



## Rearing Insects for Pollination

Seventy-five percent of flowering plants rely on insects for pollination. Among the most common insect pollinators are bees, wasps, beetles, butterflies, moths, and flies. While these pollinators are looking for food, pheromones, and potential nest-building materials, pollen grains cling to their bodies and are incidentally transferred to other flowers during subsequent foraging.

Though an abundance of pollinators is good for the environment and for fruit production in the garden, increased pollinator activity can interfere with a seed saver's attempts to produce seed that is true-to-type. Therefore, to prevent cross-pollination between varieties, some seed savers may choose to release insect pollinators into pollinator exclusion cages.





For seed savers who lack sufficient space to isolate varieties of the same species by distance (isolation distance recommendations range from 50 feet to over 1 mile depending on the species), reared insects released within pollinator exclusion tents allow for the production of true-to-type seed from more than one variety of a species in a single year. Seed savers can construct pollinator exclusion cages out of wood, plastic or metal tubing, or a wire frame that is covered with spun polyester cloth or window screen. These cages allow air, light, and water to pass through, but block out unwanted insects.

Though it is possible to attract and gather pollinators in a home garden that can be released into pollinator

exclusion cages, it is impossible to know exactly where these insects have been foraging and whether or not they are carrying pollen. Therefore, at Seed Savers Exchange, we commercially purchase and rear two varieties of bees—orchard mason bees (*Osmia lignaria*) and alfalfa leaf cutter bees (*Megachile rotundata*) – as well as houseflies (*Musca domestica*), which are released into pollinator exclusion cages.

For more information on caging practices and on promoting native pollinators, see the Seed Savers Exchange guide, *Native Pollinators in the Midwestern Seed Saving Garden*.

## MASON BEES

Mason bees (*Osmia lignaria*) are about the same size as honeybees, but are dark metallic blue in color and carry pollen on their bellies, rather than their hind legs (Figure 1). Mason bees are solitary bees, meaning that they have no queen bee and build nests in holes using mud, which is where their name “Mason” originated.

After mating, female mason bees collect pollen and nectar, which they form into a ball using saliva and place inside a nesting cell, along with an egg. These larvae consume their provisions throughout the summer before spinning a cocoon around themselves and entering the pupal stage (Figure 2). The adult bee matures in fall or winter and hibernates in this cocoon until early spring. Once temperatures reach 57°F (14°C), the bees will begin emerging after only a few hours or within three days.<sup>1</sup> Gardeners can extend the mason bee season by



FIGURE 1. Adult mason bees carry pollen on their hairy bodies and each is capable of doing the work of 200 honeybees.

keeping cocoons cold until they are needed, up to a point; eventually the bees will start emerging under cold conditions as they run out of provisions.

Mason bees are efficient pollinators of many species of crops grown in the United States, including brassicas, alliums, and cucurbits. Many seed savers choose to use mason bees to pollinate cabbage, carrots, and parsnip, among other species.

For a step-by-step guide on incubating mason bees, refer to Inset 1.



FIGURE 2. Mason bees hibernate inside their cocoons from late fall until early spring.

## INSET 1.

### Incubating Mason Bees

#### Step 1. Order Bees

Typically, commercial dealers will sell mason bees at a male to female ratio of 2:1, but only charge for female bees. Mason bees are usually shipped in late March before the growing season, so orders should be placed in January.

#### Step 2. Store Bees

Prior to incubation, mason bee cocoons should be kept in a refrigerator at a temperature of 38°F (3°C) and 50-70% relative humidity.<sup>2</sup>

#### Step 3. Prepare Bees for Incubation

Place cocoons into a small, clear plastic container, along with two or three cotton balls soaked in sugar water (INSET 2). Typically, one plastic container per cage is the most efficient practice. Cover the container with a plastic lid equipped with small pinholes. Do not use wire mesh or coffee filters for covering the tubs, as mason bees can chew through these materials.

#### Step 4. Incubate Bees

Set the container somewhere where it will be exposed to temperatures above 57°F (14°C).

Almost anywhere in the house that is between 70 and 80°F will be appropriate.

#### Step 5. Release Bees Into Cages Weekly

Mason bees will emerge within a few hours and no later than three days. Once the bees have emerged, they will diet on the sugar water until they are released. Bees should be released into the isolation cages weekly while plants are blossoming. Because mason bees are more efficient at pollinating than most other species of bees, very few bees will need to be released into cages each week while the plants are blossoming.

The number of female bees needed per cage will depend on flower density and the number of plants, but a general rule is to release 2-3 female bees per 20 plants.

## INSET 2.

### Preparing Sugar Water

Combine one part water (by weight) with one part pure cane sugar. Stir the mixture at room temperature or heat gently. A standard mixture includes one pound of sugar and one pint of water.

## ALFALFA LEAF CUTTER BEES (ALC)

Alfalfa leaf cutter bees (ALC) are a quarter-inch long and black with bands of white hair around their abdomen (Figure 3). Only the female of these naturalized bees (*Megachile rotundata*) have stingers, though both sexes use mandibles, or mouthparts, to build nests and to bite when squeezed or aggravated. While smaller and gentler than honeybees, each ALC is capable of doing the work of twenty honeybees.

Like the mason bee, ALCs are solitary bees, preferring to build their nests out of leaves in tubes or tunnels. After mating, female bees collect pollen and nectar, which they combine with saliva to form a “bee loaf.” One loaf and one egg are then placed into each nesting cell. Within the cell, the ALC larva will consume the loaf before entering into diapause for the winter. Late in the spring once temperatures reach 70 to 80°F, the bees will metamorphose from pre-pupa to pupa, and then into adults before emerging. Therefore, careful planning is necessary to

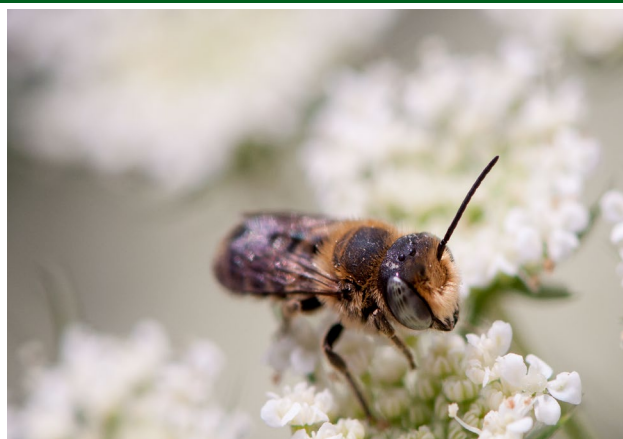


FIGURE 3. Alfalfa leaf cutter bees are solitary bees, that create nesting cells out of alfalfa leaves.

ensure that the bees will emerge when they are needed for pollination inside pollinator exclusion cages. (See Inset 3)

### INSET 3.

## Incubating Alfalfa Leaf Cutter Bees

### Step 1. Order Bees

Alfalfa leaf cutters should be ordered during the winter months.

### Step 2. Store Bees

Prior to incubation, store ALCs at 38°F (3°C) to keep them in their prepupal dormant state.

### Step 3. Prepare Bees for Incubation

The number of ALCs required per cage will vary based on the flower density of each crop. On average, one tablespoon of cocoons per 25-30 plants should be adequate for pollination. Place the desired number of cocoons into a medium-sized, clear plastic container (Figure 4). As a general rule, do not fill the tub more than one inch deep with cocoons.

Cover the plastic container with a clear lid that has been punctured with a needle, creating several pinpricked holes large enough to provide air but not so large that the bees will crawl through.

### Step 4. Incubate Bees

Gardeners can incubate ALCs in a warm spot in their house or under a light, gently heated to 85°F. Under these conditions, ALCs will be ready to be released in 24 days.

### Step 5. Release Bees

Bees should be released into the isolation cages weekly while plants are blossoming.



FIGURE 4. ALC cocoons scooped into plastic containers (one tablespoon per 25-30 plants) for incubation.

## HOUSE FLIES

There is little doubt that everyone has come into contact with the most common species of flies, houseflies or *Musca domestica*. These gray flies are about 1/5-1/3 inches (5-8mm) long with four black stripes along their thorax. While foraging for nectar, flies incidentally transport pollen on the tiny hairs that cover their body (Figure 5).

The life cycle of the housefly begins with the laying of white eggs, which are piled into groupings of 75 to 150 eggs over a few days. Within 8-20 hours under warm, moist conditions, these eggs will develop into larvae. Larvae will begin feeding immediately on whatever material in which the eggs were laid (typically rotten meat, rotten fruit, or manure). At this time, the flies will enter the pupal stage and a pupal case will form from the last larval skin (Figure 6). Depending on the conditions, adult houseflies will emerge from the pupal case within two to six days.



FIGURE 5. Adult house flies are useful for the pollination of many food crops, such as carrots.

Throughout the growing season, flies are some of the busiest pollinators, sufficiently pollinating Umbelliferae (carrots, celery/celeriac, parsnip, parsley), Brassicaceae (cole crops, mustards, Asian greens), Rosacea (strawberry, raspberry, blackberry), and Alliaceae (onions, leeks), many of which are unattractive to bees.





FIGURE 6. *House fly pupae should be incubated at 80°F in a moist, dry place for 5–6 days in lidded containers.*

Though they are less efficient pollinators than bees, houseflies are the most economic choice for home gardeners and seed savers (Inset 4).

## Sources

<sup>1</sup> Dogterom, Margriet. *Pollination with Mason Bees: A Gardener and Naturalists' Guide to Managing Mason Bees for Fruit Production*. Beediverse Publishing, 2002.

<sup>2</sup> "Mason Bee Life Cycle." [crownbees.com/]. Accessed 18, July, 2014.

## INSET 4.

### Incubating Houseflies

#### Step 1. Order Flies

Houseflies can be purchased at any time from online retailers.

#### Step 2. Store Flies

Prior to incubation, store the pupae in a refrigerator at a low temperature until it is time to incubate. Fewer flies will emerge the longer the flies are stored in the fridge, dropping from a 95% emergence in week one to a 30–50% by week four, so plan multiple shipments if an extended pollination season is needed.

#### Step 3. Prepare Flies for Incubation

The number of houseflies required per cage will vary based on the flower density of each crop. In general, one fly should be incubated for every 1 to 2 plants. Place the desired number of pupae into a medium-sized, clear plastic container (again, using one tub per cage). Since the egg sites are so small, it is not necessary to count out the exact number of flies for each container. However, do not fill the tub more than

an inch deep. By leaving extra space in the container, adult flies will have room to fly while they are waiting to be released. Cover the container with a clear plastic lid that has been punctured with a needle, creating a pinpricked hole that will ensure that the flies will receive ventilation but will not slip through.

#### Step 4. Incubate Flies

Seed savers should place houseflies in a warm spot in their house or set up a box with a small light for warming for incubation. During incubation, houseflies should be kept at a temperature of 80°F (25°C) and will not require any food source. Houseflies, like the ALCs, also should be kept at 50–60% relative humidity. Place a damp cloth near the incubating flies to raise the relative humidity of an environment that is too dry. Under these conditions, adult flies should emerge in 5–6 days.

#### Step 5. Release Flies

Flies should be released into the isolation cages weekly while plants are blossoming.



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