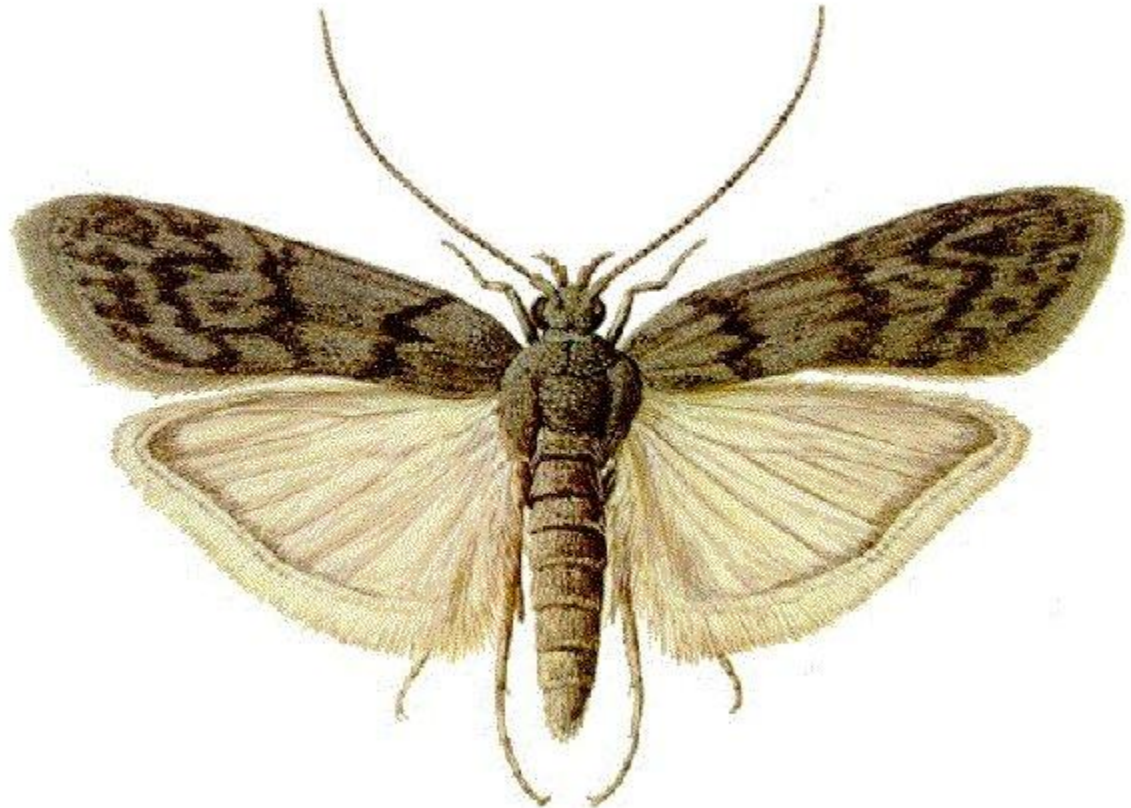
Larva on sprinkles (*Plodia interpunctella*)

The moth larvae are off-white with brown heads. When these larvae mature, they are usually about 12 mm long.



Plodia interpunctella (Indianmeal Moth)

Adults are 8–10 mm in length with 16–20 mm wingspans. The outer half of their forewings are bronze, copper, or dark gray in color, while the upper half are yellowish-gray, with a dark band at the intersection between the two.



Food:

The Indianmeal Moth larvae can infest a wide range of dry foodstuffs of vegetable origin, such as cereal, bread, pasta, rice, couscous, flour, spices or dried fruits and nuts. More unusual recorded foods include chocolate and cocoa beans, coffee substitute, cookies, dried mangelwurzel, and even the toxic seeds of Jimsonweed (*Datura stramonium*). The food they infest will often seem to be webbed together.

The Flour moth didn't infest the: salt, sugar, roasted coffee grains, beans, cinnamon, cocoa powder, jam and peas, because:

1. Salt is absolutely essential for animal life, **but can be harmful to animals and plants in excess.** (It can not be the only food that the Caterpillars are going to consume, because it doesn't contain the substances that an organism needs for the growing process.) Death can occur by ingestion of large amounts of salt in a short time (about 1 g per kg of body weight).

Sugar?

The table or granulated sugar most customarily used as food is sucrose, a disaccharide (in the body, sucrose hydrolyses into fructose and glucose). Sugar provides energy but nonnutrients—empty calories.

The sugar doesn't contain the substances that an organism needs for the growing process. By this making eat not the best product for a larva

Nutritional value per 100 g	
Energy	1,619 kJ (387 kcal)
Carbohydrates	99.98 g
- Sugars	99.91 g
- Dietary fiber	0 g
Fat	0 g
Protein	0 g
Water	0.03 g
Riboflavin (vit. B ₂)	0.019 mg (2%)
Calcium	1 mg (0%)
Iron	0.01 mg (0%)
Potassium	2 mg (0%)

Roasted coffee, why not?

During roasting, aromatic oils and acids weaken, changing the flavor. The primary psychoactive chemical in coffee is caffeine, an adenosine antagonist that is known for its stimulant effects. Coffee also contains the monoamine oxidase inhibitors β -carboline and harmane, which may contribute to its psychoactivity.

Unroasted beans contain similar acids, protein, and caffeine as those that have been roasted, but it can not represent the only food that the Caterpillars are going to eat, because excessive amounts of coffee can cause very unpleasant and even life-threatening adverse effects. Coffee's adverse effects are generally more common when taken in excess. Many of coffee's health risks are due to its caffeine content.

Also, roasted coffee beans contain extremely small quantities of proteins and lipids, and this makes them not a nutritious product for growing larvae.

Beans

Beans have significant amounts of fiber and soluble fiber, with one cup of cooked beans providing between nine and 13 grams of fiber. Beans are also high in protein, complex carbohydrates, folate, and iron, but some kinds of raw beans, especially red and kidney beans, contain a harmful toxin (lectin phytohaemagglutinin) that must be removed by cooking; many edible beans, including broad beans and soybeans, contain oligosaccharides (particularly raffinose and stachyose), a type of sugar molecule also found in cabbage. An anti-oligosaccharide enzyme is necessary to properly digest these sugar molecules. Consuming them in raw form can be toxic. To be able to consume the beans, the larvae need to have all the necessary internal structures for that, in this case, the enzymes to digest the substances

Why didn't the moth larvae eat the jam?

Well, from the previous information, we understood something important, the fact that the food the moth larvae eat is rich in substances which accelerates its growth, those substances are proteins, and some lipids, also vitamins. There are several reasons why the moth didn't want the jam, first of all, it's too viscous, also the jam does not contain what the moth needs, for instance, we got some information about the jams: ' **Fruit preserves** are preparations of fruits, vegetables and sugar, often canned or sealed for long-term storage. The preparation of fruit preserves today often involves adding commercial or natural pectin as a gelling agent'. The majority of jams don't contain proteins or vitamins, and if they do, those are in small quantities. This explains why the moth larvae didn't consume the jam

The peas

Peas are known to be very nutritious, then there must be another reason for the moth larvae to not eat them. Let us remember the fact that we deal with a flour moth. And, as it's called flour moth, it indicates the fact that it consumes flour, but the peas are very different from flour. For peas, there exist pea moths, which, as you guessed eat peas. As follows, the structural differences between the flour moth and pea moth, make them have different food preferences

Also, by studying the pea moth cycle, we find out that:

The females seek out pea plants on which they lay their eggs. They are attracted to pea plants that are in flower. After hatching, the **caterpillars** bore into the developing pea pods and begin feeding on the seeds.

This tell us that, the peas are already infested when you open them, and so, you can't find infested peas, if they weren't before.

The Cinnamon

At first it was strange that the moth didn't eat the cinnamon, but then , we found out that cinnamon has properties of a moth repellent. The moths can't stand it because of their smell, and also the substances it contains. This explain why it was not touched by the moths.