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EDIBLE INSECTS OF NIGERIA

An invited lecture for Ibadan branch, Nigerian Field Society
Presented at Drapers' Hall, Institute of African Studies
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Matt F. A. Ivbijaro PhD, FRES, FESN, JP
Professor and CEO, Mattivi Nigeria Limited

Go to the ant, o sluggard, study her ways and learn wisdom; for though she has no chief, no commander or ruler, she procures her food in the summer, stores up her provisions in the harvest. How long, o sluggard, will you rest? When will you rise from your sleep? (Proverbs 6:6-9. The African Bible, 1999).

Human Perception of Insects

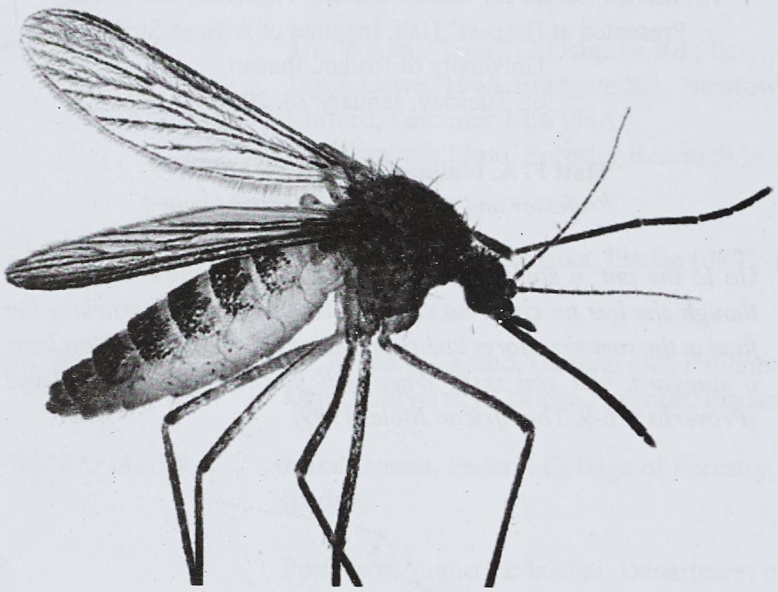
The human perception of the insect varies from person to person, between communities, and cultures and even between geographical regions of the world. Human perceptions of the insect populations arise from what people hear or see insects do.

Although many persons see the **termite**—the destroyer of timber, furniture, and various food crops—as a destructive pest which must be killed, even more persons detest the ubiquitous **cockroach** as a filthy nuisance that crawls in the dark cupboards, boxes, wardrobes and invades kitchen corners, eats books and chews through any food that is not properly stored.

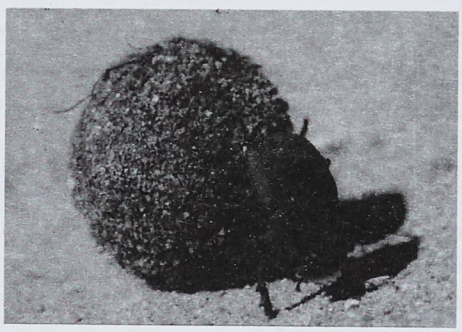
Mosquitoes have become such a formidable enemy to Nigerians to warrant the Federal Ministry of Health to wage a hopelessly unplanned war against them. The war is called **Roll-back-malaria.** The medical administrators turned warlords in the Ministry of Health have failed to recognize that the war against the mosquito is an ecological war which cannot be won by the supply of insecticide-treated bednets, mainly. It is a war

that requires adequate knowledge of the mosquito habitat, its biology and reproductive capacity, and the resistance of the malaria parasite, *Plasmodium* spp to anti-malaria drugs.

The Mosquito



The **housefly** is a universally detested insect, as it is the vector of over 100 species of disease-causing organisms such as viruses, bacteria, protozoa including those that cause cholera, diarrhoea, dysentery and typhoid.



The dung beetle - *Scarabaeus viettei*

Few individuals appreciate the work of the **dung beetle**, which I dubbed an **environmental engineer** at a lecture at the University of Lagos in 2003. The dung beetle rolls human excreta and the excreta of other animals into its burrow and lays eggs on it. Larvae of the beetle hatch in the excreta and eat the dung which decomposes to fertilize the soil.

The dung beetle could be key to environmental sanitation in Nigeria where environmental management is daunting. In many low income urban areas, water is scarce and

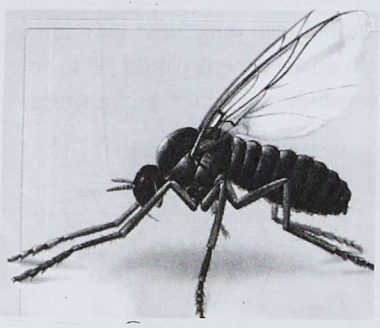
adequate or functioning toilet facilities are rare. Families are therefore forced to defecate in refuse dumps, which contaminates the environment and also puts these individuals at a high risk for infection. One way to clean such an environment would be to rear dung beetles in large numbers and release them on waste-dumps in the urban slums.

Communal defecation on a wasteland in an urban slum.

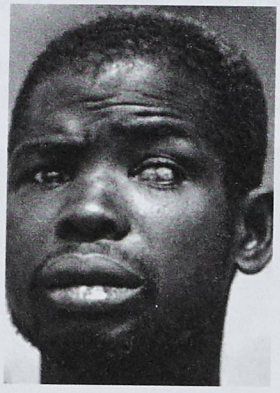
River blindness. People who live close to flowing water often suffer from various infections caused by the **black fly,** *Simulium* sp. which transmits a parasitic nematode, *Onchocerca volvulus*, that causes **onchocerciasis** (river blindness).

The black fly is common in Kainji and in parts of the southeast and southwest of Nigeria. If untreated, the disease can impair vision, which may ultimately lead to total blindness.

A blindman being led by a child. A common sight in black fly-infested areas.

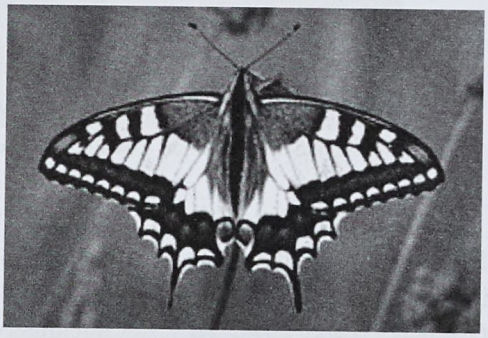


black fly, *Simulium* sp.



A victim of onchocerciasis.

Butterflies



Serene, fragile and beautiful, this insect is much admired by most people. Gifted composers and artists have developed poems and songs of love around the butterfly to assure lovers of unflinching love and sincerity. One of such songs is:

Butterfly, my butterfly,

I'll come home to you one day,

Butterfly, my butterfly, wait for me I'm on my way.

THE INSECT

The Head. On the insect head is a pair of **compound eyes** for vision. There is also a pair of antennae (feelers) which enables the insect to respond to stimuli, including noise and smell, i.e., olfaction. These structures along with mouth enable it compete well with humans for resources common to both of them.

The mouthparts are responsible for the destructive activities of the insect. Insect mouth parts could be for biting and chewing purposes as they are in the grasshopper, cockroach, termites and weevils. Some mouthparts are modified to form tubes for sucking purposes. For example, the mouthpart of the butterfly is for sucking nectar. There are piercing and sucking mouthparts found in blood sucking insects like the mosquito.

The thorax is the region behind the head. It is divided into segments. The thorax carries two pairs of wings that make flight possible. There are some insects, however, like the bedbug (*Cimex* spp) and the body louse (*Pediculus* spp) that are wingless.

A body louse.

A bedbug

Six legs. Three pairs of legs on the thorax make locomotion possible in the form of walking, jumping and hopping. In some insects the legs are also used for burrowing.

The abdomen carries the reproductive and digestive organs. Insects are very prolific and are the most numerous of all the animals without backbones (invertebrates). For

example, the queen termite, *Macrotermes natalensis* lays one egg per second uninterruptedly during an average lifespan of thirty years.

In Nigeria, out of 22,090 animal species described so far, insects are the most numerous, and account for 20,000 species or 90.54%.

EDIBLE INSECTS OF NIGERIA

In spite of the destructive mouthparts and other human-perceived offensive structures of the insect, there are insects that possess delectable, nutritional qualities that appeal to the gustatory delight of human beings all over the world..

In Nigeria, insects are eaten by virtually every ethnic group. Among rural and urban children alike, edible insects may not replace the main meal of the day, but they are a cheap source of protein and other essential trace elements. Among adults, however, insects are usually eaten as a snack. The insects most commonly eaten in Nigeria are discussed below

The Termite

Known as *esunsun* in Yoruba and *shinge* in Hausa, winged termites are commonly eaten in Nigeria and are a delicacy in the Delta North Senatorial zone of Delta State (Ivbijaro 2003). They are also widely consumed in Ondo State (Ajayi and Adedire 2007). Termites are most abundant food insect in Benue State (Agbidye et al 2009).

Winged termite, *Macrotermes natalensis*

Refusing to acknowledge the inalienable rights of winged termites to love and marry, and to raise their own family, Nigerians who cherish eating winged termites, use "Weapons of Mass Destruction" (WMD) in the form of buckets and bowls of water to

trap winged termites during their nuptial (wedding) flights. Termites are then roasted or fried. Both the queen termite and the winged termite are a delicacy.

It is obvious that winged termites live in style to be able to wed in flight. This elegant and flamboyant life style of the termites may have added to the speed with which they are hunted down during their wedding night and killed. Winged termites in flight, fall naturally under a light source, shed their wings and walk in pairs to find a home in the ground.

Nutritional qualities of the termite

A proximate analysis of the winged termite in Nigeria shows it contains high values of protein energy, vitamins, minerals.

1. Crude Protein: The crude protein content of the termite, *Macrotermes bellicosus* ranges from 20.4% (Banjo et al 2006) to 35.88% in Macrotermes nigeriensis (Mba and Elekima, 2007).
2. Carbohydrate or nitrogen-free extract in *Macrotermes bellicosus* is 43.3% (Banjo et al, 2006).
3. Oil content: 28.37% (Mba and Elekima, 2007)

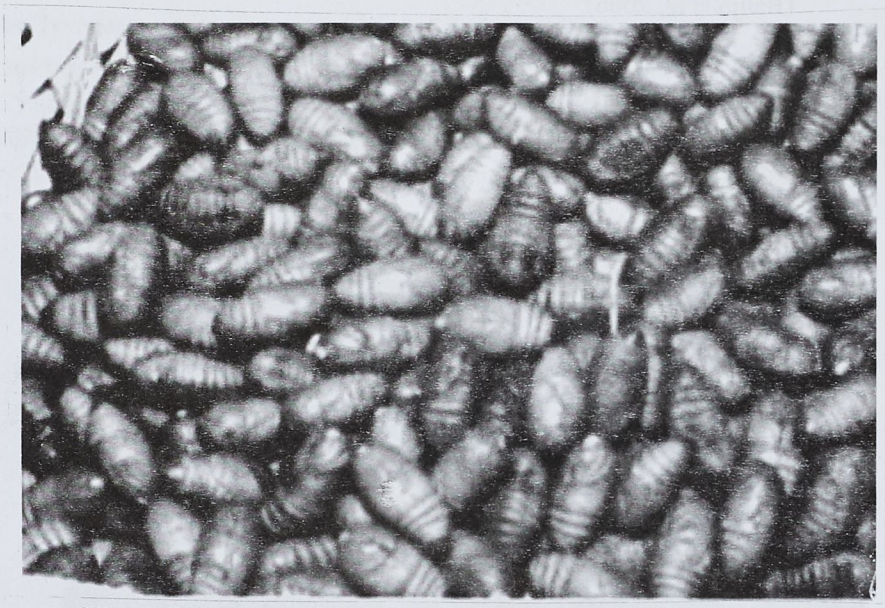
The dried alate form of *Macrotermes natalensis* (termites) on sale in Gboko main market, Benue State (after Agbidye et al, 2009).

4. Vitamins: The winged termite *Macrotermes bellicosus* is rich in vitamins, ranging from Vit. A, 2.89 ug/100g; B_2, 1.98mg/100g, and to C, 3.41mg/100g.
5. Minerals: The value of minerals in winged termites is high and ranges from calcium, 21mg/100g; phosphorus, 1.36mg/100g; iron, 27mg/100g; and to magnesium, 0.15mg/100g.

Winged termites are a veritable source of protein, vitamins, energy and minerals which developing countries need to alleviate protein and mineral deficiency, especially in children, pregnant women and lactating mothers.

CATERPILLARS, CRICKETS AND GRASSHOPPERS

Caterpillars are the larvae of butterflies and moths. The larvae of the African silkworm (moth) *Anaphe venata* are commonly roasted and eaten in southern Nigeria. Called *ekuku* in Yoruba, the larvae are consumed in Ondo State (Ashiru 1988; Adeduntan and Bada, 2004). They are prepared by roasting or drying them in hot, white sand.



Silkworm larvae, *Anaphe venata*.

Nutritional value of the Larvae of *Anaphe venata*

Crude protein: 25.7% (Banjo et al, 2006) to 60% (Ashiru, 1988).

Fat content: 23.27%

Nitrogen free extract or carbohydrate content, 55.6%

Calorific value: 611 Kcal/100g

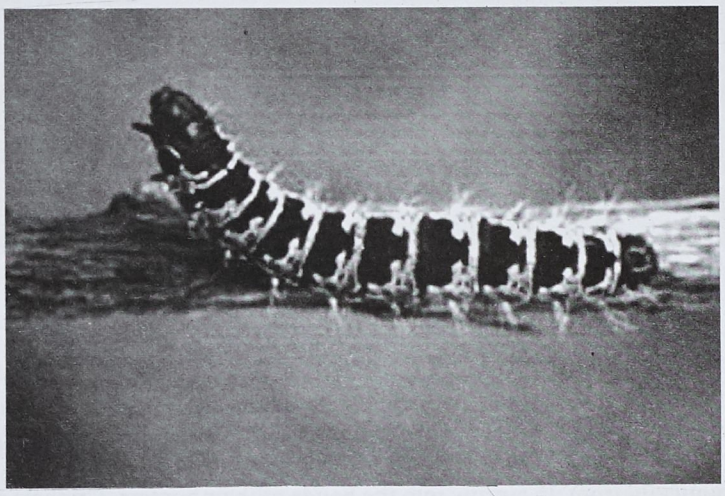
Vitamins: Vit A, 3.12 ug/100g; B_2, 1.25mg/100g, and C, 2.22mg/100g

Minerals: calcium, 8.57mg/100g; phosphorus, 100mg/100g; iron, 2.01g/100g, magnesium, 1.56mg/100g.

The African silkworm larvae are rich in protein, energy, vitamins and minerals. They contribute significantly to the protein, energy and vitamin needs of the people, especially the nutritionally deprived.

Larvae of the giant silkworm, *Cirina forda*

Known in Hausa as *manimani,* and in Yoruba as *kanni*, the larvae (caterpillars) of the giant silkworm, *Cirina forda* are also called the 'pallid emperor moth' or the saturniid caterpillars. The giant larvae are the most widely marketed food insects in Kwara State (Fasoranti and Ajiboye, 1993). The larvae are starved for one or two days after collection to eliminate their gut content, then boiled and sundried over mats on the ground.



Giant silkworm, ***Cirina forda.***

Nutritional content of the dried giant silkworm larvae

A proximate analysis of the dried saturniid caterpillar (Banjo et al, 2006) shows that it contains the following:

Crude protein, 20.2%; Nitrogen-free extract, 66.6%

Fatty acids (Ande, 2003): Linolenic acid, 33.4%; Oleic acid 12.93%

Cholesterol content is lower than that of egg yolk.

Vitamins: A, 2.99 ug/100g; B_2 2.21mg/100g; C, 1.95mg/100g

Minerals: Calcium, 8.24mg/100g; phosphorus, 111.0mg/100g; iron, 1.79mg/100g; magnesium, 1.87mg/100g.

C.forda larvae sold in markets at Makurdi, Benue State. (Agbidye et al, 2009).

CRICKETS

The common cricket, *Brachytrupes membranaceus* is eaten across Nigeria. Known in Hausa as *gyare*, and in Yoruba as *ire*, the cricket is usually hunted by children and farmers who pour water into its burrow in the ground to suffocate it. The cricket emerges frantically from its burrow into the hands of their hunters. Crickets are usually roasted and are quite delicious to taste.

Nutritional content of the common cricket

Crude protein: 6.25%; Nitrogen-free extract 85.3% (Banjo et at, 2006)

Vitamins: Almost none except a very low Vit.B_2, 0.03mg/100g.

Minerals: Calcium, 9.21mg/100g; phosphorus 126.9mg/100g; iron, 0.68mg/100g; magnesium 0.13mg/100g.

The cricket, *Gymnogryllus lucens*, common in Akwa Ibom State, is considered a delicacy (Ekop et al, 2010).

Nutritional Content of *G. lucens*

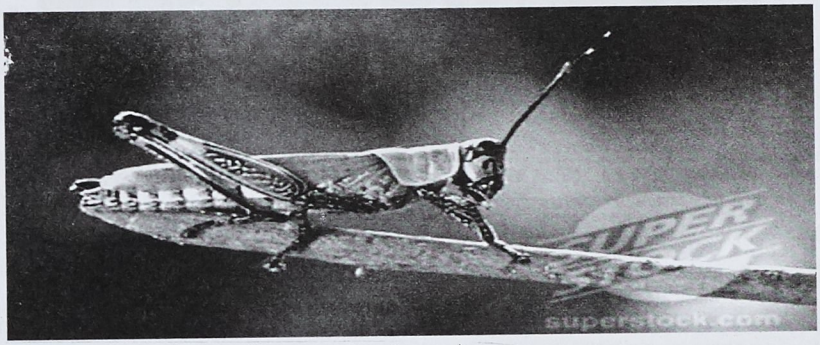
Crude protein is very high 50.75%

Lipids: 26.46%

Nitrogen free extract: 13.08%;

Calories: 493.53 Kcal/kg.

GRASSHOPPERS



Variegated grasshopper *(Zonocerus variegatus)*.

The variegated grasshopper, *Zonocerus variegatus* L. is eaten with relish across Nigeria, especially in the southwest, and Kwara State, (Idowu et al, 2004); in the south-south, particularly Akwa Ibom State (Ekop et al, 2010) and in Samaru, Zaria (Mba and Elekima, 2007).

Nutritional qualities of the variegated grasshopper

Crude protein: ranging from 26.8% (Banjo et al 2006) to 38.72% (Mba and Elekima, 2007)

Lipids: 23.63%;

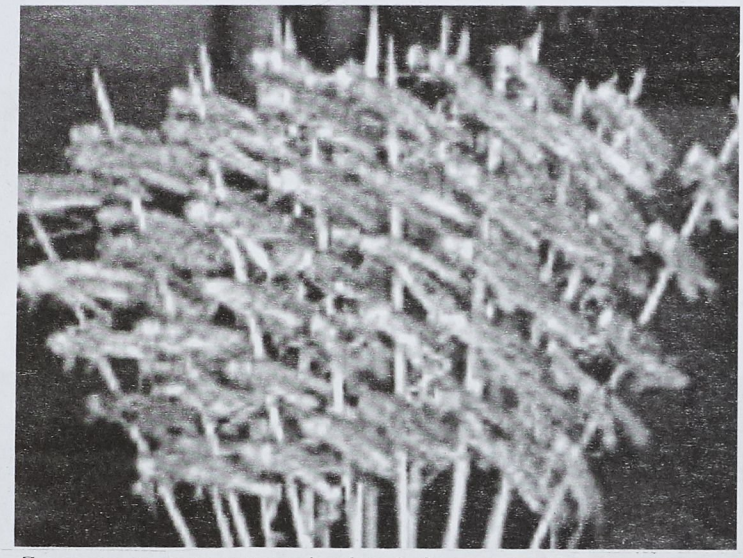
Calorific value: 490.96 Kcal/kg;

Nitrogen-free extracts: 24.94% (Ekop, 2006) to 63.2% (Banjo et al, 2006)

Oil: 28.64%

Vitamins: A, 6.82 ug/100g; C, 8.64mg/100g.

Minerals: calcium, 42.16mg/100g; phosphorus 131.2mg/100g; iron, 1.96mg/100g; magnesium, 8.21mg/100g.



Zonorcerus variegatus, toasted and ready for consumption.

Short-horned grasshopper

Cytacanthacris aeruginosus unicolor is another type of grasshopper that is commonly eaten all over Kwara and Niger states (Banjo et al, 2006).

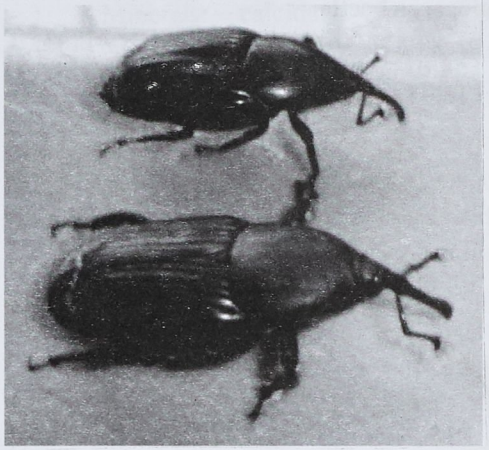
Nutritional qualities of the short-horned grasshopper

Crude protein: 12.1% < than ½ the crude protein in *Z. variegatus*.

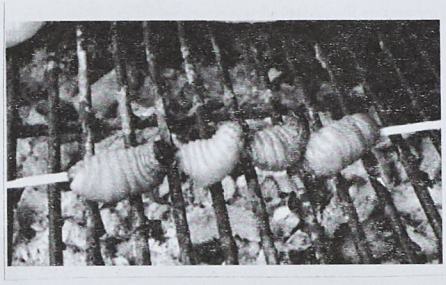
Nitrogen-free extract 60.5%.

The palm weevil and the rhinoceros beetle

The larvae of the palm weevil, *Rhychophorus phoenicis* F. and of the rhinoceros beetle, *Oryctes monoceros* Oliver, are eaten throughout the rainforest, riverine and coastal states where the oil palms are grown. Skewered *C. forda* larvae is sold in markets at Makurdi, Benue State (Agbidye et al, 2009)on slim bamboo sticks or on other flat and slender sticks of about 30cm long. The larvae of both beetles are roasted or fried to taste and eaten with *Foniyan,* a type of tapioca or with bread. Both larvae are well distributed in Delta and Ondo states.



Palm weevil, *Rhychophorus phoenicis* F.



The palm weevil larvae and adult.

Nutritional qualities of the palm weevil larvae

Crude protein: Very high, ranging from 28.42% (Banjo et al 2006) to 71.63% (Braide and Nwaoguikpe, 2011).

Energy content: 387.01 Kcal/100g (Braide and Nwaoguikpe, 2011) to 473.8 Kcal/kg (Ekop et al, 2006).

Carbohydrate: 22.75% (Ekop et al, 2006) to 48.6% (Banjo et al 2006)

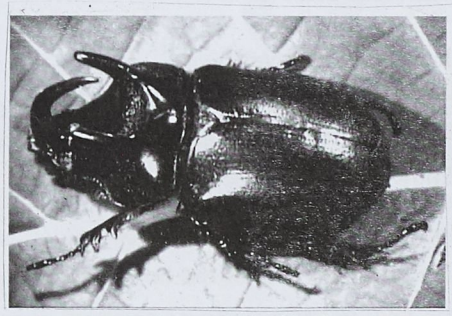
Lipids: 8.25% (Braide and Nwaoguikpe, 2011) to 20.36% (Ekop et al 2006)

Vitamins: A, 11.25 ug/100g; B_2, 2.21mg/100g; C, 4.25mg/100g.

Minerals: Calcium 39.58mg/100g; phosphorus 126.4mg/100g; magnesium 7.54mg/100g; iron 12.24mg/100g.

Larvae of the rhinoceros beetle, *Oryctes monoceros* Oliver

The larvae of the rhinoceros beetle is popular in oil palm growing areas of the rainforest and coastal areas of Nigeria. The larvae is white but not as soft in texture as the larvae of the palm weevil. They are also skewered and roasted like the larvae of the palm weevil.



The adult rhinoceros beetle, *Oryctes monoceros*.

Nutritional qualities of larvae of the rhinoceros beetle

Crude protein (high): 36.45%;

Lipids: 34%; Nitrogen-free extract 15.05%;

Crude fibre: 10.50%.

Essential amino acids: Rich in leucine, 6.30g/100g; phenylalanine 4.65/100g; methionine 2.085/100g. These rich amino acid values meet the minimum daily requirements for humans as recommended by the WHO.

Minerals: iron 8.5mg/100g; sodium 440mg/100g; potassium 38.4mg/100g; magnesium 175mg/100g; zinc 7.0mg/100g.

Rhinoceros beetle larvae .

The high iron content of the larvae of the rhinoceros beetle is of advantage to women in developing economies including Nigeria and more so for pregnant women who are reported to suffer from iron deficiency during pregnancy.

Magnesium is useful to maintain normal muscle and nerve function. It steadies heart rhythm, supports immune the system and regulates blood sugar levels. Magnesium is needed for more than 300 biochemical reactions in the human body (Saris et al, 2000).

Larvae of *Oryctes boas*

The larvae of another species of the rhinoceros beetle, *Oryctes boas* is also consumed in Nigeria. The larvae are prepared in the same way as the larvae of the more commonly known rhinoceros beetle, *O. monoceros*.

Nutritional value of the larvae of *Oryctes boas*

Crude protein: 26.0%;

Nitrogen-free extract: 30.5%;

Crude fibre 3.4%.

Vitamins: A, 8.58 ug/100g; B_2, 0.08mg/100g; C, 7.59mg/100g.

Minerals: calcium 45.68mg/100g; phosphorus 130.2mg/100g; iron 2.31mg/100g; magnesium 6.6mg/100g.

The nutritional values of the larvae of both species of the rhinoceros beetle, particularly the high levels of crude protein, essential amino acids, fibre, vitamins and minerals make the larvae an important source of the dietary needs of those who consume them.

Honey bee (*Apis mellifera*)

The adult honey bee is rarely eaten in Nigeria. It has a hard cuticle (exterior) and strong, piercing mouth parts. However, the eggs, larvae and pupae are reportedly eaten in some parts of the country.

Nutritional value of larvae and pupae of the honey bee

Crude protein: 21%

Nitrogen-free extract: 73.6%

Ash: 2.2%

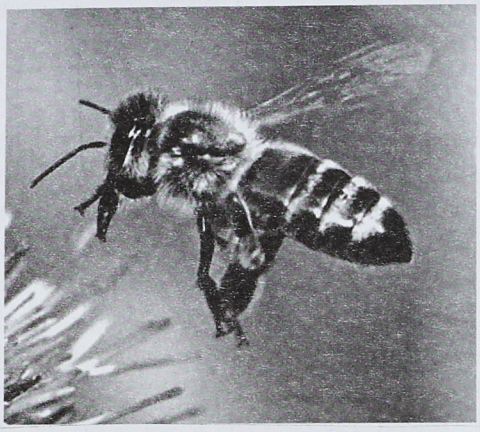
Vitamins. Very rich, containing Vit. A, 12.44 ug/100g; B_2, 3.24mg/100g; C, 10.25mg/100g.

Mineral content: is among the highest in food insects, comprising calcium, 15.4mg/100g; phosphorus 125.5mg/100g; iron, 25.2mg/100g; magnesium 5.23mg/100g.

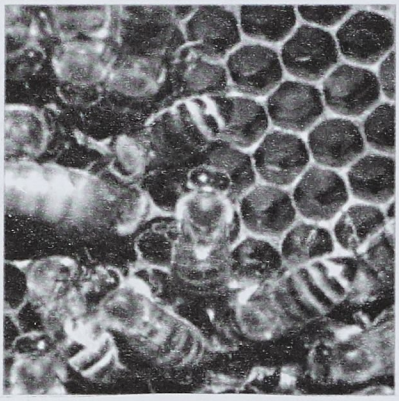
Honey

Honey is produced by the adult honey bee. Eulogized all over the world and in all civilizations, honey is the sweetness of life, the drink of the gods of Olympus in the Greek philosophy. Honey is the symbol of knowledge, learning and wisdom. It is food reserved for the elect, the initiate and those that are exceptional. In the scriptures, honey was the food eaten by some great prophets including John the Baptist, the harbinger of Jesus the Christ.

Honey is widely consumed throughout Nigeria especially among persons who are becoming more conscious of the health implications of obesity and arteriosclerosis. Honey also plays a key role in traditional weddings, child-naming ceremonies and in the rites of initiation and purification. It is a therapeutic for cough and is used to remove stubborn scars in human skin arising from severe burns or deep cuts.



Adult honey bee.



The honey comb.

Honey production

Scientifically, honey is produced from the nectar and sweet deposits of plants as gathered, transformed and stored in the honey comb to mature. The bee blends the transformed nectar with its saliva and converts the sucrose into *fructose* and *glucose*.

Nutritional value of honey

Honey is solely a natural product that does *not* contain additives or preservatives. Honey contains:

Natural sugars: 70 – 80% (mostly fructose and glucose).

Honey is 1 to 1.5 times sweeter than table sugar

Vitamins: Very rich in B_6, thiamin; niacin; riboflavin, pantothenic acid, amino acids – to name a few

Minerals: High such as calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium, zinc. Contains antioxidants. Honey is free of fats and cholesterol, preventing obesity and arteriosclerosis. Honey is rich in energy, e.g., 1 (one) tablespoon of honey contains 64 calories.

Honey has a healthy glycaemic index (GI) i.e. honey sugars can be absorbed gradually into the blood stream resulting in better digestion.

Table: 1. Nutritional value of honey

Nutrient	Average	Range
Fructose (%)	38.1	27.25 - 44.26
Glucose (%)	31.28	22.03 - 40.75
Sucrose (%)	1.31	0.25 - 7.57
Reducing sugars (%)	76.75	61.34 - 83.72
Moisture (%)	17.2	13.4 - 22.9
Higher Sugars (%)	1.50	0.13 - 8.49
Free acidity (mg/kg)	22.03	6.75 - 47.19
Total acidity (mg/kg)	29.12	8.68 - 59.49
Nitrogen (%)	0.041	0.0 - 0.133
PH	3.91	3.42 - 6.10
Minerals (Ash) (%)	0.169	0.020 - 1.028

Source: Adapted from the nutritional value of honey. Lunedemiel.tm. fr/anglais/04.htm

Biological properties of honey

Honey has antimicrobial properties that prevent the growth or persistence of many microorganisms. It contains numerous fragrances due to the esters and alcohols present in the plants which honey bees visit. Honey colours derive from pigmentary matters such as carotene in the plants honey bees visit. Honey crystallizes more or less rapidly depending on its content of fructose or glucose. Honey crystallizes less when it contains more fructose. Honey crystallizes more when it contains more glucose

Crystallization of honey is a natural or complex phenomenon. It can occur at anytime. Crystallization does not alter the taste, nutritional or therapeutic properties of honey.

Health and national relevance of edible insects to Nigeria

Edible or food insects are rich in food qualities and contain medium to high levels of protein, high levels of energy, minerals and vitamins that the human body needs to prevent malnutrition and its dire consequences.

A most recent national survey by the Federal Ministry of Health reveals that at least 41 per cent of under-5 children in Nigeria suffer from malnutrition and are stunted in growth.

Malnourished children.

The consequences of malnutrition in children include stunted mental and physical growth. If malnourished children survive, they become adults with severely reduced mental acuity and cognitive capability, unable to advance themselves and achieve the basic necessities of life. They become adults most in need and least able to help themselves. Unable to compete naturally with their peers, these adults become insecure, bitter and angry with the lives they live, with society and Nigeria.

Adequate nutrition and a balanced diet for children have long been recognized in many countries to build a healthy and productive national work force. For example, the United States initiated a National School Lunch Programme (NSLP), which President Harry Truman signed into Law in 1946 . The NSLP was expanded to include breakfast by a 1975 legislation. A 1998 legislation further expanded the programme to include reimbursements for snacks served to children in after-school educational and enrichment programmes (*The Guardian,* Sunday Edition, January 19, 2014, pg 27-28).

India's School Feeding Programme (SFP) dates back to the 1920s, though largely run by state governments with some external assistance. The Supreme Court later ruled that all state governments should introduce the SFP in all government and government-assisted primary schools. In 1997, Brazil commenced its own School Feeding Programme that covers nearly 37 million school children each year, and is reported to be the largest SFP in the world.

People are the real wealth of a nation (UNPD: HDR, 1990). People are the most valuable development resource. For Nigeria to develop and compete favourably in a knowledge-based global economy, its children and citizens must be mentally active and physically fit. Edible insects can contribute to closing the nutritional gap so evident in Nigeria's food system, in Nigeria's food balance sheet. Food insects in Nigeria are available all through the seasons at little or no financial cost.

Tastily prepared and well-packaged, food insects can be promoted *officially* for consumption by pre-primary and primary school children along with other regular foods to enable them grow and become adults that will transform naturally into a healthy and productive national work force. Edible insects should be part of any pilot School Feeding Programme, and should also be promoted by hospitals as part of a protein-enriched diet for low-income pregnant women and lactating mothers.

The challenge of edible insects to the Nigerian Field Society

I am informed that the Nigerian Field Society (NFS) is 84 years old this year. I congratulate the society that it has survived this long in a country where the functional life-span of an organization is less than 30 years.

In reminiscence, the NFS must have seen the growing decline in forests and vegetation cover, the high loss of biodiversity including the loss of rare species of animals, birds, insects, fisheries, and medicinal plants. The NFS must have seen the reclamation of water fronts, beaches and wet-lands and their conversion to commercial uses. They must have seen the loss of aquatic resources as well, and their hearts must be bleeding. Mine is bleeding profusely.

A common sight here in Ibadan is the growing destruction of the forested slope on the side of the Premier Hotel and its willful conversion to praying grounds. The teak forest on the slope was planted to reduce rainfall intensity, check erosion, soil denudation, soil nutrient loss, loss of biodiversity and reduce climate change and its negative impacts.

The Nigerian Field Society should **not** watch silently as the hill surrounding the Premier Hotel, and many other ecosystems are being destroyed in Nigeria.

The NFS should create more awareness, increase its advocacy, mount pressure on policy makers in the state and federal ministries of agriculture, fisheries, works, and environment; and also mount pressure on lawmakers in the state and the national assemblies and bring some level of sanity to conservation issues in Nigeria. The time to increase pressure and advocacy for environmental conservation purposes is now.

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