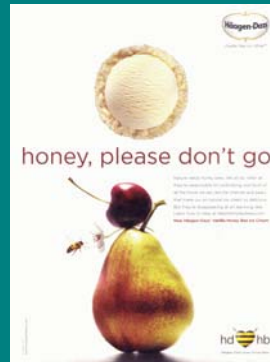


## Edible insects – insects as food



## Colony collapse disorder (CCD)

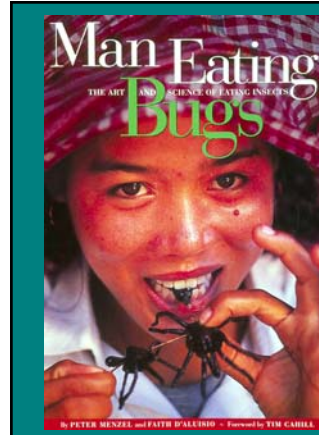


Time magazine  
(this week)

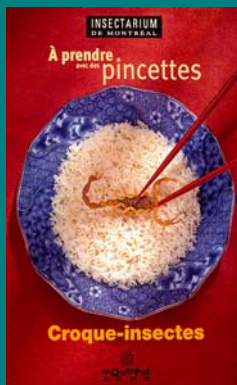
## Colony collapse disorder (CCD)



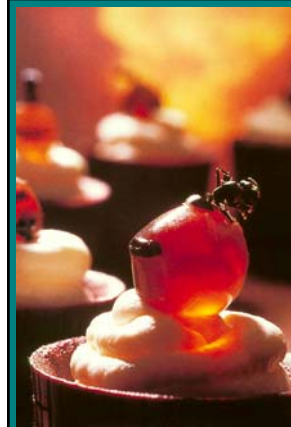
<http://helpthehoneybees.com/>



Edible insects:  
yum!



Insects are a major source of food in many parts of the world: Asia, Africa, Australia, Latin America, and others.



Insect haute cuisine

## Some data on insect consumption

Approximately 500 species of insects are eaten around the world

Over 200 species are eaten in Mexico alone

## Some data on insect consumption

Insects as a proportion of total protein intake:

Zaire: 10% overall but ranges from 22-64% depending on what region of the country

Columbia: 12-26% in the peak months (May – June). Insects are also a major source of fat (20%).

## Edible insects (some examples):

- South Africa:** Mopane worms (*Imbrasia belina*)
- Mexico:** Chapulines (*Sphenarium* grasshoppers)
- Mexico:** maguay worm (*Xylentes redtenbachi*)
- Mexico:** escamoles (*Liometopum* ants)
- Angola:** termites (*Macrotermes subhyalinus*)
- Angola:** olumbalala (*Imbrasia ertli*)
- Africa:** palm weevil (*Rhychophorus phoenicis*)
- Australia:** witchety grub (Hepialidae)

## Australia



Witchety grubs are a delicacy in Australia (the larvae are collected on acacia bushes)



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## Australia

Bogong Moth (*Agrotis infusa*)





Mainland Asia:  
Cambodia  
Thailand  
Malaysia  
China

### Insect products: edible insects



Water bugs are an important food in Thailand



Thailand  
Insects on sale in the market

### Insect orders consumed in Thailand

Odonata (damselflies and dragon flies)  
Orthoptera (crickets, grasshoppers, katydids)  
Mantodea (mantids)  
Isoptera (termites)  
Hemiptera (water bugs, cicadas, backswimmers)  
Lepidoptera (silkworm moths are popular)  
Coleoptera (weevils, wood-boring beetles, diving beetles, etc.)  
Hymenoptera (bees, ants, wasps)

### Some Thai recipes involving bees

- Fried queen bee larvae with fresh green peppercorns
- Queen bee larvae omelette
- Steamed bee brood in chili sauce
- Scrambled bee brood



From Chen et al. 1998



Japan



## Japan

*hachi-no-ko* - boiled wasp larvae  
*zaza-mushi* - aquatic insect larvae  
*inago* - fried rice-field grasshoppers  
*semi* - fried cicada  
*sangi* - fried silk moth pupae

Most of these insects are caught wild except for silk moth pupae. They are by-products of the silk industry. Silk moths are raised in mass for their ability to produce silk. The larvae, the young silk moths, produce the silk. Once they pupate, they can no longer produce silk and are then used as food



Africa:  
 Angola  
 Uganda  
 Botswana  
 Algeria  
 South Africa  
 Zambia  
 Zimbabwe  
 Mozambique

## Algeria

Desert locusts were collected in large numbers:

"To prepare them, they are first cooked in salt water, then dried in the sun. The natives collect and prepare such considerable stocks that apart from their own needs, they have some for trading in the markets....I have in my hands now two boxes of freshly prepared locusts and I convinced myself that they are quite an acceptable food. *The taste of shrimps is very pronounced: with time they lose their quality.*"

The consumption of desert locusts in Algeria

from DeFoliart 1989 (p. 22)

## Africa



Palm weevils can be four inches long and more than two inches wide. The mature larvae are fleshy and grublike with a high fat content. These insects are collected from the trunks of palm trees. They are fried in a pot or frying pan and they are reported to be very delicious.

Africa: palm weevil (*Rhychophorus phoenicis*): a traditional food item in Angola

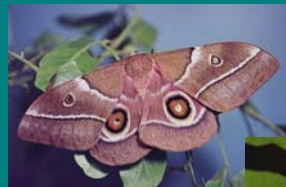
## Africa

Kwara State, Nigeria -- termites



Termites are collected by placing a bowl of water under a light source. The termites are attracted to the light and will then fall into the water. If large numbers of termites are gathered, they are sold at local markets. People of all ages eat the winged reproductive termites, but the queen termites are considered a delicacy and are only eaten by adults. The termites are roasted over a fire or hot coals or fried in a pot. After cooking, the wings are removed and salt is added to taste

## Africa – southern Africa



Mopane worms (right) are the larva of a moth called *Imbrasia belina* (above)

## Africa – southern Africa



Mopane worms (*Imbrasia belina*)

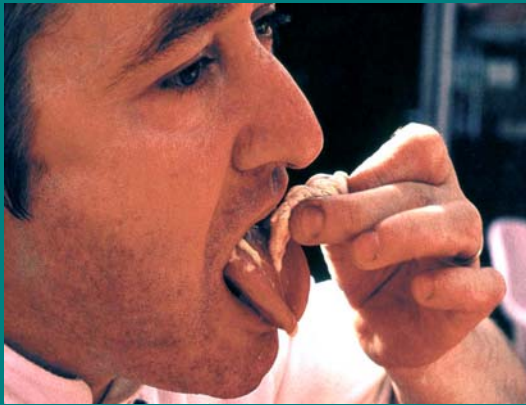
"The Pedi people not only prefer mopane worms to meat, but, according to Quin, prefer a quarter pound of these caterpillars to a pound of fresh beef."

## Africa – southern Africa



Mopane worms (*Imbrasia belina*)

**Method of preparation:** caterpillars are de-gutted then boiled, lightly salted and dried in the sun. They contain 50% protein when dried and are an important protein source in southern Africa. Harvests occur three times per year. 1600 metric tons harvested per year in South Africa alone!



Latin America:  
Peru  
Chile  
Bolivia  
Mexico

## Insect orders consumed by Yukpa people (Venezuela/Colombia border)

Orthoptera (crickets, katydids)  
Lepidoptera (noctuid moths are popular)  
Coleoptera (weevils, wood-boring beetles, etc.)  
Neuroptera (dobson flies)  
Diptera (flies)  
Hymenoptera (stingless bees, ants, paper wasps)

From K. Ruddle 1973

## The Yukpa (Venezuela/Colombia border)



Paper wasps are collected and the larvae steamed or fried

## The Yukpa (Venezuela/Colombia border)

Polybiine wasps are used in rituals because of their aggressive stinging behavior. When a boy is born, his father must go into the forest and collect the nests (and larvae) of *Polybia ignobilis*. This involves getting seriously stung by these wasps because he is not allowed to use any smoke to calm the wasps



## Edible insects in Peru



Peru: coconut palm grubs in the Amazon

## Edible insects in Peru



"I have eaten both cooked and raw coconut palm grubs (called suri by the local people in the Peruvian Amazon). Cooked on skewers, they taste kind of like BBQ pork - raw, like cheese curds (but don't eat the chitinous jaws!)."

From Rick Gillis (University of Wisconsin)

## Edible insects in Mexico



The maguete worm is a delicacy in Mexico – this is the worm in tequila. Why?



Mexico: maguete worm (*Xylentis redtenbachi*)

## Edible insects in Mexico



Mexico: Chapulines (*Sphenarium* grasshoppers)

[Red color comes from chilis]

## Edible insects in Mexico



Mexico: Chapulines (*Sphenarium* grasshoppers)

## Edible insects in Mexico



"Mexican caviar"

Mexico: Escamoles (*Liometopum* ants, harvested from the roots of agaves)

## Native Americans



"We followed them on horseback and I noticed that there were but very few crickets left behind. As they went down, the line of crickets grew thicker and thicker till the ground ahead of the drivers [men, women and children] was black as coal with the excited, tumbling mass of crickets..."

"I went down below the trenches and I venture to say there were not one out of a thousand crickets that passed those trenches."

Maj. Howard Egan, 1850

mormon cricket: *Anabrus simplex* (Tettigoniidae)

## Nutritional value of some insects compared to chicken (per 100g)

	Emperor moth	Palm weevil	Chicken
Energy (kcal)	370.5	561	138.5
Protein (g)	28.23	6.69	15.24
Lipid (g)	19.8	<i>no data</i>	4.14
Iron (mg)	35.5	13.1	1.33
Thiamine (mg)	3.67	3.02	0.06
Riboflavin (mg)	1.91	2.24	0.37
Niacin (mg)	5.20	7.78	5.03

## Nutritional value of insects

### Caloric content of insects is very high

Corn (high energy food)	320 kcal/100g
<i>Macrotermes</i> (termites)	613 kcal/100g
<i>Rhynchophorus</i> (palm weevil)	561 kcal/100g
<i>Xylentes redtenbachi</i> (maguey worm)	516 kcal/100g

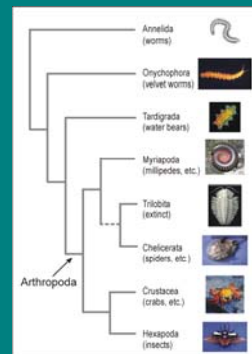
## You may already be eating insects

### Insect parts per 100 grams:

Chocolate - 80 Insect Fragments  
 Canned Citrus Fruit Juice - 5 Fly Eggs or 1 Maggot  
 Canned Corn - 2 Insect Larvae  
 Frozen Broccoli - 60 Aphids, Thripes, or Mites  
 Frozen Brussels Sprouts - 60 Aphids, Thripes, or Mites  
 Ground Cinnamon - 800 Insect Fragments  
 Macaroni and Other Noodle Products - 100 Insect Fragments  
 Mushrooms - 20 Maggots  
 Peanut Butter - 60 Insect Fragments  
 Tomato Sauce and Pizza Sauce - 30 fly eggs or 2 Maggots  
 Wheat Flour - 150 Insect Fragments

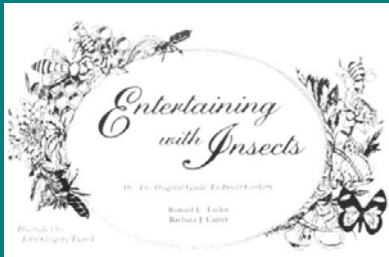
[www.cfsan.fda.gov/~dms/dalbook.html](http://www.cfsan.fda.gov/~dms/dalbook.html)

## Why don't we eat insects?



Insects are closely related to Crustacea (crabs, shrimp, etc.)

If you want to get started...



Widely available insects for home cooking:

1. Honey bee larvae – excellent sauted in butter or deep fat fried. Taste like walnuts, sunflower seeds or rice crispies.
2. Crickets (*Acheta*) – some recipes: tempura cricket with vegetables, cricket seaweed salad, cricket pot pie, chirping stuffed avocados, etc.
3. Wax moth larvae (*Galleria*) – thin-skinned, tender and succulent; best when fried in hot vegetable oil (taste like potato chips or corn puffs).

If you want to get started...



<http://www2.ville.montreal.qc.ca/insectarium/>