Insects as a delicacy: the value of diversity in deliciousness

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If it were simply a matter of sustainability, nutrition, and edibility, insects would already be a part of the Western diet. Many require fewer resources to rear and have a lower environmental impact than conventional livestock (1). Many are also highly nutritious (2), and are celebrated for their high gastronomic value in much of the world (3). The main barriers to their consumption in the West are psychological, particularly disgust and a lack of knowledge of their hedonic potential (4,5). The Western palate simply does not know how delicious insects can be.

Our research purpose is to investigate the gastronomic value of different types of insects and the conditions that give rise to the most delicious insects. This exploration of taste and flavour is a critical part of building the necessary context for enabling the acceptance of novel, unfamiliar foods in general – be they insects, which already comprise an immensely diverse category of organisms, or any of the other neglected, underutilised, ignored or forgotten edible resources whose gastronomic potential it is our mission to rediscover and, as appropriate, integrate into our cooking in culturally contextual ways.

A major component of our insect research over the past year has focussed on developing an understanding of these diverse species as delicacies in their cultural, ecological, and gastronomic contexts around the world. Starting with the existing wealth of knowledge in these cultures, we aim to honour these traditions by using them to more deeply engage with the insects in our own region, as ingredients in the kitchen and organisms in a complex ecological-agricultural system.

Here are some examples of our culinary work with different insect species, to illustrate our approach towards this goal.

Aroma and acidity

Ants are one of the most ubiquitous insect families on Earth. They are also one of the most aromatically diverse, which arises from the range of pheromones they produce to communicate with each other. Incidentally we humans perceive these same volatile molecules as aroma – a broad range of smells such as citrus, pine, coriander, leather, cinnamon, peach, wintergreen, vanilla, and more (6).

Many ants also have a powerfully sour taste from the formic acid they produce for defense. Formic acid even takes its name from ants, as it was first distilled into its pure form by English naturalist John Ray in 1671 from the common wood ant, *Formica rufa*, widespread throughout Europe and the ant most common in

Danish forests. In the spring and summer at the height of their aromatic power, they have a lemony taste with a bit of burnt sugar – like lemon rinds seared on the grill. *Lasius fuliginosus*, the smelling carpenter ant, is another species we find in Denmark. It exhibits a gentler acidity than the *F. rufa* and a pronounced aroma of kaffir lime. Because of their big taste and small size, we use both these species mainly in the context of a spice or seasoning – for example, in the "chimp stick", inspired by the sticks chimpanzees use to draw termites up from their mounds. It is a way of clearly appreciating the small creatures' strong flavour and difference in aroma.

Chimp Stick[1]

Liquorice roots, whittled
A clear, light honey infused with toasted juniper wood
Local ants, both *F. rufa* and *L. fuliginosus*, frozen within an hour of harvesting
Buckwheat, soaked overnight, toasted and cracked
Golden linseeds
Freeze-dried raspberry pieces
Small leaves of purple shiso and coriander cress
Small cherry blossoms

Infuse the juniper wood into the honey overnight. Strain and filter.
Whittle liquorice roots, removing all rough skin an thinning slightly to a more slender shape, leaving a section at one end unwhittled as a 'handle'.
Brush the liquorice root on all whittled surfaces with a light coating of honey - just enough to make things stick. Place liquorice root handle-side down into a bowl of rice to hold the stick upright for plating. Begin adhering the buckwheat and linseeds, then the ants, then the raspberries, herbs, and flowers. It is best to begin with the more sturdy ingredients and move on to the more delicate ones. Coat the stick until a desirable density is reached. Place a piece of juniper wood on a plate, burn until smouldering with blowtorch and rest chimp stick, handle-side on the plate, on the fragrant smoking wood.

This dish takes cues from cuisines in South East Asia for example, where some insects are used not for their substance or as a 'protein source', but primarily for their particular aroma, such as the use of the giant water bug in the Thai chili paste *nam prik maeng da*.

Because the formic acid in the ants can be distilled, we also made 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 and a unique expression of our local 'botanicals'. We have

[1] http://nordicfoodlab.org/blog/2013/6/ants-and-a-chimp-stick?q=chimp%20stick

developed the Anty Gin into a commercial product which we have recently released to the market.

The pursuit of umami taste

One of our great interests since the beginning has been umami taste and finding sources of this versatile savouriness in the Nordic landscapes. This exploration has led us to working with a wide variety of ingredients and techniques, from seaweeds to shellfish, wild game, heritage varieties of grains and pulses, and of course, the protein-rich insect class which has immense potential for umami especially when subjected to the chemical and physical breakdown carried out in fermentation. Grasshoppers are an apt example.

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 5 minutes and kept at 5-7°C – a technique that has proven to keep the insects microbially stable for two weeks (7). 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 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 the fungus *Aspergillus oryzae*, borrowed from East Asian fermentation traditions, to create an umami-tasting sauce, much like a fish sauce but without fish. We call the sauce grasshopper garum.

Grasshopper garum[2]

1000g whole grasshoppers (usually adult *Schistocerca gregaria* or *Locusta migratoria*)
225g of pearl barley *koji* made with *Aspergillus orzyae*
300g of filtered water
240g of salt

Blend grasshoppers, water salt until mixed but not smooth.
Add koji and mix. Place in glass containers and cover surface with plastic wrap.
Incubate at 40˚C for at least 10 weeks.
Filter, bottle, and pasteurise if desired.

This sauce has many applications. It is salty and deeply savoury, with notes of soy sauce, oyster sauce, and sometimes roasted cacao. We have used it to bolster the savoury depth of sauces, marinating meats and dressing vegetables, and in many other contexts. Below, it is used as a simple accompaniment to diced fresh raw jellyfish, and also to enhance a broth made of crickets and

[2] http://nordicfoodlab.org/blog/2012/07/mad-2-finding-the-deliciousness-of-insects?q=mad%202
http://nordicfoodlab.org/blog/2013/8/koji-history-and-process?q=koji

served with soft potato dumplings and fresh chervil.

(photo jellyfish)

(photo broth and dumplings)

Celebrating texture

In many cases, the texture of insects poses one of the greater challenges for the new entomophagist. The crunchy, chitinous exoskeleton of many insects must be either removed, broken down, rendered crisp through frying or roasting, or not included in the dish (by extracting flavour through infusion, for example).

Yet other insects, particularly in their larval stages, can have very delicate textures. One of our favourite examples is bee larvae, which are a waste product, at least for many beekeepers in Denmark who practice drone removal (which is described further in this issue). This technique, called the 'safe strategy', was devised by Danmarks Biavlerforening as a way to contain Varroa mite populations without using chemical pesticides.

It turns out the larvae are also very nutritious – about 50% protein and 20% unsaturated fats (2). Fresh, they are very soft, breaking gently on the tongue, savoury and fatty, with flavours of raw macadamia or hazelnuts, avocado, herbs and flowers – like honey, their flavour changes depending on the season, the bees' forage, and their age.

This recipe takes inspiration from the South American technique of ceviche, which we learned in Peru, using acid instead of heat to coagulate or in essence 'cook' proteins. This firms up the outer skin of the larvae just enough to keep them intact, and maintaining their soft, delicate interior.

Bee larvae ceviche[3] (one serving)
15 g bee larvae
100 ml rhubarb vinegar
3 g lemon thyme
5 g freeze-dried lingonberries
3 g red oxalis stems
5 g søl salt

Pick lemon thyme leaves. Chop dried lingonberries and oxalis stems very finely. Pull the bee larvae from the freezer and defrost for 3 minutes. Add them to the vinegar and season with salt. Wait another 3 minutes.Take the bee larvae out from the vinegar and dress them with the other ingredients (stems, lingon-berries and lemon thyme).

[3] http://nordicfoodlab.org/blog/2013/6/cebiche-ceviche-sebiche-seviche?q=ceviche

(photo ceviche)

Here is another dish we developed for the Science of Taste Symposium in Copenhagen, August 2014. This dish emerged from several sources of inspiration. In June 2014, some of our team visited the island of Livø in the Limfjord in northern Jutland to conduct field work for our insect research. While on the island investigating the European cockchafer *Melolontha melolontha*, we also obtained some fresh bee larvae from a local beekeeper, along with some very mature lovage stems from her garden. As part of an outdoor experimental cookout we steamed the delicate, fatty larvae inside the lovage stems along with jasmine flowers which at the time were riotously in bloom. The herbal and floral notes of the larvae were enhanced in this rustic and simple preparation, and we wanted to take it further in a more controlled context.
Our Head Chef Roberto was reminded of an old-school Italian dish from the 70s called Risi e Bisi – risotto with peas. The bee larvae sort of reminded us of the rice. When blanched they retain their herbal, floral delicacy and soft texture, while fried, they take on a deep savouriness and a light crisp texture – two different expressions of the same ingredient.

Peas and Bees (one serving)
100ml pea cream
8 fried bee larvae
5 blanched bee larvae
10 g barley
3 pieces fresh lovage leaves
fermented bee pollen (also known as 'bee bread')

Pea cream: 1.5kg fresh peas in the pod yields roughly 500g shucked peas. Blanch the peas in salted water for 1 minute, cool in salted ice water and dry. Place in thermomix with 400ml cold filtered water, season with salt and pepper to taste, and blend at highest speed for 2 minutes. Pass through chinois, place in vacuum bag and vacuum to remove bubbles.

Fried larvae: Heat a pan until very hot. Pour in sunflower oil, allow to heat but not smoke. Add frozen bee larvae and fry until golden, puffed and crisp, 2-3 minutes. Blot on paper towel, and keep in oven at 70˚C to dry, then salt.

Blanched bee larvae: Boil water, salt and add lovage leaves. Once it comes to the boil, turn off heat, add frozen larvae, and cook for at least 1.5 minutes. Can be kept in the water longer as it cools.

Barley: In simmering water with salt and lovage leaves, cook barley until cooked.

(photo peas 'n' bees)

Conclusion

Acceptable food production is based on food security and sustainability, a key to which is preserving and cultivating bio-cultural diversity (8, 9). We hope our culinary work can both contribute to the diversification of the Western diet, and also help preserve the bio-cultural diversity of indigenous and traditional diets around the world (10) – the very places where the practice of entomophagy is most robust and most rapidly being given up (11). By challenging and dismantling the unnecessary Western stigma against insects, it could help to reverse the perception of entomophagy as inferior, continuing the development of these rich culinary traditions and crucially the ecological stewardship, bio-cultural diversity, and food security that go along with them (12).

In order to accomplish these goals, it is necessary to develop a deeper relationship with these ingredients that are new to us: a sensitivity to how their flavours and textures change depending on the season or their developmental stage, for example, or when it makes sense to use them whole and celebrate their form, or use them more as a supporting player in a dish. This gastronomic knowledge – the knowledge of how to feed each other well – has an important role to play in diversifying our diets and strengthening our food systems through taste.

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Nordic Food Lab

Nordic Food Lab is a non-profit, open-source organisation that investigates food diversity and deliciousness. Established in 2008 by René Redzepi and Claus Meyer, we combine scientific and cultural approaches with culinary techniques from around the world to explore the edible potential of the Nordic region. We work to broaden our taste, generating and adapting practical ideas and methods for those who make food and those who enjoy eating.
In June of 2013 we received funding from the Velux Foundation, along with colleagues at the University of Copenhagen, for a three-year research project entitled ‘Deliciousness as an Argument for Entomophagy’.

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