

Silkworm Eggs

- 2nd Grade - Insects and Plants

Silkmoth – *Bombyx mori*



What to do when they arrive. Purchased silkworm eggs usually arrive loose in a vial.

Working on a large piece of white paper, use the little paintbrush to divide the eggs into eight piles, and put one pile into each of eight vials. Cap the vials. Keep them in a warm place out of direct sunlight until you are ready to introduce them to students.

Eggs from a colleague may be stuck to paper. If this is the case, cut or tear the paper so that each piece has 10–15 eggs, and put the bits of paper into the vials.

Background. Silk is a natural fiber of exceptional strength, texture, and luster. When silk fibers are spun into thread and woven into fabrics, the result is an exquisite commodity. Silk was first made in China, and for centuries the methods of production were cloaked in secrecy, so valuable was the technology to those who controlled the art and industry of silk making. Eventually, however, the secret and the organisms escaped the control of the Chinese, and thriving silk industries were established in Japan, Arabia, and Spain. Even today, with the vast array of synthetic fibers that rival silk in many ways, the demand for the real thing is still high.

Although the larvae of most moths and butterflies produce silk, that produced by *Bombyx mori* is the silk of commercial importance. The silkworm moth lived in nature 4500 years ago when the Chinese silk industry was in its infancy, but as years passed, the insect became so domesticated that it can no longer fend for itself in the wild. It can no longer fly, move more than a few centimeters to find its food, or defend itself against predators.

As the silkworm prepares to pupate, it spins a protective cocoon. About the size and color of a cotton ball, the cocoon is constructed from one continuous strand of silk, perhaps 1.5 km long (nearly a mile). If the silkworm were allowed to mature and break through the cocoon, the silk would be rendered useless for commercial purposes. So the encased insect is plunged into boiling water to kill the inhabitant and dissolve the glue holding the cocoon together. The end of the silk is then located and the cocoon unwound onto a spindle to be made into thread.

Life cycle. A silkworm starts its life as a tiny egg laid by the female moth. The egg is just about this size: . The egg, laid in the summer or early fall, remains dormant until the warmth of spring stimulates it to start developing. When silkworms first hatch in the spring, they are tiny—3 mm or so (about 1/8")—and hairy. They require young tender mulberry leaves during their first few days. As they grow, they can eat tougher leaves, and late in their development they will eat any mulberry leaf you can supply. The larvae advance through five stages of growth, called instars. The silkworm literally outgrows its skin five times, and molts its outgrown skin. With the first molt the silkworm loses its hairy exterior, and for the rest of its larval life its skin is soft and smooth.

Silkworms grow rapidly, eventually reaching the size of your ring finger. Then they spin beautiful oval white or yellow cocoons in which they pupate. After 2–3 weeks the creamy-white adult moths emerge from the cocoons. They clamber around, vibrate their wings rapidly, and mate, but they don't fly or attempt to escape from their container. During the adult phase of the life cycle, the silkworm moths do not eat or drink. After mating, the female lays a profusion of eggs, and the moths die.

Males and females look slightly different, and students will be able to tell them apart with a little practice. The female has a larger abdomen. The male has a much larger pair of antennae, which look like long rakes or comb-shaped eyebrows, and vibrates its wings rapidly to attract a female.

Silkworm feeding and alternative food. Silkworms eat mulberry leaves; lots of them! But getting leaves in the late fall and winter months is nearly impossible, as the trees are deciduous. If you are raising silkworms in the winter, there is an alternative food. With every order of silkworm eggs you will be sent a half-pound of dry silkworm chow. Preparation requires hot tap water and a heat-source such as a microwave oven or stove-top. Water is mixed with the dry powder and then brought to a boil. The resulting mixture is poured onto a sheet of cling wrap, cooled, wrapped, and stored in the refrigerator. When firm, the silkworm chow can be sliced and fed to the hungry larvae.

The cooked silkworm chow can be stored in the refrigerator for a month or two if kept in an airtight container. Each bag of the dry powder comes with detailed instructions on the back of the package. Make sure your hands are clean when handling the cooked chow as the silkworms are susceptible to bacterial problems if their food is not kept sterile. But remember, if you are raising silkworms in the spring, summer or early fall, fresh leaves are the best food source. If you are using mulberry leaves, the first 10 days the larvae will need catkins or young tender leaves, but after that the larvae will eat any leaf you can provide. Keep leaves in the refrigerator. Feed the silkworms once or twice a day.

Obtain silkworm eggs. Eggs of the silkworm must be obtained from a colleague who worked with silkworms last year, or ordered from a biological supply company. Order 50 eggs. If you purchased eggs from a biological supplier, plan to conduct this part as soon as the eggs arrive, because they will hatch 1–2 weeks after you receive them.

Habitat. A shoe box is all that you need to make a silkworm habitat. Choose a place in the room where the silkworms will be warm but not in direct sunlight. Place the shoe box in an open plastic bag, or drape a sheet of plastic over the box. The idea is to reduce evaporation from the leaves a bit without developing a humid environment.

If the eggs are scattered all over the box, that is OK, but the larvae should be placed on a leaf. New larvae must be rounded up each day and delivered to a fresh mulberry leaf. Larva. Silkworm larva are delicate at first and should not be handled for the first 2 weeks except with a tiny paintbrush. By the time the larvae are 2 cm (1") long, students can carefully pick up and gently hold them. The larvae seem to survive better if they are kept together in a single culture early in life—later they can be kept in pairs or small groups on students' desks.

Plan for spinning. Get a medium-size corrugated cardboard box and a couple of paper egg cartons. Open the egg cartons and attach them to the inside walls of the box. The silkworms will spin in the depressions in the egg cartons. The silkworms must all be in this box for spinning their cocoons. The time for this will

be signaled by the first larva that starts to spin, either in your class habitat or, more likely, in one of the group habitats.

Prepare for silkworm moths. Once the larvae spin cocoons, they require no further care. The moths will emerge in a couple of weeks and can be handled by students. They do not eat or drink—they mate, lay eggs, and die.

Prepare for mating and egg laying. Get a large flat box, or cut a taller one down to about 10 cm (4"). Line the bottom with paper. As the adults emerge, move them to this new box. The moths will stay in the open box. The females will lay eggs on the paper, making them easy to collect.

Collect eggs. The eggs will remain viable for a year with minimal care. Seal them in a labeled zip bag and put them in the refrigerator (not the freezer!) as soon as all the moths have died. If you don't refrigerate the eggs, they will still hatch, but over an extended period of time instead of all at once.

What to do with them when the investigations are completed. Any silkworms can be fed to some reptiles or amphibians as food, or passed on to another teacher who will do the investigation. Eggs should be stored in the refrigerator as described above, and used the following spring. Old cocoons or dry silkworms can also be stored in a zipbag to display later at a science table, or students can take them home.

With adult supervision, students can place the spent cocoons in a cup of hot water and use a craft stick to "pull" the silk threads apart. The most humane way to end the lifecycle is to place the eggs, larvae, pupae, and moths in the freezer for a few days. They can then be placed into the compost. Living silkworms, cocoons, or moths should not be released into the wild as they might impact the local environment. These silkworms are domesticated and will not survive.