

found that *Boletus edulis* contained 0.83 i.u./g, *Cantharellus cibarius* 0.83, *Gyromitra esculenta* 1.12, *Psalliota campestris* (grown in dark) 0.12 (in light) 0.62.

Perhaps it would be well to end with the cultivated mushroom. It should be pointed out that there is doubt when the name *Psalliota campestris* is used. This name should be restricted to the field mushroom which is now known to be a different species from the forms under cultivation. It is probably safe to assume that the cultivated species—*P. hortensis* (*P. bispora*)—has been studied in experiments on nutrition unless the contrary is stated. Anderson & Fellers (1942) found that commercially cultivated *P. campestris* contained in mg/100 g :

Vitamin A	None	Vitamin D	None
Thiamine	0.12	Vitamin K	++
Riboflavin	0.52	Nicotinic acid	5.85
Ascorbic acid	8.60	Pantothenic acid	2.38

Potassium and phosphorus salts are the chief constituents of the ash, with no significant amounts of calcium but with copper and iron in appreciable amounts. Rats receiving mushrooms as the sole source of protein in their diet survived a 6-week test period and made a gain in weight equivalent to 30% of that shown by rats on a casein diet. One further point, Friese (1948) concluded that provided sound mushrooms are used they can be cooked and held overnight in a refrigerator without fear of anything untoward.

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#### Insects as Food

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When dining with friends a few years ago I was invited to play a card game and found to my embarrassment that, in changing my clothes, I had left all my money at home. Just at that moment I noticed a small House Spider (*Tegenaria atrica*) running across the carpet, so I seized it and offered to eat it alive in return for

monetary contributions. It was obviously a lucky spider because this small initial capital I obtained was increased by 1000% by the end of the evening's play!

Although I had never eaten this species of spider before I was confident it could do me no harm because it used to be prescribed by doctors in England as a cure for malaria. Indeed its use for this purpose was not finally abandoned until towards the close of the nineteenth century when malaria itself was stamped out. To quote just one out of dozens of references: 'Swallowing a spider gently bruised and wrapped up in a raisin or spread upon bread and butter' was recommended by Dr. Watson (1760) who claimed to have found spiders efficacious in more than sixty cases where bark (*Cinchona*) had failed on prisoners suffering from malaria in the Isle of Man.

Eating a spider, or a beetle grub or a caterpillar, is a nauseating idea to most people. So it was to me until I visited Siam in 1931. There I learned that the Laos and the Siamese enjoyed eating many kinds of insect. Indeed His Serene Highness Prince Sithiporn told me that his cousin, King Rama VI, was particularly fond of the larva of the Cossid coffee-boring moth, *Zeuzera coffeae*, which was roasted and eaten with rice and salt. In the discussion which ensued Prince Sithiporn invited me to compare the idea of eating this fresh clean-feeding caterpillar with that of such scavengers as lobsters or shrimps. He expressed disgust at our consumption of high game and decaying cheese.

The more I thought about it, the more I realized how greatly we are all influenced by tradition and prejudice and how far we are from allowing our sense of taste to decide what we will eat with pleasure.

Religious taboos, for instance, are widespread and Japan might now be an important dairying country but for the introduction of Buddhism at a time when that seemed likely. The common belief amongst primitive tribes that the mental and physical qualities of an animal are transferred to those who eat them has sometimes led to the abandonment for food purposes of succulent slow-moving or cowardly animals. Then again, the appearance of food is so important to us that a chef has to be an artist as well as a cook in order to stimulate our appetites whilst conservatism or fear often prevent our experimenting with unaccustomed foods.

Having at least reduced my own initial prejudice against some of the Siamese items of food I began by trying and disliking the somewhat musty flavour of curried lizard. My first insect was a locust which I toasted and ate like a shrimp in the manner favoured by the Laos. I chose this for my initiation because I knew that locusts were widely eaten in the East from Biblical times up to the present. I was encouraged on finding that the flavour was neither strong nor unpleasant, though, like all flavours, difficult to describe.

After this I went hunting for insect foods with experienced Lao collectors and ate whatever they recommended, taking care to identify the species and to make notes of what they told me about species which were out of season or not available in sufficient quantity to enable me to form clear impressions of their flavour. Cicadas (*Dundubia intemerata* Walck.), for instance, are collected chiefly in the southern forest clearings and my impression of the few boiled specimens available

was of eating 'vegetable' rather than 'animal' food. In the right areas they can, however, be collected with amusing skill and eaten in bulk. When darkness falls a fire is lighted and cicada hunters arrange themselves around it. They then rapidly clap pieces of bamboo together (or even their hands) and down fly quantities of cicadas. The inference is that the vibrations produced are similar to those of the male's whistling love-call and that it is the poor misguided females that end up in the cooking pot instead of finding a mate.

I was impressed with the knowledge and skill of the collectors and, as I shall mention later, high prices are paid in the village or town bazaars for some of the insects. There are no domesticated bees, but quite a lot of wild honey is marketed and the grubs and even the bees' abdomens may also be eaten. The collectors differentiate clearly between those bees whose bodies are tasty (*Xylocopa confusa* Perez, *X. latipes* Dr.) and those whose bodies and whose larvae have a sour unpleasant flavour (*Trichona*).

The taking of some nests is fraught with danger because three or four stings are said to bring on fever. Some men, however, are said to be immune but in spite of this quite a ritual is followed before the collecting is begun. Incantations and prayers are followed by the sprinkling of sacred water over the collectors before they set off in darkness accompanied by friends to trees with several nests of *Apis* (probably *dorsata*) hanging in their branches. The followers have brought a number of bamboo sticks each with a sharpened end hardened in fire. One by one these are hammered into the trunk and if any of them need more than three blows the omens are unpropitious and no further attempts are made that night. If, however, the test is satisfactory a collector is hauled up by means of a rope pulley. He then lights a big wad of cotton-wool and waves it round the nests. Out swarm the bees, he drops the flaming wad and they follow it to the ground. Now is his opportunity to cut down the nests, and a skilful worker may collect 200 or 300 nests in one night. A high price is paid for the wax. Both the grubs and the honey are eaten. The grubs are fried or eaten in curry. A favourite dish is as follows: in coconut milk put onion, pepper, *takrie* (a lemon grass, *Cymbogon citratus*) and *bai makrut* (*Citrus hystrix*) leaves. Wrap the mixture in linen, steam, and then add rice.

The grubs of some wasps (*Eumenes petiolata*, *Vespa cincta* Fab.) are also eaten fried with a little salt. Considerable trouble is also taken with one ant which builds a subterranean nest the size of 'a big basket'. The ants, larvae and pupae are all pickled together in salt water, tamarind juice, ginger, onion, a little sugar and the leaf of *bai makrut* (*Citrus hystrix*).

Flying termites are trapped by lighted candles set in water into which they fall after singeing their wings. The 'catch', roasted with salt, is far from unpleasant but rather insipid. Again the flavour is vegetable in nature.

The strongest flavour I experienced was provided by giant water-bugs about 3 in. in length (*Lethocerus indicus* Lep. and Sev.) whose relatives in Mexico (*Corissella mercenaria* Say) are also eaten. The *Lethocerus* is caught in nets and at different seasons was fetching from 5 to 20 satangs (1d. to 4d.) each in Bangkok.

It reached the tables of princes as well as peasants. The usual methods of preparing it for table are as follows : 1. Steam thoroughly and then soak in shrimp sauce. The flavour reminded me of Gorgonzola cheese. 2. After cooking, pound up and use for flavouring sauces or curries. A popular sauce called *namphla* is made by mixing shrimps, lime juice, garlic, and pepper and then adding the pounded-up bugs.

The larvae of several Longicorn and other beetles (including dung beetles !) are esteemed highly by the Laos. The only kind I tried was the large white juicy grub of the Dynastid beetle, *Oryctes rhinoceros* Linn. The grubs were soaked in coconut milk for a quarter of an hour and then roasted. The flavour was not strong but quite pleasant. I can only liken it to that of a mixture of vegetables including a little parsnip. Cooked in this way the grubs have a crisp exterior and the consistency of a soufflé inside.

Laos from all districts eat two kinds of spider, and I confess that I left spiders until last. The first is the giant orb-weaving *Nephila maculata* Fabr. (which is also eaten in Burma, India and Indo-China). Sometimes the Laos bite off the abdomen of the living spider and eat it raw, but I preferred to have mine cooked. The spiders are roasted and dipped in salt. Only the abdomen is eaten and this has a not unpleasant flavour which reminded me of raw potato and lettuce or raw cabbage.

The second is a fine blue-legged Mygalomorph spider (*Melopoeus albostrigatus* Sim.) which has a body  $2\frac{1}{2}$  in. in length and weighs  $1\frac{1}{3}$  oz. In an hour the collector whom I accompanied captured six from holes in the ground (i.e. half a pound). After removing the chelicerae these spiders are toasted on a skewer, a process which removes the hair, and eaten whole with salt or sliced up with chillies. The taste reminded me of the marrow of chicken bones. When offered in the village market at Hua Hin each spider fetched about 4 satangs ( $\frac{3}{4}$ d.) in 1931. The same spider or a close relative is eaten everywhere it is found in Siam, Burma, Annam and Cambodia.

Amongst the insects used as medicine was a very large beetle (*Helicopriss* sp.), for diarrhoea and dysentery. This is roasted, pounded up, and then water is added with a little powdered lime and saffron. At the price ruling in 1931 (20 satangs, or 4d.) I reckoned that 350 such beetles would yield an income about as great as the average annual income of a peasant (70 ticals), so it occurred to me that an enterprising peasant who started an insect farm breeding *Helicopriss*, *Lethocerus*, *Zeuzera* and a few other marketable kinds could improve his income.

Inquiries about the diet of primitive man in other parts of the world show that some kinds of insects are almost invariably eaten, but it is probable that the custom normally has waned as improved agriculture provided greater abundance of food, as trade provided greater choice of food, and as population increased. In Siam, I found that the Laos definitely liked the flavour of several of their insects. In all probability there is also a need, if not a craving, for them to supplement their staple diet. A rural economic survey carried out by Professor Zimmermann (1931) showed that out of 9428 persons examined in country districts of Siam there were

thirty clear cases of diet deficiency. The basis of their diet was rice which contained 75% carbohydrates, 8% protein and 1% fat. Fish represented the main protein constituent, in the seasons when fresh fish was not available, fermented fish, shrimp paste or dried salt fish was consumed. The protein content of fermented fish and shrimp paste was 18% and 23%, respectively, and the fat content 6% and 3%, respectively. Insects have quite a high protein content. An analysis of three specimens of the spider, *Melopoeus albostratus* Sim., carried out for me at the Government Laboratory in Bangkok gave a protein content of 63.4% and a fat content of 9.8%.

In 1931 I found that Siamese resident in Bangkok knew little about the diet of the peasant and, moreover, that Siamese and Laos were somewhat reluctant to speak of their insect diet until they felt sure the information was not sought in order to label them as 'dirty feeders'. My inquiries led me to believe that insects were eaten more extensively perhaps than in any other country, that they were not infrequently eaten in bulk and that they had to be regarded as at least one of their lesser foods rather than merely as a 'relish' or flavouring to the otherwise limited menu.

A fuller discussion of the use of insects and invertebrates in Siamese diets will be found in a paper by Bristowe (1932).

In conclusion I ought perhaps to express my opinion that a demand for an insect diet in Britain is unlikely to develop and that I hope it will never be necessary even though the flavour of some insects would be found to be not unpleasant.

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## The Indigenous Foods of Mexico and Central America

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### *Introduction*

The primary purpose of this paper is to review the work carried out by Professor Robert Harris and his colleagues (of the Massachusetts Institute of Technology) who for the past 8 years have been investigating the composition and nutritive value of the foods of Mexico and Central America. Before considering in detail the programme of the Massachusetts group it may be useful, however, to outline the historical and geographical setting in which current investigations must be placed.

Central America in the strict geographical sense embraces all those countries (see Table 1) lying between the southern borders of Mexico and the northern