THE ROUTLEDGE HANDBOOK OF SUSTAINABLE FOOD AND GASTRONOMY

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BROADENING INSECT GASTRONOMY

Afton Halloran, Christopher Münke, Paul Vantomme, Benedict Reade and Joshua Evans

Introduction

In recent years there has been a trend among chefs to diversify their ingredients and techniques, drawing inspiration from other cultures and creating new foods by blending this knowledge with the flavours of their local region. Edible insects, with their plethora of taste, aromatic, textural and visual characteristics, is an example of an area of nature that requires further gastronomic exploration. Many parts of the world consume insects, neither as a novelty nor as a fall-back famine food (FAO, 2013). Insect-consuming populations often eat them as a delicacy, seeing each insect as an ingredient in its own right – not collectively as ‘insects’, as it is easy for many uninitiated to do. Many of these insects frequently fetch higher prices than other meat sources in the market, and it is this approach of investing insects as a delicious gastronomic product that interests us. Indeed, if people might be expected to adopt a new food, it is necessary that it tastes good!

Despite the diversity of insect flavours, those who do not eat insects often react adversely when confronted with a six-legged meal. The universal emotion of disgust is something that has only recently been studied. Nonetheless, it is understood that disgust (lit. ‘bad taste’) most likely originates from a rejection response that protects the body from potentially harmful foods. The sensation most distinctly associated with disgust is nausea, which inhibits the body from ingesting food; in a sense, disgust becomes ‘a guardian to the temple of the body’ (Rozin et al., 2008: 764).

Because some insects live in contact with rotting flesh or faeces, in general they are often associated with filth and unsanitary conditions even though many are in fact quite clean (DeFoliart, 1999). Moreover, some arthropod species like spiders invoke mixed sensations of fear and disgust, despite the fact that they are seldom of danger to humans (Rozin et al., 2008). Humans are omnivores who make choices of what to eat based partly on experience (Rozin, 2002). In addition to biology, culture also plays a major role in food selection (Rozin, 1984). Thus, given that most human–food relationships are acquired, they may also be altered both positively and negatively. Cuisines, as systems of selecting and preparing food, emerge out of geography, climate, culture, disposition and other factors, and can also change through social needs and advances in technology (Rozin, 2002).
Developing broader culinary roles for insects is one way to change the disgust that many Westerners commonly associate with them. Chefs and other gastronomic leaders thus play an integral role in broadening the perception of what is edible and (re-)introducing ingredients, like insects, into delicious foods. To illustrate this process, Nordic Food Lab (NFL) describes their gastronomic innovation through their experiments with three different kinds of insect: ants (wild), grasshoppers (domesticated) and bees (semi-domesticated).

These three categories (wild, semi-domesticated and domesticated) are considered in relation to the methods for their harvest and sustainable management. Wild insects are collected from wild sources, which are often not monitored and can therefore be more prone to over-harvesting. Wild gathering therefore requires strong knowledge about the ecology and biology of the species in order to minimize the impact on a specific area’s population (Yen, 2009). Ants, as described in the following by Nordic Food Lab, are in principle wild, but can be semi-domesticated by creating favourable conditions. Semi-domestication allows a more consistent supply, while keeping insects in their natural habitat or a habitat closely mimicking their natural environment. This technique is mostly used for species that cannot be taken completely out of their environment as they are too difficult to be domesticated fully (FAO, 2013). In order to provide a sufficiently consistent supply of insects for gastronomic institutions, farmed insects are an option for species that can live outside of their natural habitat and are relatively easy to breed in captivity relative to the initial cost of investment (FAO, 2013). However, in order to be utilized for human consumption, farmed insects have to be produced in hygienic and food-safe conditions.

The objective of this chapter is to discuss the growing interest in the potential of insects as food. Moreover, we describe how edible insects can help secure sustainable food systems for the future. Furthermore, we use insects as a case to explore the potential of diversified, wild and undervalued food sources. This is done by analysing how insects can be shifted from the category ‘inedible’ to edible and integrate them as a valued component of a cuisine, rather than just a novelty food or gimmick.

**Ants**

Many societies around the world eat ants. In Mexico the larvae of (*Liometopum* sp.) are known as escamoles and consumed as a delicacy at celebrations. In Colombia and other countries, (*Atta laevigata*) is valued for its large abdomen, hence its Spanish name, hormigas colunas, translated literally as ‘big-arsed ants’. In Denmark we (NFL) have been working with two species of ant: the smelling carpenter ant (*Lasius fuliginosus*) and the common wood ant (*Formica rufa*). These two ants have interesting organoleptic characteristics, one quite different from the other – this diversity is the key to developing gastronomic context for insects in a region, where each species can be recognized for its particular qualities. Many ants produce formic acid as a defence mechanism, which gives them acidity. Because of their big taste and small size, we use both these species mainly in the context of a spice or seasoning. The wood ant has quite a straight and sharp acidity with the aroma of charred lemon, while the smelling carpenter ant has a gentler acidity and a pronounced aroma of kaffir lime. It seems as well that different populations can express different aromas. This aromatic diversity arises from the ants’ use of pheromones for communication, which humans experience as a myriad of aromas, similar to those of other herbs and spices (Morgan, 2009).

There has arisen one potential food safety concern regarding ants. Some of the wood ants can harbour a parasitic flatworm called a lancet liver fluke (*Dicrocoelium dendriticum*) that is potentially parasitic to humans (Cengiz et al., 2010), so it is necessary to ensure the ants are
safe before consumption. We are currently investigating different treatments that make the ants safe for consumption, like thorough freezing.

Because the formic acid in the ants can be distilled at Nordic Food Lab relatively easily, we decided to make a gin by infusing the ants into alcohol, then distilling the alcohol under a strong vacuum to collect a concentrate of the aromatic mixture. The gin has a distinct note of nasturtium seed spice, which leaves a tingle on the tip of the tongue. It is completely delicious.

**Grasshoppers/locusts**

Grasshoppers are commonly farmed around the world and for that reason make an interesting case study due to their relatively wide accessibility (Hanboonsong et al., 2013; FAO, 2013). They are also notable as locusts so often decimate human crops, especially in Africa. Most farming of grasshoppers takes place to provide pet reptiles with feed, so pet shops are often a good source for these food-grade insects. As with any food, the sourcing of the product must be undertaken carefully. We choose locusts that have been fed only grass which has not been exposed to synthetic pesticides or fertilizers. The locusts are then purged (kept without food) for 24 hours before we freeze them. They can also be blanched for five minutes and kept at 5–7 °C – a technique that has proven to keep the insects microbially stable for two weeks (Belluco et al., 2013). The insects are excellent toasted in a tiny amount of oil on medium heat, or roasted in butter in the oven. The most appropriate preparation technique is largely informed by the developmental stage of the insect. Locusts in the third or fourth instar (developmental stage) tend to be optimal for eating whole, as the wings are not fully developed but the main body has reached a size which gives some amount of substance. With larger locusts we have experimented with making a salt-rich fermentation using a barley koji moulded with *Aspergillus oryzae* to create a umami-tasting sauce, much like a fish sauce but without fish. We call the sauce ‘grasshopper garum’. Our recipe is as follows:

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<td>800g whole grasshoppers (usually adult <em>Schistocerca gregaria</em> or <em>locusta migratoria</em>)</td>
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<td>225g of pearl barley koji made with <em>Aspergillus oryzae</em></td>
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<td>300g of filtered water</td>
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<td>240g of salt</td>
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Place everything in a blender and mix.
Incubate at 40 °C for ten weeks.

It is interesting to remember that in some places in the world people get a considerable amount of their protein from fish sauce. In the Philippines, for example, up to 18 per cent of daily protein may be obtained through fish sauce. When considering the immense biomass in a swarm of locusts, perhaps this incredibly damaging force to agriculture should instead be harvested, processed and used as human food and animal feed which can be used to provide valuable nutrition to people who have been ravaged by such a plague.
Bees

Bee larvae are particularly interesting because unlike ants, which we harvest wild, and grasshoppers, which are often farmed, bee larvae are the young of the semi-domesticated honeybee (*Apis mellifera*), which are often a by-product of beekeeping, as a result of a strategy to regulate the Varroa mite population in a hive. The larvae are an easy target for the mite, and the drones in particular attract the highest concentration of mites because of their extended developmental period, staying in the larval stage for a few days longer than worker bees. Once the queen lays the eggs in the comb, the individual hexagonal cells are sealed with wax until the larvae pupate and hatch – but not before the mites find their way into the cells too. Since the drones attract the greatest number of mites, beekeepers use drone brood as a sort of decoy, drawing the mites into the cells then removing the brood to keep overall mite levels low – they remove about one-third of a hive frame per week during the season. This technique, called the ‘safe strategy’, was devised by the Danish Beekeeping Association (Danmarks Biavlerforening) as a way to contain Varroa mite populations without using chemical pesticides.

The mite harms the bee by biting holes in the bee’s tissue which cannot heal, opening their circulatory system to the environment. It then serves as a vector for viruses to attack the weakened bee. So why do we eat the drone brood if it is covered with Varroa mite? In fact, the mite itself poses no threat to other organisms. The drones would almost all die anyway, as only a few of the many thousands are needed to inseminate the queen, so we are in some sense helping our apian friends by consuming the most serious threat to their population.

The fat and protein composition of the larvae is high, which lends itself to techniques that highlight its savoury taste such as a bee larvae granola. In addition it has a delicate flavour and a fragile texture, for which we have developed a bee larvae ceviche. The following recipes containing bee larvae have been developed by the Nordic Food Lab:

**Bee larvae granola**

750g oats/seeds/nuts (rough ration: five parts rolled oats; two parts sesame seeds; two parts sunflower seeds; one part pumpkin seeds)
250g bee larvae
100g honey
5g salt

**sometimes a pinch of fennel seed or tiny amount of crushed juniper berry is nice**

Let bee larvae thaw.
Blend until smooth with honey and salt.
Mix through dry ingredients on a baking tray.
Spread thin and bake at 160 °C for 16 minutes or until golden.
Toss through some birch syrup for added sweetness and clump-ability.
Stir at minutes 5, 10, 13, 16 or as needed; for more clumps, stir less.
For extra bee effect, mix in some dehydrated whole larvae for texture after cooked and cooled.
Broadening insect gastronomy

Despite the growing interest in entomophagy there are still many challenges that influence the widespread adoption of insects as food. First, the lack of regulations governing insects as food and feed at national, regional, and international levels affects the market availability of

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**Bee larvae ceviche**

15g bee larvae
100ml rhubarb vinegar
3g lemon thyme
5g freeze-dried lingonberries
3g red oxalis stems
5g søl salt

Pick lemon thyme leaves and chop dried lingonberries and oxalis stems very finely.

Take the bee larvae from the freezer and defrost for three minutes. Add them to the vinegar and season with salt. Wait another three minutes.

Take the bee larvae out from the vinegar and dress them with the other ingredients (stems, lingonberries and lemon thyme).

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**Market development**

Despite the growing interest in entomophagy there are still many challenges that influence the widespread adoption of insects as food. First, the lack of regulations governing insects as food and feed at national, regional, and international levels affects the market availability of
edible insects. In Europe, legislation for insects as food is a relatively grey area as insects are not explicitly mentioned in general food regulations. Under Regulation (EC) 258/97, novel food and ingredients that were not consumed ‘to a significant degree’ before 1997 may have to undergo an authorization before entering the market. As proposed in the new draft Novel Food Regulation 872 (COM, 2007), a legally recognized novel food needs evidence for its significant consumption in Europe before 1997, or proof that it has been and continues to be part of the normal diet for at least one generation in a large part of the population of a given country outside Europe. As suggested by Gradowski et al. (2013), scientific evidence should be used where no official regulations exist.

Second, supply chains are relatively undeveloped. With relatively few producers compared to other food sources/ingredients, insects as an ingredient are difficult to come by. Current trade in edible insects in developing countries is usually specific to migrant communities in Europe or North America, or through the development of niche markets for exotic foods (FAO, 2013). Despite these challenges, edible insects in the food sector is growing quickly and gaining more and more interest in the Western world.

Conclusion and discussion

Entomophagy has gained a flush of attention recently due to the arguments for their nutritional potential and supposed sustainability benefits. These are interesting ideas but they are not enough to ensure the preservation of the crucial bio- and cultural diversity on which truly sustainable food systems rely. Insects as delicacies in their cultural, ecological and gastronomic contexts contribute to traditional diets around the world. They also provide an example for better understanding of agro-ecologic and sustainable food systems, as well as the benefits, and limits, of related traditional knowledge. Ultimately, they can only be a ‘sustainable’ ingredient in the context of the larger ecological–gastronomic system. Moreover, they should not be seen as a ‘future food’, out of any gastronomic context, for the sake of ‘pushing the boundaries’. Instead they should be investigated and shared as a delicious ingredient which celebrates the diversity of life in our edible landscape.

The adoption of insects within contemporary food cultures thus relies on collaboration between foragers, producers, food scientists, gastronomic leaders, policymakers, consumers and media – bringing together ecology, psychology, gastronomy, social economics and knowledge from diverse traditional food cultures to further the contextual understanding and culturally appropriate use of insects as a sustainable, nutritious and delicious ingredient.

References


