

## **Raising Mealworms and a few Recipes**

(This article is adapted from a leaflet prepared by the Insectarium of Montreal for the public. The leaflet contains several illustrations and photos and is available free in French and English. It is a much-needed contribution and an excellent start in making food insects more of a possibility for the general public in North America. The leaflet contains exactly the kinds of information for which many of our U.S.A. and Canadian Newsletter readers have been asking. Another leaflet is now available on crickets and will be featured in the next Newsletter with appropriate recipes. What is needed next is a similar efforts on how to rear and serve home-grown waxmoth larvae. To request a copy of the mealworm leaflet, write to: Ms. Marjolaine Giroux, Insectarium de Montreal, 4581 Sherbrooke Street East, Montreal, Quebec H1X 2B2, Canada. Tel.: [514] 872-0663.)

Partial text of the leaflet: Eating insects is a long-standing tradition in many cultures. People in some countries of southern Africa, for example, consume great quantities of different species of caterpillars. In Mexico, 'ahauhutle,' the eggs of water bugs, and 'escamoles,' black ant larvae, are traditional Indian dishes. Some species of ants are very popular with the inhabitants of southwestern China and in Southeast Asia, the giant water bug, *Lethocerus indicus*, is considered a true delicacy.

For many in the Western world, insects are viewed as a culinary curiosity, and are most often considered the last resort of people in other parts of the world who have nothing else to eat. It is true that in some cases people eat insects out of necessity. Generally speaking, however, it is the abundance, accessibility, nutritional value, and taste that makes insects popular as food. Insects contain proteins, lipids, minerals (mostly zinc, copper, and iron), vitamins (in particular, riboflavin and thiamine), and water. Chitin, the polymer which forms insect exoskeletons, is not easily digested by humans and thus thought to be a source of dietary fiber.

### **Quality Insects**

Eating insects is becoming more and more popular in Western cultures. However, there is little information available on edible insects available in areas where these Western cultures are located. Since one cannot know under what conditions any insects one may capture in the wild developed, it is best not to eat them. They may have been exposed to pesticides, fed on and accumulated plant toxins, or contain parasites or bacteria. [Ed. If insects are thoroughly cooked, like pork or wild game, the meat will not transmit parasites, bacteria or viruses].

Although it is still not possible to dash to the supermarket to obtain that unique, entomologic addition to your menu, it is possible to raise your own. If you wish to

add insects to your daily menu, or, even to have on hand for those special parties, the best approach is to raise them on a small scale at home. This will allow you to control the conditions under which they develop and reproduce.

Mealworms are one of the easiest insects to raise at home in the kitchen area. Raising your own mealworms means that they are available, year-round, at no significant cost, and ready to use at the last minute, even as the guests are arriving. Yellow mealworms, *Tenebrio molitor* (Family: Tenebrionidae), are well suited to this type of 'insect farming.' These beetles are small, reproduce quickly and are resistant to disease and parasites. In addition, they are simple to handle and require little space and maintenance. There are four stages in its life cycle. The egg is 1.8 mm; the larva grows from ca. 2 to 30 mm; the pupa is ca. 16 mm; and the adults are 16 mm.

## **How to Raise Mealworms**

### **Equipment**

Acquire at least 3 containers, preferably plastic. To provide proper air circulation and prevent condensation, punch holes in the lid and cover the lid with mosquito netting or cheesecloth. Suggested dimensions for this rearing container is 41 cm x 28 cm x 15 cm.

Feed the mealworms mixed grains such as: oat or wheat kernels (10 parts), rolled oats (oatmeal) or whole wheat flour (10 parts); wheat germ or powdered milk ( 1 part); and brewer's yeast (1 part). Brewer's yeast can be obtained at health food stores. This is an important ingredient, because it provides proteins and trace elements essential to the insects' growth.

To supply the water that these insects need to develop, provide bits of vegetables (cabbage, carrots, potatoes, lettuce, etc.) or fruit (mainly apple). Monitor this item daily to watch for visible mold growth. Immediately replace the water supply when mold growth appears.

When all is in readiness, obtain the mealworm larvae starter culture. This can be bought from pet shops where they are used as food for reptiles and amphibians. Bait shops may also have these available. If there is no such source in your area, national suppliers will fly the mealworm starter culture to you where ever you are. Some of these North American suppliers are: Rainbow Mealworms, PO Box 4525, Compton California; Yarbrough Bit Distributors, Route 2 Box 202, Heidelberg, Mississippi 39439; and Sure-Fire Fresh Bait RR 6? Calgary, Alberta, Canada. You will need about sixty larvae to start your 'farm.'

### **Culture Management**

In one of the culture containers, place about 2.5 cm of the grain mixture, the

mealworm larvae, and bits of vegetables and/or fruit (=the water source). As soon as the first pupae appear (this is a non-feeding and non-ambulating stage), transfer them to another container, an empty box. This will prevent the larvae from eating the pupae. For the same reason, the adults must be separated from the pupae as soon as they emerge from the pupal 'skin' (exuviae). Transfer the adults into a third box, also containing 2.5 cm of the grain mixture and chunks of vegetables or fruit.

The males and females of the mealworm are indistinguishable. They mate 2-5 days after emerging, and the female lays up to 40 eggs a day. The eggs take 12 days, on average, to hatch. The larvae molt several times over a period of about 10 months, until they reach 25-30 cm in length. It takes about 12 days for the pupa to complete metamorphosis into an adult. The adult lives, generally, only 2 months. All in all, at temperatures from 18°C to 25°C, the insect's life cycle is about one year.

### **Culture Maintenance**

Replace the pieces of fruit or vegetables when they dry out, and remove any dead insects. Stir the grain mixture from time to time to incorporate the larval skins, so that they will also be consumed by the larvae. Change the mixture when it begins to look sandy. You will have to remove the insects one by one or separate them using a sieve.

### **Helpful Hints**

Clean the containers thoroughly before using them. To speed up the insects' development, keep your 'farm' at a temperature of from 25°C to 30°C. Above 30°C there are negative effects on growth and development. Avoid placing the containers in bright sunlight. Keep the cultures in a dimly lit, dry, and well-ventilated place. Keep the mixture as dry as possible to avoid mold and other undesirable organisms. Keep your insects in a number of different containers to minimize losses due to contamination or any other problem.

### **When to Begin Harvesting the Larvae**

Since you are developing a stock culture and it is the larval form of this insect that is eaten, you would want to wait for the first generation after the parents to harvest any larvae. In concrete terms, this means that you must feed the larvae that you obtain from a commercial source until they become adults, allow them to reproduce, and then 'harvest' the larvae of the new generation. Make sure, of course, that you leave enough of the larvae to keep your farm running!

### **Preparing the Insects for Use**

Before you begin whipping up delicious insect meals, you must take some

precautions: Always kill the larvae by freezing them alive. About 48 hours is sufficient. You can keep them in the freezer for a few months if they are properly wrapped in airtight bags or containers.

Insects can deteriorate quickly, just like meat that is left out on a counter. Always keep them in the freezer until you are ready to use them. It is also a good idea to rinse them in running water before you cook them.

Never eat any insects of doubtful quality (rotten smell, unusual color, etc.). If in doubt, DON'T.

### **Start the Ovens**

Dried mealworm larvae can be used in place of nuts, raisins, and chocolate chips in many cookies, bread, and dessert recipes. In powdered form, mealworm larvae can also replace part of the flour in cakes or pie crusts. If they are just barely thawed, whole, or ground, they can be added to sauces or used to make delicious spreads.

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### **Mealworm Recipes**

We suggest these starters to try out your new culinary raw material. The following recipe was developed by the *Food Insects Newsletter* Editor and taste-tested by undergraduate and graduate students at Montana State University and various dinner guests at the Dunkel/Diggs home:

#### **Hot Mealworm Appetizers**

Ingredients:

5 ml (1 tsp.) cayenne

2.5 ml (1/2 tsp.) black pepper

85 ml (1/3 cup) mealworm larvae, slightly thawed

30 ml (2 Tbsp) butter or margarine

Place all ingredients together into a sauce pan. SautŽ, stirring constantly, until the mealworms are golden brown. Drain and serve. Or, these may be added to a hot bridge mix available in many grocery stores. Or, one may add them to 'Party Mix' made from cold cereal squares, pretzels and nuts. The combination made at home to which one could add the mealworms for extra nutrition, fiber, and interesting texture is as follows: Melt 1/4 cup margarine in roasting pan in preheated 250jF oven. Stir in 5 tsp. Worcestershire sauce, 1-1/4 tsp. seasoned salt, 1/4 tsp. garlic powder. Gradually add: cereals (2-2/3 cup corn squares, 2-2/3 cup rice squares, 2-2/3 cup wheat squares); 1 cup nuts and 1 cup pretzels. Stir to

coat evenly. Bake 1 hour, stirring every 15 minutes. Spread on absorbent paper to cool. Store in airtight container. Makes 10 cups.

The following recipes are from: *Entertaining with Insects: The Original Guide to Insect Cookery* By Ronald L. Taylor and Barbara J. Carter. 1992. Salutek Publ. Co. Yorba Linda. 160 pages.

### **Mealworm Cookies**

#### **Ingredients:**

550 ml (1-1/4 cups?) all-purpose flour  
5 ml (1 tsp.) baking soda  
5 ml (1 tsp.) salt  
250 ml (1 cup) softened butter  
175 ml (3/4 cup) white sugar  
125 ml (1/2 cup) crumbled dried mealworms  
175 ml (3/4 cup) firmly packed brown sugar  
5 ml (1 tsp.) vanilla  
2 eggs  
360 grams (1-1/2 cups) chocolate chips

Place the cleaned and prepared insects on a cookie sheet and dry in the oven for 1 -2 hours at 100°C (200°F). Preheat oven to 190°C (375°F). In a bowl, mix the flour, baking soda and salt. In another bowl, cream butter, white sugar, brown sugar, and vanilla. Stir in eggs. Gradually add the flour mixture. Stir in chocolate chips and mealworms. Drop by teaspoonfuls onto a cookie sheet, and bake 8- 10 minutes.

### **Mealworm Canapés**

#### **Ingredients:**

85 ml (1/3 cup) mealworm larvae, slightly thawed  
2 garlic cloves, finely chopped  
5 ml (1 tsp.) tomato paste  
15 ml (1 Tbsp) olive oil  
5 ml (1 tsp.) lemon juice  
5 ml (1 tsp.) red wine vinegar  
plus: red wine vinegar, freshly ground pepper, loaf of French bread (baguette), finely chopped fresh parsley

With a mortar and pestle or in a blender, mash the mealworms, garlic and tomato paste into a puree. Stirring constantly (or with the blender running), add the oil, a few drops at a time. Add the lemon juice, wine vinegar and pepper. Cut the baguette into 1.5 cm slices. Under the broiler, toast one side of the bread slices, and spread the untoasted side with the mixture. Place the canapés on a baking sheet and bake at 200°C (400°F) for 10 minutes. Sprinkle with parsley.

## **Siu Mai**

### Ingredients:

250 ml (1 cup) mealworms  
4 water chestnuts  
60 ml (4 Tbsp) green onions, sliced  
125 ml (1/2 cup) bamboo shoots  
1 egg  
5 ml (1 tsp.) salt  
23 ml (1 - 1/2 Tbsp) soy sauce  
30 ml (2 Tbsp) sherry  
5 ml (1 tsp.) sugar  
23 ml (1 1/2 tsp.) cornstarch  
1 ml (1/4 tsp.) pepper  
plus: wonton wrappers, dipping sauce (see below), vegetable oil

Place mealworms in blender, and grind until paste-like. Chop water chestnuts and add mealworm paste, green onions, bamboo shoots, egg, salt, soy sauce, sherry, sugar, cornstarch and pepper. Mix well. Fill center of won ton wrapper with 30 ml (2 tsp.) of mixture. Fold won ton in shape of a triangle. Moisten finger tips, and seal edges. Fold creased corners backward and secure the ends with more water. (They should now be shaped as a bishop's cap.) Place in skillet containing oil heated to about 350 degrees Fahrenheit. Fry for about 5 minutes. Serve with Dipping Sauce.

### Dipping Sauce:

15 ml (1 tsp.) boiling water  
15 ml (1 tsp.) mustard  
15 ml (1 tsp.) vinegar  
30 ml (2 tsp.) soy sauce

Add boiling water to mustard and mix well. Add vinegar and soy sauce. Stir well.

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## **A Word About Leftovers**

If you simply ordered too many mealworms for that special event, or your kitchen production unit has become too prolific, you can turn those leftovers into planovers. Place late instar larvae (older larvae, about to pupate) in plastic containers with small holes punched in lid. Cover larvae with wheat bran and place in the refrigerator. We have kept larvae up to one month in this manner, arrested at just the right stage for using in cooking.

## **Fast Snack Mealworm Alternative**

If the recipes sound good, but you would just like a taste and not the initial effort of

developing your own culture, you can order a new product from Hotlix (791 Dolliver, Pismo Beach, California 93449 USA phone (805)773-1942). Larvets, the original Worm Snax™, are mealworm larvae, now being sold roasted with barbecue, cheddar cheese, or Mexican spice flavors.