

# EDIBLE INSECTS: FOOD FOR THE FUTURE

## *Secrets of African Edible Insects*

COOKERY VOLUME II



## Secrets of African Edible Insect Cookery

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## Foreword

Our first edition of the “Secrets of African Edible Insect Cookery” was launched in 2020 and reached out to many traditional and future consumers of edible insects. Since publication of this edition, the book has been in public demand at various international trading forums where it was greeted with enthusiasm. The idea of introducing innovative dishes to the once traditionally consumed edible insects was something that readers highly valued as the future of food eating experiences. Since this first edition, a number of innovations have emerged in the cuisine space particularly through re-imagination of “future food” by renowned Chefs.

The second edition of the “Secretes of Edible Insect Cookery”, is thus born out of increasing diversity of edible insect products arising from keen interest and developments from our first edition. We are proud to present this new edition with an additional dimension of documenting both traditional and innovative cuisines from different insect products. We accompany all the recipes with stories of food hunting expeditions associated with the insect ingredients, how they are processed using traditional methods and kitchen stories. From the foundations of traditional cuisines, modern recipes with a wide consumer appeal have been formulated and are proudly presented here. We take cognisance of the fact that the future of food consumption needs to be rooted in both traditional and contemporary contexts. This edition captures the old traditional methods while taking the culture of insect consumption into the future.

We also address in this edition, aspects of food safety, which many consumers had expressed concern on especially with regards to wild harvested/ gathered insect species. This volume thus begins by outlining key food safety considerations when handling insects as food. Additionally within the preparation for consumption practices we converge traditional practices, kitchen stories and modern rules of science to highlight key food safety steps. We hope to excite our consumers while giving them the comfort of guaranteed food safety standards associated with gathering, preparation and presentation of these attractive dishes. We set our cuisines on the belief that edible insects are the food for the future and through innovation we present this recipe book.

Bon appétit!



Assoc. Prof. Sofia Boqvist  
Programme Director AgriFoSe2030



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Common name			Scientific name
English	Shona	Ndebele	
Edible bug	Harurwa	Umtshipela	Encosternum delegorguei
Bagnest Moths	Hondokotowa/Pfukusi		Anaphe panda
Soldier termites	Juru	Amagenga	Macrotermes natalensis
Bullet beetles	Gwenjemukwenje	Ithuku	
Ground Cricket	Jenya	Inyekevhu	Henicus whellani
Mealworm	Pongwe wemudura	Umhlogoi	Tenebrio molitor
Black Soldier Fly	Gonye	Umhlogoi	Hermetia illucens
Common house cricket	Humbwe	Inyekevu, emnyama	Acheta domesticus (L.)
White grub	Ndere	Ithuku	Eulepida mashona
Mopane worm	Dora	Icimbi	Gonimbrasia belina
Emperor moth	Gandari		Gynanisa maia
Giant Sand Cricket	Gurwe	Inyekevhu	Brachytrupes membranaceus

## Introduction

More than 470 edible insect species are known to be consumed in Africa with protein ranging from 15–53 % on dry matter basis and energy contents in excess of 300Kcal/100g. Some African edible insects are highly constituted in essential amino acids, macro and micronutrients which highly place them as complementary food resources. Several opportunities on the use of insects as genuine and universally accepted alternative food resources can be exploited through development of innovative foods that have good visual and sensory appeal to consumers in the same manner as conventional foods on the market. Modernizing traditional insect cuisines is an important step towards improving consumer acceptance. As the traditional insect consumers and gathers are becoming less due to old age and passing on of generations, a new pathway should be followed in order to preserve the culture from dying while making new imagination of future integration of insect based diets within the context of contemporary eating habits and food systems.

The second edition of the “Secrets of African Edible Insect Cookery” seeks to consolidate traditional knowledge of insect gathering, harvesting practices processing and preparation of different cuisines with new innovative cuisines that have potential for appeal to non-traditional consumers. This Cookbook sets the traditional cuisines as the foundation upon which new innovative food products are developed and also upon which new food safety standards are developed. The cookbook highlights the basis of traditional collection and processing methods, coupled by

kitchen stories, nutritional benefits and innovations around specific insect species when used as food ingredients.

Innovative products are categorized into those ready to eat products with a prolonged shelf life and suited for consumers with no access to cold chain facilities for preservation. This applies greatly to consumers in developing countries in Africa. The second category are those products that are integrated as powders to make soups; the third category are the condiments that can be accompaniments to other food products while the final category are the ready to eat cuisines that can be prepared as menus.

The book also brings the innovation of diversifying flavours by integrating unique flavours of fruits and vegetables from the communities where the respective insects are gathered. These unique blends bring a true authentic traditional dimension of recipes presented in this Cookbook.

Developing more complementary food formulations that incorporate edible insects is a sure way of increasing the acceptability of edible insects among a diverse group of consumers and encouraging consumption of the highly nutritious edible insects.

## Master recipe for insect pre-processing

All recipes in this book will be using a specific quantity of either edible insect powders, crushed edible insects or whole edible insects. For their preparation, the edible insects are boiled for 10 minutes, washed and further boiled for another 10 minutes with salted (1% sodium chloride) water before being dried. The boiled edible insects are spread out on a baking tray and dried at 70 °C until they are fully dried. The dried insects are either ground into a powder or crushed or minced into a small-sized chunks. Some recipes require fine powders which can be sieved using a 425µm sieve.

## Key Food Safety Instructions

### The Core Four Practices

Whenever one is handling, preparing and cooking food, there may be an invisible enemy ready to strike. This enemy is called harmful bacteria, and it can make people sick. In fact, because you cannot see, smell or taste bacteria, it may already be invading food products, kitchen surfaces, and utensils. As such you have the power to fight bacteria and to reduce your risk of food poisoning. This is possible by following these core four practices for food safety:

#### Clean:

*Wash hands and surfaces often*

- Wash hands with soap after touching [food, e.g., raw poultry, meat, eggs, raw flour, seafood].
- Wipe off tops of cans before opening (optional).
- Wash the food thermometer probe with hot, soapy water (optional).

#### Separate:

*Do not Cross-Contaminate*

- Wash using detergent [equipment, e.g., cutting board, counter, utensils, serving plate] after touching [food, e.g., raw meat, poultry, seafood, eggs, raw flour].
- Do not rinse raw meat or poultry.
- Do not reuse marinade used on raw foods (if applicable).
- Store ready-to-eat and cooked foods above raw foods in the refrigerator.
- Use a different cutting board for raw meat, poultry, seafood, and produce (applicable for food service).
- Wear single-use gloves when serving the public (applicable for food service).
- If not serving cooked food immediately, keep the food hot at 140°F (60°C) or higher, or cool and refrigerate within 2 hours (applicable for food service).

#### Cook:

*Cook to the safe internal temperature*

Cook the food until the internal temperature reaches (minimum internal temperature) on a food thermometer.

- Insert into blanks above as applicable:
  - i. Chicken, turkey, duck (whole, parts, or ground), 74°C
  - ii. Beef, pork, lamb, veal (ground), 71°C
  - iii. Beef, pork, veal, lamb (roasts, steaks, or chops), 63°C with a 3-minute rest after removal from heat source
  - iv. Fin fish (e.g., cod, haddock, tilapia, salmon, tuna), 63°C
  - v. Shrimp, lobster, crabs, 63°C (flesh pearly and opaque)
  - vi. Scallops, 63°C (milky white, opaque, and firm)

- vii. Clams, oysters, mussels, 63°C (shells open during cooking)
- vii. Eggs and egg dishes, 71°C (cook eggs until yolk and white are firm; scrambled eggs should not be runny)

#### Chill:

*Refrigerate promptly*

- If not serving food immediately, refrigerate at 4°C or lower (if applicable).
- Refrigerate leftover food in shallow containers within 2 hours. Use within 3 to 4 days or freeze for future use (if applicable).





## Harurwa Recipes



## Harurwa Recipes



**Figure 1:** Adult harurwa. The chlorophyll green colour, the triangular marking on the back side and a body size between 1.5- 2cm distinguishes it from other non-edible green stink bugs.

### Hunting your own food: gathering from the wild and preparation for consumption

#### **Hunting and gathering**

Harurwa is harvested during mild winter period from March to August of every year from tree canopies and in a forest known by the local communities as “Jiri re Harurwa”. This period is also marked by scarcity of indigenous vegetable within these communities. Harurwa are collected at dawn when the temperatures are low (minimum ground temperatures of approximately 5°C- 15 °C). At low temperatures, insects are easily dislodged from tree branches where they will be

patched using the knock down approach (Figure 2). As day temperatures rise, insects become more active and readily migrate from patched branches when disturbed.

Harurwa can also be knocked down by jarring trees to shake off the insects using long wooden hook sticks (Figure 2). Alternatively, stones weighing between 5 to 10 kg are used to knock tree trunks; yielding a force that is adequate to knock down the insects.





**Figure 2:** Traditional methods of harvesting harurwa. Insects can either be collected from small tree branches into woven baskets and plastic bags (a) or by using long hooking sticks and jarring to knock down the insects.

Insects are picked from the ground using bare hands but taking precautions to avoid damage to the eyes by the alarm pheromones released by the bugs. Prolonged harvesting of harurwa (> 5 times of repeated harvests) usually results in semi-permanent brown stains on parts of the palms (Figure 3).



**Figure 3:** Brown stains on the hands of an individual who frequently harvests harurwa. The stains are difficult to remove with detergent soaps.



**Figure 4:** Harurwa are collected in perforated plastic bags to facilitate aeration and reduce mortality before processing for consumption.

Harurwa are temporarily collected into perforated empty plastic or polypropylene bags previously used to store grains (Figure 4). Perforation allows free air circulation, thus ensuring that insects remain alive until they are processed using warm water special preparation method for consumption.

**Processing for consumption**

Harurwa are processed through five stage traditional processing methods. First is cleaning debris from the field, next is gradually killing using a lukewarm method in order to remove the alarm pheromone; next is flaming, colouration and roasting. Figure 5 (a-f) describe the steps in detail.



**Figure 5:** Gradual killing of harurwa. Mildly warm water, (approximately 27°C), is used to kill insects. At this stage, insects release the offensive alarm pheromone. This helps in avoiding bitter taste. A flame is passed on the dead insects (after sieving from water) to remove volatile substances released by the insects during drying. Improperly processed insects accumulate alarm pheromones on their thoraces. Such insects have a sharp bitter taste. Harurwa with a goldenbrown colouration indicates that the insects are of good quality.



**Figure 5 a:** harurwa being stirred in lukewarm water



**Figure 5 b:** set up of the cooking utensils for the flaming process



**Figure 5 c:** flaming process using a lit match to ignite the insects



**Figure 5 d:** flaming process as the insects have caught on the lit match



**Figure 5 d:** roasted harurwa ready for consumption and further processing



**Nutritional composition**

Harurwa are a good source of proteins, fibre carbohydrate, fat and energy and antioxidants (flavonoids) unsaturated fatty acids (Omega-3 and Omega-6 fatty acids); essential amino acids which lack in cereal based diets (lysine, tryptophan and methionine). Harurwa have an energy value of 597.4 kcal/100g

**Table 1:** Nutritional composition of harurwa

Constituent	Composition (On dry matter basis) g/100g
Protein	43.3
Fat	45.0
Ash	1.3
Carbohydrates	5.0
Crude fibre	5.3

**Traditional dishes of harurwa**

Processed harurwa are usually cooked using a small amount of water and salt for up to 5minutes after which the water can be strained and insects roasted to a crispy texture (Figure 6). Depending on preference, a small amount of cooking oil or chili spices can be added. Harurwa can be consumed as snacks or accompany other complimentary relish such as vegetables.



**Figure 6:** The traditional way of consuming harurwa. Roasted or fried insects can be used as a relish alongside the staple starch (sadza).

**Harurwa Oat and Raisin Muffins**



**Figure 7:** Harurwa oats and raisin muffins

**Ingredients**

- 250g Plain flour 125g Oats
- 125g Stinkbugs 125g Raisins 125g Margarine 2 Eggs
- 125g Sugar
- 2.5g Salt
- 2.5g Baking powder
- 250ml Milk

**Method**

1. Preheat the oven to 180°C and line the muffin trays with muffin cups.
2. Mix the margarine sugar using the creaming method until small peaks are formed.
3. Add the vanilla essence and mix evenly.

4. Add the egg to the mixture mixture and mix together until evenly distributed.
5. The dry ingredients are mixed together in a separate bowl (plain flour, oats, minced stink bug, baking powder and salt).
6. The two mixtures are combined and mixed using the folding in method, for even distribution of ingredients.
7. Add milk gradually to the mixture until the required consistency is achieved.
8. Add the raisins to the mixture.
9. Place the batter in the muffin trays and place them in the preheated oven.
10. Baking for 15 minutes, remove from the oven and allow to cool. The muffins can be stored in air tight containers, in a cool and dry place.



## Peri bug snack



**Figure 8:** *Roasted harurwa, spiced with chilles and mixed with soldier termites ingredients*

### Ingredients

800g stink bug  
1 tsp grated ginger  
Peri-peri

### Method

1. Add ginger in a pan and toss.
2. Add edible stink bugs and toast until golden brown.
3. Dissolve peri-peri in water, and add to the sink bug.
4. Mix and serve.





## Silkworm (Hondokotowa/ Pfukusi) Anaphe panda dishes

### Hunting expeditions

Cocoons are produced on *J. globiflora* and *B. glaucescens*. Food plants are *Diplorhynchus condylocarpon*. Cocoons are produced on *J. globiflora* and *B. glaucescens*. Food plants are *Diplorhynchus condylocarpon*.



**Figure 9:** Silkworm (Hondokotowa/Pfukusi) *Anaphe panda*

### Kitchen Stories

#### Preparation for consumption



**Figure 10 (a):** Upon collection from the wild, larvae naturally aggregate in preparation for hibernation. This process takes 4-5 days before they begin to weave the cocoon.



**Figure 10 (b):** Bag nest larvae forming cocoons as the first process of hibernation. It takes three to four weeks before the cocoons are fully weaved. During this process, the larvae shed off the hair on their body surfaces. It is at this point that they can be considered ready or safe for consumption. A sharp object can be used to tear the bag apart and collect the larvae (c).

## The King's Dish



**Figure 11:** The King's Dish (Finger millet sadza served with hondokotowa, chimukuyu and mutsine relish)

### Ingredients

- 500g silkworm (hondokotowa)
- 500g biltong (chimukuyu)
- 1 cup dried blackjack leaves ((mutsine) that's been cooked till tender
- 1/2 an onion, chopped)
- 1 ripe tomato, chopped
- 3 tbsp. peanut butter
- salt and pepper to taste
- 1 teaspoon garlic-ginger paste

### To Serve

Finger millet sadza

### Method

1. Add Soak the biltong and dried blackjack leaves separately in hot water.
2. Boil the meat with garlic-ginger paste and lots of water.

3. Half way through, add onions and tomatoes.
4. Add the soaked blackjack leaves and simmer for a further 10 minutes.
5. Add peanut butter, salt and pepper, and simmer on low for 15 -20 minutes, or until the peanut butter is fully cooked.
6. Serve with finger millet sadza.
7. And add red chilli's (optional).



# Mopane Warm Recipes

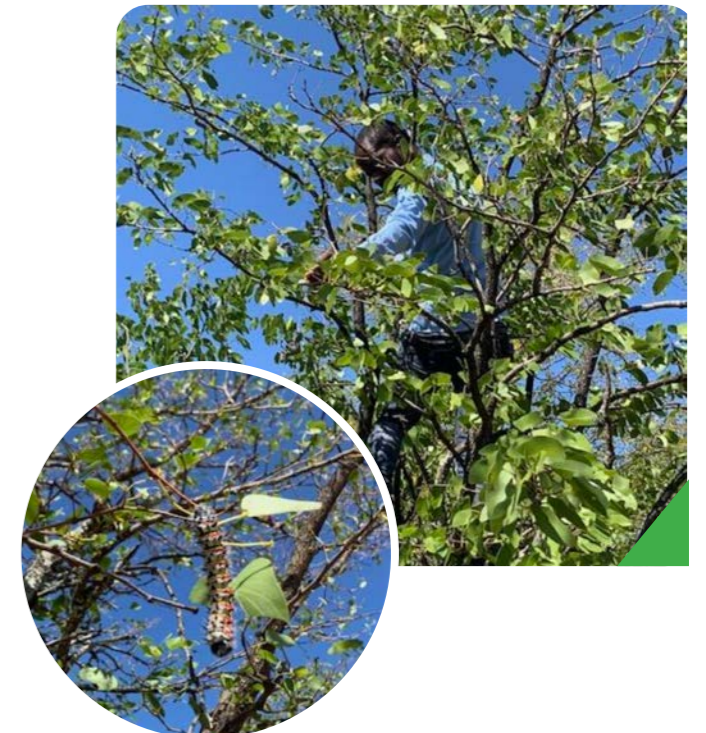


**Table 2:** Mopane worm nutritional composition

Constituent	Composition (On dry matter basis) g/100g
Protein	55.4
Fat	16.4
Ash	8.3
Carbohydrates	8.2
Crude fibre	16.0
Moisture	-

**Table 3:** Satumiids and associated host plants in Zimbabwe

Component	Mopane worm g/100g
Potassium	35.2
Calcium	16.0
Phosphorus	14.7
Magnesium	4.1
Iron	12.7
Zinc	1.9
Sodium	33.3



**Figure 12: Wild collections**

Mopane worms occur naturally in many mopane tree based woodlands of the southern provinces of Zimbabwe and northern parts of South Africa and eastern parts of Botswana.



**Saturniids and associated host plants in Zimbabwe**

Saturniid species	Host plants
<i>Gonimbrasia belina</i>	<i>Colophospermum mopane</i> , <i>Brachystegia spiciformis</i> (Musasa), <i>Brachystegia tamarindoides</i> (Munze) and <i>Julbernardia globiflora</i> (Munhondo)
<i>Bunea alcinoe</i>	<i>Ekebergia arborea</i> (Muvhuranyimo) and <i>Cussonia</i> sp. (mufenje)
<i>Buneaa</i> sp. (Masinini)	<i>Brachystegia spiciformis</i> and <i>Julbernardia globiflora</i> (Mutondo or Munhondo)
<i>Cirina forda</i> (Harati)	<i>Burkea africana</i> (Mukarati)

Source: Chavhunduka (1975).

**Traditional practices**

Mopane worm harvesting is a seasonal practice with the outbreaks occurring from the period November to January and April-May following good rains. The mopane worm collection season is usually during the school break, so the children can as well participate in the harvesting. Some of the children who participate in the harvesting will utilise the earnings they get for their education, clothes and uniforms.



Figure 13: Traditional practices during Mopane worm harvesting activities



Figure 14: Mopane worm degutting practices at the harvesting site.

**Harvesting from the wild**

The worms are gathered by gently shaking host trees thereby knocking them down for hand picking. However, these worms release exudates that can permanently stain clothes, so care must be taken to avoid contact with these exudates.

Post-harvest handling of the insects can affect the taste and it is important to aerate them during and after harvesting. The traditional ways for small scale harvesting is accomplished through tying a string on the middle abdominal positions of a collection of worms with a knot separating individual insects within a bunch.

This method ensures free air circulation among the harvested worms. Gathered insects treated this way can be kept for about 24 hours without adverse effects on appearance and quality. In addition this method is popular with livestock herdsman who spend a lot of time in the pastures before processing the insects.

There are potential applications for use of exudates in manufacture of dyes based on the observation that they make permanent stains on contact with clothes. This could provide additional benefits associated with these edible insects.



Figure 15: Traditional small-scale method of gathering mopane worms. Larvae are tied to form a bunch with a knot separating individuals to improve aeration.

**Charcoal roasting and sun drying**

This processing is usually done in the forest where the worms are harvested. Charcoal roasting is the process where mopane worms are placed in hot charcoal, until the sharp spines are burnt. The process will last for about 5 minutes with consistent shuffling.



Figure 16: Charcoal roasting process using hot charcoal



Figure 17: Sun drying process done after the mopane worms have been charcoal roasted

Charcoal roasting method is more favoured by the mopane worm processors and consumers for various reasons including:

- It retains the insect flavour more than when boiling and sun drying.
- The process helps in reducing the amount of spikes left on the product.
- Keeping quality is similar to the boiled ones.
- A subjective reason why the method is more preferred is that it has a better quality than boiled mopane worm



### Boiling and sun drying

When the mopane worms are degutted, they are washed three times with clean water, before being boiled. After about ten minutes of boiling the mopane worms are then removed from heat ready for sun drying. Salt is added after the boiling process, to help with the preservation process. This method is more hygienic than charcoal roasting method, though some consumers claim that the flavour is washed out during the boiling process. After sun drying processes for both methods, mopane worms may be stored in cool dry places for up to 12 months.

### Preparation

1. Dried mopane worms are first placed in a metal pot (saucepan) with a lid. After wards, the closed pot is shaken to help remove the spikes on the mopane worm.
2. The mopane worms are then transferred to a clean pot and boiled for 10 minutes, with the lid off.



**Figure 19:** Washing of boiled mopane worm with clean water

3. After the boiling, the mopane worms are now soft enough for washing two times in clean water.



**Figure 20:** Boiling of Mopane worm with salted water

4. Further boil the mopane worm for another 10 minutes with salted (1% sodium chloride) water, or until the mopane worm are salted enough and soft. Drain the remaining water.



**Figure 21:** Frying of Mopane worm in heated oil

5. Heat the oil in a saucepan and fry the mopane worms for 5 – 10 minutes, or until the mopane worms are crunchy (depends on preference).



**Figure 22:** Fried Mopane Worm

6. After frying for 5 minutes chopped onions are added and sauteed for a few minutes before tomatoes are added and cooked until well done. The relish is seasoned with salt, pepper and ready to serve.



**Figure 23:** Maize meal sadza served with fried mopane worm, fried covo and stewed offals

7. After frying for 5 minutes chopped onions are added and sauteed for a few minutes before tomatoes are added and cooked until well done. The relish is seasoned with salt, pepper and ready to serve.



**Figure 24:** Maize meal sadza served with fried mopane worm



**Figure 25:** Fried Mopane worm with tomato and onion relish



## Creamed Mopane worm



### Ingredients

- Mopane worm
- Fresh cream
- Salt to taste

### Method

1. Dried mopane worms are first placed in a metal pot (saucepan) with a lid. After wards, the closed pot is shaken to help remove the spikes on the mopane worm.
2. The mopane worms are then transferred to a clean pot and boiled for 10 minutes, with the lid off.
3. After the boiling, the mopane worms are now soft enough for washing two times in clean water.
4. Remove the heads and rear end of the mopane worm. For the long mopane worm, cut them in half after removing the ends.

5. Place back on the fire/heat source at a lower temperature (medium to low) and add some salt.
6. Allow the mopane worm to drain left over water from the cleaning and washing step.
7. When the water is about to finish draining, add the fresh cream to the pot. Allow them to cook until the cream is thick, and your creamed mopane worm are now ready for consumption.
4. Remove the heads and rear end of the mopane worm. For the long mopane worm, cut them in half after removing the ends.



Figure 26: Mopane worm relish mix label

The mopane worm relish mix is a mix of mopane worm powder, dried vegetable powders and spices which add flavour to cooked relish and meats. With the added edible insect powder, the relish mix adds to the flavour of the food to which it is added, and the starches present help to thicken the sauce of the relish being made.

### Ingredients

- 12g pre-cooked mopane worm powder
- 30g corn starch
- 10g white sugar
- 22g salt
- 15g potato powder
- 2.5g paprika powder
- 2g garlic powder
- 2g onion powder
- 1.5g tomato powder 1g black pepper
- 1g coriander powder
- 0.5g turmeric powder
- 0.3g ginger powder
- 0.2g cinnamon powder

### Method

1. Place the pre-cooked mopane worm powder in a mixing bowl, and add sugar, salt, and seasonings (paprika powder, garlic powder, onion powder, tomato powder, black pepper powder, coriander powder, turmeric powder, ginger powder and cinnamon powder).
2. Add the corn starch and potato powder to the seasoning mix, and mix well.
3. Package the relish mix in clear mylar and aluminium laminate (heat sealable) bags and store in a cool, dry place.



Figure 27: Mopane worm relish



## Mopane worm crackers

Mopane worm crackers are one of the most traditional hunger chasers, so crispy and flavourful. They are light, and made from only simple ingredients including flour, salt, spices and mopane worm powder. Crack your day any time with mopane worm crackers, which provide one with high biological value proteins, calcium, zinc and other essential nutrients to cater for all age groups.



**Figure 28:** Mopane worm crackers

### Ingredients

250g plain flour  
125g pre-processed mopane worm powder  
150ml water  
20ml olive oil  
10g brown sugar  
5g salt  
5g black pepper

### Method

1. All dry ingredients are weighed according to the above measurements and mixed in a mixing bowl to make a product weighing a total of 400g.

2. After obtaining a homogenous mixture, the wet ingredients are added that is water and olive oil and the mixing is done to make a stiff dough.
3. The dough is then flattened using a roller pin (alternatively one can use a tortilla press) and the pressed dough can then be cut into different shapes and sizes
4. The crackers are placed in baking trays and baked at oven temperature of 200 °C for 8 - 15 minutes.
5. Once done baking, leave the crackers to cool completely. The crackers will turn crispy only once they have cooled completely. Store them in air tight container or package them in khakhi paper with plastic lining zip lock packages.



**Figure 29:**

*Serving suggestion for mopane worm crackers – Caramelised onion, teriyaki chicken and sweet basil pesto*

## High protein fruit roll-ups

A four-ingredient recipe which is simple and delicious way to make your own high protein fruit leather with the simplest equipment. With the presence of the underutilised indigenous fruit (wild loquat fruit pulp), the fruit roll-ups are a good source of vitamins and minerals. On top of that, the roll-ups contain mopane worm powder which contains high protein content and as well improving on the mineral content of the product. The fruit pulp adds to the chewy texture and natural flavour of the roll-ups, whilst the honey adds to the sweetness of the product without affecting the mouthfeel.

### Ingredients

350g smelly-berry finger leaf fruit pulp  
50g honey  
45ml lemon juice  
20g pre-processed mopane worm powder

### Method

1. All dry ingredients are weighed according to the above measurements and mixed in a mixing bowl to make a product weighing a total of 400g.
2. Add the lemon juice, honey and mopane worm powder to the blended fruit. Blend together all the ingredients until smooth. The sweetness and taste can be adjusted based on preference.
3. Line a baking sheet with parchment paper. Spread the blended fruit mix to a 0.3 – 0.6 cm thickness.

4. Dehydrate the spread fruit mix in a preheated oven at 60 – 75 °C for 4-6 hours, or until the middle is not sticky. The time will vary according to the temperature used and the type of fruit pulp used. The fruit leather should look and feel dry whilst still being pliable.
5. Allow the dehydrated fruit leather to cool before cutting with clean scissors, a pizza cutter or sharp knife into 2cm strips. Roll the leathers whilst still connected to the parchment paper.
6. Package the fruit leathers in laminated aluminium foil packages. Store in a cool, dry place, or refrigerate or freeze to keep for longer.

**Note:** Other exotic fruits such as blueberries, strawberries, peaches, nectarines and berries can be used in place of the indigenous fruits mentioned above. For the purpose of blending with the insect powder, darker coloured fruits are more preferable.

## High protein Jelly Candy

High protein jelly candy made from indigenous fruit pulp (wild loquat fruit), gelatine, edible insect powder giant cricket powder, lemon juice and sweetener. Cane sugar or honey can be used as sweeteners and the main ingredient is the indigenous fruit pulp. Introduction of the edible insect powder helps to improve the nutritional value, particularly the protein and mineral content of the jelly candy. Artificial colours may be added to help the candy to have their distinct appearance, flavour and texture. These colourful fruit jellies can be cut to any size before being rolled in sugar, which is an optional step.



**Figure 30:** High protein smelly berry jellies

### Ingredients

160ml smelly-berry fingerleaf fruit pulp, strained if needed  
75g granulated sugar  
60ml water  
37.5g unflavoured gelatine  
30g corn syrup  
10g pre-processed ground mopane worm powder  
5g citric acid  
Food colouring (deep purple), optional

225g superfine or caster or confectioners' sugar, optional (Vegetable oil cooking spray)

### Method

1. Prepare a 20 cm (8-inch) pan by spraying with vegetable oil spray.
2. Pour the water into a bowl and add the gelatine, let sit for about 5 minutes to soften
3. Place the juice, sugar, ground mopane worm powder, and corn syrup in a medium saucepan over medium heat. Stir until the sugar dissolves.
4. Add the gelatine and continue stirring until the gelatine dissolves.
5. When the gelatine is fully dissolved, add food colouring if desired.
6. Pour the mixture into the prepared pan and leave until completely set. This will take about 4 hours in the refrigerator or overnight at room temperature.
7. When set, turn out of the pan and cut with a sharp knife or cookie cutter into desired shapes.
8. Jellies are served plain.
9. Package the high protein fruit jelly candy in an airtight PET plastic container or use polypropylene plastic bags.

**Note:** Instead of pouring mixture into a baking tray, a silicon mould can be used which has various shapes, and saves time.

## Mopane worm chilli sauce



**Figure 31:** Mopane worm chilli sauce

### Ingredients

1 medium tomato  
1 teaspoon garlic  
1 teaspoon crushed chilli  
1 tablespoon pasilla chilli  
1/4 cup apple cider vinegar  
2 teaspoon mopani powder  
oil  
salt to taste

1. Sauté onion, garlic and ginger.
2. Add coriander stem and tomato, and fry until broken down.
3. Add pasilla chilli and apple cider vinegar, and mopane worm powder, let it cook for 10 minutes.
4. Add the crushed chilli and blend all the ingredients.

5. Serve as a deep sauce.

## Mopane worm filled potato cakes



**Figure 32:** Mopane worm filled potato cakes

### Ingredients

- 2 cups mashed potatoes
- Cup of boiled mopane worm, diced 1 onion, chopped
- 1 tomato cubed
- 1 cup all-purpose flour
- 1 onion, dice
- 1 red and green pepper diced Tsp garlic ginger paste
- 2 Tsp Royco usavi mix
- 1 egg
- 1/2 teaspoon ground black pepper
- 1/2 teaspoon salt
- 1/2 cup vegetable oil, or as needed

### Method

1. For the filling: Fry the boiled the diced mopane and add onion, garlic ginger paste and tomato. Once Tomatoes are done add the diced peppers and Royco mix.



2. Filling must not be too dry or too wet. Set aside and allow to cool down.
3. Mix mashed potatoes, flour, onion, egg, black pepper, and salt in a bowl until well combined, similar to a batter consistency.
4. Form into balls and pat them in your palm.
5. Add filling at the centre and enclose.
6. Once done, dredge with flour then drop into egg-wash and finally bread crumbs.
7. Deep fat fry in peanut oil till golden brown.
8. And drain on a paper towel.

### Mopane worm filled potato cakes



Figure 33: Mopane worm salad

### Ingredients

- Ingredients
- Half head Lettuce
  - 1 Red onion, diced
  - 800g mopane boiled and fried
  - 1 or 2 tomatoes cubed

### Mango dressing ingredients

- 2 ripe mangoes
- 2 tbsp vegetable oil 60mls lemon juice
- 1 clove of garlic crushed
- 1/4 cup mango juice
- Feta cheese to garnish

### Method

1. Layer Lettuce leaves in a salad bowl.
2. Combine cherry tomatoes, onion, and fried mopane worm, in a large bowl. Add mixture on top of the lettuce leaves.
3. In a small bowl, mix together dressing ingredients and blend till smooth.
4. Dress the salad and garnish with feta cheese.



# Emperor Moth Larvae Recipes





# Emperor Moth Larvae Recipes



Figure 34: Emperor moth larvae

### Nutritional composition

*Gyanisa maia* is highly nutritious with high protein content. Fat, ash, carbohydrates and energy (355.3 Kcal/100g) contents are also in high amounts (Figure 39). These insects have higher quantities of carbohydrates and energy on dry matter basis compared to other Saturniids such as *G. belina*.

Table 4: Nutritional composition of mopane worm

Constituent	Composition (On dry matter basis) g/100g
Protein	51.1
Fat	10.9
Ash	7.7
Carbohydrates	14.1
Crude fibre	16.2
Moisture	-



Figure 35: Emperor moth larvae relish mix



Figure 36: Emperor moth larvae relish mix label (front)



Figure 37: Emperor moth larvae relish mix label (back)

### Nutritional composition

The emperor moth larvae relish mix is a mix of emperor moth larvae powder, dried vegetable powders and spices which add flavour to cooked relish and meats. With the added edible insect powder, the relish mix adds to the flavour of the food to which it is added and the starches present help produce a thick soup.

### Ingredients

- 12g pre-cooked emperor moth larvae powder
- 30g corn starch
- 10g white sugar
- 22g salt
- 15g potato powder
- 2.5g paprika powder
- 2g garlic powder
- 2g onion powder
- 1.5g tomato powder
- 1g black pepper
- 1g coriander powder
- 0.5g turmeric powder
- 0.3g ginger powder
- 0.2g cinnamon powder

### Method

- Place the pre-cooked emperor moth larvae powder in a mixing bowl, and add sugar, salt, and seasonings (paprika powder, garlic powder, onion powder, tomato powder, black pepper powder, coriander powder, turmeric powder, ginger powder and cinnamon powder).
- Add the corn starch and potato powder to the seasoning mix, and mix well.



3. Package the relish mix in clear mylar and aluminium laminate (heat sealable) bags and store in a cool, dry place.

## Emperor moth larvae tortilla chips



**Figure 38:** *Emperor moth larvae tortilla chips*

Tortilla chips are a snack food made from corn tortillas, which are cut into triangles and then fried or baked. Corn tortillas are made of masa dough produced from nixtamalized corn, vegetable oil, salt and water, however for this product variations will be done by substituting part of the corn with Emperor moth larvae powder. The snack comes out with a crispy texture, whilst having a variety of flavours from salt and vinegar, chillies or black pepper.

### Ingredients

280g Instant Masa Flour  
 65g toasted sesame seeds  
 50g pre-processed Emperor moth larvae powder  
 95 – 100mL warm water  
 5g salt  
 2.5g nutmeg  
 2.5g black pepper  
 oil for frying (canola or vegetable)

### Method

1. In a bowl mix the dry ingredients (masa flour, Emperor moth larvae powder, salt, nutmeg and black pepper). Add water and mix until a soft dough forms. If it feels a little dry, add a teaspoon of water at a time, until you reach the desired consistency.
2. Divide dough into approximately 16 equal balls weighing approximately 45 – 50g each. Alternatively divide the dough in half, then halve each half and repeat until you have 16 pieces.
3. Roll the dough into balls and with a moist paper towel, cover them to keep the dough soft.
4. Line each side of a tortilla press with plastic wrap. Place dough in the middle and press until ball is about 12 – 15cm in diameter.
5. Heat skillet or griddle on medium high heat. Carefully peel tortilla off of plastic and cook for about 50 seconds on each side. Cover them with a cloth napkin to keep them soft and warm.
6. When cool, the tortillas can be stored in a plastic ziplock bag in the refrigerator for up to a week or in the freezer for a few months. However, to make the tortilla chips the tortillas can be used soon after cooling.

### Make Corn Tortillas Chips

1. Take the cooled tortillas and then quarter them
2. Frying of quartered tortillas using either of the following methods:
  - a) For deep frying: Fill a sauce pan with peanut oil or vegetable oil so that it is 7 cm deep in the pan. Heat oil on medium high and then slowly add the quartered tortilla pieces, one layer at a time.
    - After frying, place the tortilla chips on a greaseproof paper and allow to cool before packaging in an airtight container or package.
  - b) For air frying: brush the quartered tortillas with oil on both sides and place on the air fryer basket, one layer at a time. Air fry at 175°C for 3-5 minutes.
    - Allow the tortilla chips to cool and package in an airtight container or package them in khakhi paper with plastic lining ziplock packages.

## High protein mixed Fruit Chutney



**Figure 39:** *High protein mixed fruit chutney*

Chutney is a spicy-sweet-sour condiment made with fresh and dried fruit, sugar, vinegar and chillies. The condiment is made by slow-cooking fruits, vinegar, and spices. The combination of fresh fruit, fruit pulp and raisins are the best on chutneys. Chutney can be eaten alongside a meat platter or with a pie or with cold meats, and can even work as a marinade.

### Ingredients

1500g fresh apples  
 1300g false wild medlar fruit pulp  
 700g dried fruit mix  
 900ml red wine vinegar  
 400g white sugar  
 230g pre-processed emperor moth larvae powder  
 20ml olive oil  
 20g salt  
 15g garlic powder  
 15g ginger powder  
 15g coriander powder  
 15g chilli powder

**Method**

1. Fresh fruit pre-processing: peel and remove any stones and seeds. Cut the fruit into chunks and place into a large saucepan. Soak dried fruit mix in warm water for 10 – 15 minutes, until softer, plumper and juicier. Add the soaked dried fruit and wild medlar fruit pulp to the large saucepan.
2. Add red wine vinegar, sugar, emperor moth larvae powder, oil, spices and salt, and stir.
3. Bring the mixture to the boil and simmer without a lid until the fruit has softened and the liquid is reduced.
4. As the chutney is cooking, place the chutney bottles and lids on a baking tray and place in an oven set at a low temperature (60 °C ) for about 10 minutes to sterilise. Alternatively, place the chutney bottles and lids in an airfryer set at 150 °C and sterilise for 5 minutes or boil the bottles and lids for 10 minutes in water.
5. When the chutney is well cooked, pack the hot chutney into the hot jars to just below the top, making sure to exclude air pockets. Screw the lids onto the chutney bottles and leave to cool.
6. Store in a cool, dry place for a minimum of 2 months before using to allow for the flavours to mature.

**Note:** Sodium benzoate can be added as a preservative to the cooked chutney at a rate of 0.7g / kilogram of the finished product.

**High protein Jelly Candy**

High protein jelly candy made from indigenous fruit pulp (Indian jujube), gelatine, emperor moth larvae powder, lemon juice and sweetener. Cane sugar is used as a sweetener, together with maple syrup and the main ingredient is the indigenous fruit pulp. Introduction of the edible insect powder helps to improve the nutritional value, particularly the protein and mineral content of the jelly candy. The candy gets to have their distinct appearance, flavour and texture due to the fruit pulp that is used. These colourful fruit jellies can be cut to any size before being rolled in sugar, which is an optional step.



**Figure 40:** High protein Jelly Candy

**Ingredients**

160ml false wild medlar fruit pulp, strained if needed  
 75g granulated sugar  
 60ml water  
 37.5g unflavoured gelatine  
 30g corn syrup  
 10g pre-processed emperor moth larvae powder  
 5g citric acid  
 Food colouring, optional  
 225g superfine or caster or confectioners' sugar, optional  
 Vegetable oil cooking spray

**Method**

1. Prepare a 20 cm (8-inch) pan by spraying with vegetable oil spray
2. Pour the water into a bowl and add the gelatine, let sit for about 5 minutes to soften.
3. Place the fruit pulp, sugar, mealworm powder, and corn syrup in a medium saucepan over medium heat. Stir until the sugar dissolves.
4. Add the gelatine and continue stirring until the gelatine dissolves.
5. When the gelatine is fully dissolved, add food colouring if desired.
6. Pour the mixture into the prepared pan and leave until completely set. This will take about 4 hours in the refrigerator or overnight at room temperature.
7. When set, turn out of the pan and cut with a sharp knife or cookie cutter into desired shapes.
8. Jellies are served plain.
9. Package the high protein fruit jelly candy in an airtight PET plastic container or use polypropylene plastic bags.

**Note:** Instead of pouring mixture into a baking tray, a silicon mould can be used which has various shapes and saves time.

**Chapati filling**

**Figure 41:** Cricket chapati served with beef and emperor moth larvae filling

**Ingredients**

500g pre-boiled beef steak cut into strips  
 500g pre-processed Emperor moth larvae powder  
 Onions sliced  
 1 tsp Chicken spice  
 1 tsp BBQ spice  
 1 tsp Cumin

**Method**

1. Cut the pre-cooked steak into strips.
2. Add the Emperor moth larvae powder, onion, and spices (chicken, barbeque and cumin). Fry until onion has wilted down.
3. Assemble the chapati by spreading mayonnaise, top with the prepared filling, garnish and serve.



## Baobab and Emperor Moth Larvae Juice



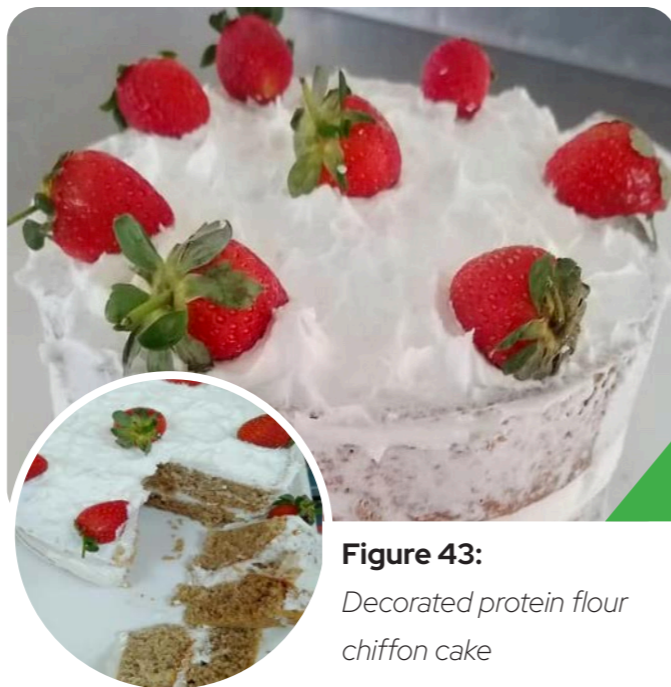
**Figure 42:** Baobab and Emperor Moth Larvae Juice

### Ingredients

- 300ml mango juice
- 40g baobab powder
- 40g Emperor moth larvae powder

### Method

1. Mix mango juice, baobab powder and Emperor moth larvae powder.
2. Shake well.
3. Allow to sit overnight and chill in the refrigerator.



**Figure 43:** Decorated protein flour chiffon cake

### Ingredients

- 1 cup flour self-raising
- 1 cup pre-processed Emperor moth larvae powder flour
- 1 1/2 cup sugar divided
- Vanilla essence
- 60ml water
- 60ml oil
- 4 eggs, separated

### Method

1. Preheat oven to 160°C. Add cake flour and cricket flour, and half the sugar in a bowl.
2. Make a well at the centre and add oil, egg yolks, water, vanilla essence and mix well.
3. Whisk egg white and the remaining half of the sugar till stiff.
4. Fold into the cake batter, pour the batter into a greased and lined cake tin.
5. Bake at 160°C for 15- 20 minutes.

# Soldier Termites Recipes





# Soldier Termite Recipes

## Know your food

Termites are probably the most widely consumed insects in Zimbabwe. Termites are medium sized, social insects comprising approximately 2600 species worldwide. They live in highly organized and integrated societies, or colonies, with the individuals differentiated morphologically into distinct forms or castes namely the workers, soldiers, winged reproductive, the king and the queen.

## Termite castes

### Reproductives and the queen

The reproductive function in the termite society is carried out by the primary reproductives, the king and the queen; most commonly one pair in a colony. These develop from fully winged. The winged reproductives from which the king and the queen develop are produced in large numbers seasonally and migrate from parent colonies at the beginning of the rain season every year. They leave the colony in a swarming or colonizing flight, shed their wings along a basal suture, and, as individual pairs, seek a nesting site, mate and establish new colonies. In some species only one emergence occurs each year while in others there are many swarms.

In the initial stages of colony foundation, the reproductives feed the young and tend the nest, but these household duties are soon taken over by the young nymphs and workers. If it happens that the king and queen die or part of the colony is separated from the parent colony, supplementary reproductives develop within the nest and take over the function of the king and queen.



**Figure 44:** Winged reproductive adults shedding wings. Within 24 hours after emergence, insects move in pairs and mate.

The queen develops from the female primary reproductive and gradually develops an enlarged abdomen (Figure 33). Her primary purpose is to lay eggs and depending on the circumstances in the colony, she can either lay fertilized or unfertilized eggs to give rise to reproductives, workers and soldiers.



**Figure 45:** The queen with an enlarged abdomen surrounded by the king, worker and nymph. The enlarged abdomen is composed of fat tissues and egg sacs.

### Workers

The worker caste is made up of both sexes which are sterile, wingless, blind and polymorphic. The workers are usually the most numerous individuals in the colony (Figure 50). They are pale and soft-bodied, with mouthparts adapted for chewing. They perform most of the work of the colony: nest building and repair, foraging, feeding and grooming the other members of the colony. The worker caste causes most of the degradation of wood and grasses and in the process performs an ecologically useful function of nutrient recycling.



**Figure 46:** Termite workers building a nest. Members of this caste are small with brownish heads and big abdomens relative to their body side.

**Table 5. Nutritional composition of majuru**

Constituent	Composition (On dry matter basis) g/100g
Protein	46.5
Fat	27.6
Ash	4.9
Carbohydrates	0.9
Crude fibre	2.8
Moisture	-



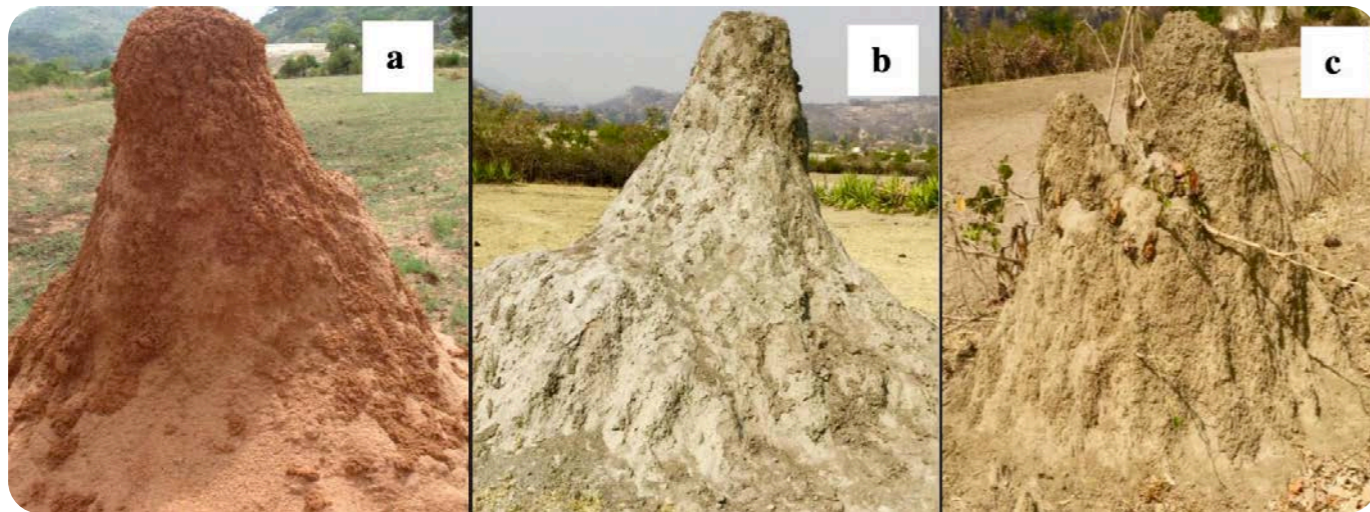
## Hunting And Gathering Your Own Food

### Harvesting

#### Soldier termites

The best harvests for soldier termites in Zimbabwe are made in spring or just before the summer season from September to November. During this period, the worker termites are active in building mounds for protection of the colony during the rainy season. Correspondingly there is increased population of soldiers that are required to protect the colony.

Fresh soil deposits on termite mounds (Figure 47 a-c) give indications that an anthill is active and likely to have many soldier termites on guard. Some termite species do not build mounds (subterranean species), and harvesting sites are normally identified by locating small openings to the galleries termed "hwendedza" in "shona" language (Figure 36). Some special skill is required to locate these openings.



**Figure 47:** Active termite mounds with fresh soil deposits. Mounds with fresh deposits are considered more suitable for harvesting soldier termites. Additionally, termite mounds exist in different colours depending on the soil characteristics of the location. Experienced gatherers can use properties of termite mounds to predict the quality and quantity of soldier termites.

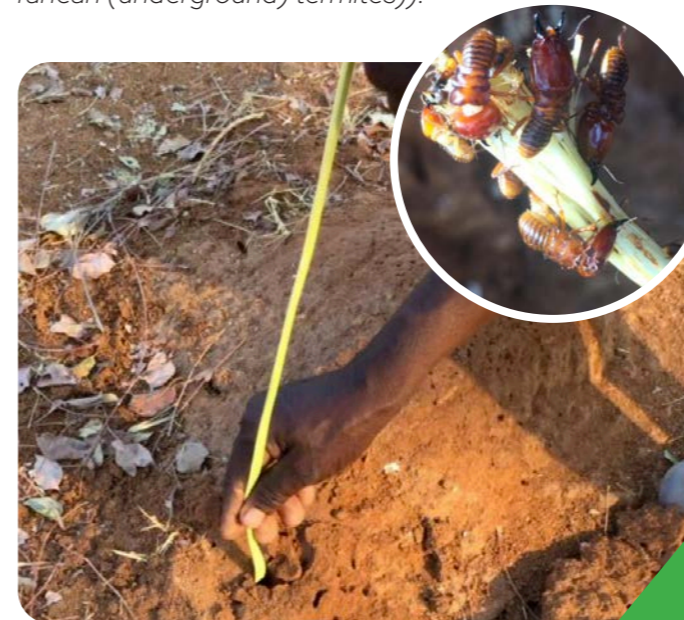
Soldier termites are trapped from the mounds by placing grass rods in the galleries (Figure 48). The introduction of the grass rods stimulates soldier termites to release a defence chemical, which is diffused to the whole colony. This presumably triggers a collective defensive action among the soldier termites which results in unilateral attack of the foreign grass rod. Soldier termites get trapped as they are unable to unlock their mandibles from the succulent grass rod (Figure 49).

In some communities, specific plant species in the family Cyperaceae are used as grass trapping rods. In the south-eastern districts of Zimbabwe, the species *Cyperus involucratus*, which grows in wetlands can be used to trap termites in wet (Figure 51, 52) or dried form. In some communities they are termed "nhokwe" in shona language. In other communities, strips of fleshy sisal plants are used in place of *C. involucratus*.

It is believed that plant compounds from these two species aid in eliciting defensive action of the soldier termites. Some gatherers enhance the amount of termite harvests by applying small amounts of ground tobacco in the galleries. This is presumed to agitate the soldiers and thus enhance the trapping process.



**Figure 48:** Entrance to a termite gallery "hwendedza" for species that do not build termite mounds (subterranean (underground) termites)).



**Figure 49:** Soldier termites trapped on a fleshy grass rod.

**Figure 50:** Succulent sisal rods being inserted into a termite gallery. **Caution:** Injuries can be inflicted to the hands due to bites by the soldier termites which guard the gallery entrances. It is recommended to wear protective gear such as thick woollen or canvass gloves.



**Figure 51:** *Cyperus involucratus* growing in close proximity to a water pond



**Figure 52:** Rods without florets ready for use in trapping termites



**Figure 51:** Harvested termites should be collected in aerated woven baskets or open plastic containers before processing for consumption.



### Preparation for cooking

Termites are first washed to remove soil and dirty particles before boiling. In most cases the insects are sun or air dried (Figures 53). In other instances, soldier termites are ground into fine powder before consumption to minimise damage to the softer inner parts of the mouth by the termite's sharp mandibles. Grinding also ensures ease of consumption by children and the elderly. Spices can also be added to improve taste.



**Figure 54:** Through indigenous knowledge systems local consumers have mastered the skill of harvesting edible insects. The queen termite is consumed for specific rituals and specialised skills are required to capture it from termite mounds which are usually heavily guarded by the biting soldier termites.



**Figure 53:** Sun dried soldier termites are stored in aerated woven wooden trays.

### Traditional recipes

Termites can be fried or roasted without fat and eaten as snacks and are widely used as a relish during the dry periods when indigenous vegetables are scarce. In addition, termite powders can be used to fortify porridge for feeding infants and the elderly.

### Traditional recipes

*Termites in peanut butter source*



**Figure 55:** Traditional processing of termites above and below



### Termite porridge



**Figure 56:** Ingredients for termites in peanut butter



**Figure 56:** Termites in peanut butter sauce

**Figure 57:** Soldier termites relish mix label (front)

**Figure 58:** Soldier termites relish mix label (back)

### Modern termite recipes

Soldier termites relish mix





## Soldier termites relish mix

Soldier termites are one of the highly consumed edible insects and is particularly rich in protein, iron, zinc and many other essential nutrients. With this in mind, they are a good addition in a variety of products to improve their nutritional quality. A relish mix is a mix of dried vegetable powders and spices which add flavour to cooked relishes and meats. Most relish mixes have thickeners so they help produce a thick sauce and add flavour from their top notes.

### Ingredients

- 12g pre-cooked soldier termite powder
- 30g corn starch
- 10g white sugar
- 22g salt
- 15g potato powder
- 2.5g paprika powder
- 2g garlic powder
- 2g onion powder
- 1.5g tomato powder
- 1g black pepper
- 1g coriander powder
- 0.5g turmeric powder
- 0.3g ginger powder
- 0.2g cinnamon powder

### Method

1. Place the pre-cooked soldier termite powder in a mixing bowl, and add sugar, salt, and seasonings (paprika powder, garlic powder, onion powder, tomato powder, black pepper powder, coriander powder, turmeric powder, ginger powder and cinnamon powder).
2. Add the corn starch and potato powder to the seasoning mix, and mix well.

3. Package the relish mix in clear mylar and aluminium laminate (heat sealable) bags and store in a cool, dry place.



Figure 59: Soldier termites relish mix

## Termite Snack bars

A snack bar is an inexpensive counter food that can be eaten in-between main meals. The most commonly perceived benefits of snack bars are their high fiber content, antioxidant components, vitamins and minerals, and high-quality protein content. Snack bars provides a boost of energy if several hours pass between meals and blood glucose level drops. Soldier termite snack bars will contain a high level of protein, thanks to the natural crushed soldier termites added. The dry fruits and the roasted seeds will give the natural sweetness, flavour and chewy texture to help balance the energy bar. The snack bar will help curb your appetite to prevent overeating at the next main meal.



Figure 60: Termite Snack bar

### Ingredients

- 125g roughly chopped nuts like almonds, walnuts, pecans, peanuts or a mix
- 50g sunflower seeds
- 50g pumpkin seeds
- 50g sesame seeds
- 50g mixed dried fruits (raisins / sultanas)
- 50g pre-processed soldier termites, crushed
- 25g Indian Jujube fruit, dried peel and pulp
- 150g honey
- 2g salt
- 1.25g ground cinnamon (optional)

### Method

1. Pre-processing steps: Pre-heat the oven to 176 °C in an oven for 10-15 minutes. Spread the nuts, sunflower seeds, pumpkin seeds, and sesame seeds on a rimmed, ungreased baking sheet. Toast in the oven until the sesame seeds looks lightly golden and the nuts are toasted and fragrant, about 10 minutes, stirring once halfway through. Reduce the oven temperature to 150 °C.

2. Line a 20 – 25cm (8- or 9-inch) square baking dish with parchment paper so that two sides of the paper overhang the sides like handles. Coat generously with nonstick spray.
3. Meanwhile, heat the honey in a medium saucepan over medium heat. Remove from the heat. Stir in the cinnamon and salt.
4. As soon as the nut/seed mixture is finished toasting, carefully transfer it to the pan with the honey, and mix to combine with a rubber spatula. Let cool for 5 minutes.
5. Scoop the batter into the lined baking pan. With the back of a spatula, press the bars into a single layer.
6. Bake the snack bars for 15 to 20 minutes: baking for 15 minutes yields a slightly chewy bar, whilst baking at 20 minutes will yield crunchier bars.
7. When the bars are baked to desired consistency, cut the bars to desired sizes using a knife. Press a knife down into the pan to cut into bars, typically cut into 2 rows of 5. Do not remove the bars. Let them cool completely in the pan.
8. Use the parchment paper to lift the bars out of the pan onto a cutting board. Use a sharp knife to cut the bars again in the same place, going over your lines in order to separate them completely.

- Package the snack bars into a bar wrappers or bar packaging which are made of composite film material. Store in a cool, dry place.

### Soldier termite crackers

An addictive savoury snack that can be served with different toppings including combinations such as avocado, tomato, feta and olive oil. The crackers are high in protein due to the crushed soldier termites added, and as well high in mineral elements such as zinc, iron and potassium. These crackers have a great crunch to them and are more rewarding and fun to make.



Figure 61: Soldier termite crackers (above and below)

### Ingredients

85g masa flour  
10g pre-processed, minced soldier termites  
65g sunflower seeds  
60g pumpkin seeds  
35g sesame seeds  
175ml water  
30ml (2 Tbsp) olive oil 5g (1 tsp) salt  
2.5g (1 tsp) black pepper  
1.25g (1/2 tsp) onion powder

### Method

- Preheat oven to 170°C and place parchment paper over two trays.
- Using a food processor mix together all of the dry ingredients.
- Place dry ingredient mixture into a bowl and mix in water and olive oil to make a dough.
- Place half the mixture onto each tray and roll out thinly between 2 sheets of baking paper.
- Cut the mixture into triangles roughly.
- Bake in the oven for 30 minutes or until crispy, flipping crackers over halfway through and brushing with olive oil.
- Once the crackers are fully baked, leave them to cool completely, and package them in khakhi paper with plastic lining ziplock packages. Store them in cool, dry place.

### High protein fruit roll-ups

A four-ingredient recipe which is simple and delicious way to make your own high protein fruit leather with the simplest equipment. With the presence of the Indian jujube fruit pulp, the fruit roll-ups are a good source of vitamin C and minerals such as copper, magnesium, and potassium. On top of that, the roll-ups contain crushed soldier termites which contains high protein content and as well improving on the mineral content of the product. The fruit pulp adds to the chewy texture and natural flavour of the roll-ups, together with the crushed soldier termites, whilst the honey adds to the sweetness of the product without affecting the mouthfeel.



Figure 62: High protein fruit roll-ups

### Ingredients

350g Indian jujube fruit pulp and peels  
50g honey  
45ml lemon juice  
20g pre-processed crushed soldier termites

### Method

- Blend the fruit of choice using a blender or food processor until smooth with small peel chunks. For multi-fruit varieties, the fruits can be blended separately first before being combined before addition of other ingredients.
- Add the lemon juice, honey and crushed soldier termites to the blended fruit. Blend together all the ingredients until smooth. The sweetness and taste can be adjusted based on preference.
- Line a baking sheet with parchment paper. Spread the blended fruit mix to a 0.3 – 0.6 cm thickness.
- Dehydrate the spread fruit mix in a preheated oven at 60 – 75 °C for 4-6 hours, or until the middle is not sticky. The time will vary according to the temperature used and the type of fruit pulp used. The fruit leather should look and feel dry whilst still being pliable.
- Allow the dehydrated fruit leather to cool before cutting with clean scissors, a pizza cutter or sharp knife into 2cm strips. Roll the leathers whilst still connected to the parchment paper.
- Package the fruit leathers in laminated aluminium foil packages. Store in a cool, dry place, or refrigerate or freeze to keep for longer.



**Note:** Other exotic fruits such as blueberries, strawberries, peaches, nectarines and berries can be used in place of the indigenous fruits mentioned above. For the purpose of blending with the insect powder, darker coloured fruits are more preferable.

## Termite Flour East African Chapati



**Figure 63:** Termite Flour East African Chapati

### Ingredients

- 1 cup Flour
- Oil and water
- 1/4 cup termite
- 1 tbsp. sugar
- 2 tbsp cooking oil
- 1 tsp salt

### Method

1. Put all dry ingredients into a bowl, and make a well on the centre.
2. Add wet ingredients - olive oil and water, and mix to a dough.
3. Turn the dough onto a floured surface.
4. Knead until smooth for about 10 minutes.

5. Rest for 10 - 30 minutes or overnight.
6. Divide the dough into 6 evenly sized balls.
7. Roll it out into a flat bread. and heat pan and toast the flat bread.
8. When it bubbles on top, flip over and toast for a minute.
9. Oil the side you have flipped using a brush.

## Termite-tuna benedict



**Figure 63:** Termite-tuna benedict

### Ingredients

- 1 Croissants
- 2 poached eggs
- 300 mls hollandaise sauce
- Salt and pepper to taste
- Small tin tuna
- 300g termites roasted

### Method

1. Cut croissants in half.
2. Put a layer tuna and termites.
3. Add poached egg and hollandaise on top.
4. Garnish and serve.

## Angel eggs

### Ingredients

- 5 eggs, hard boiled
- 2-3 tbsp mayonnaise
- Handful of termites, toasted
- Salt and pepper to taste

### Method

1. Cut croissants in half.
2. Put a layer tuna and termites.
3. Add poached egg and hollandaise on top.
4. Garnish and serve.

## Angel eggs



### Ingredients

- 5 eggs, hard boiled
- 2-3 tbsp mayonnaise
- Handful of termites, toasted
- Salt and pepper to taste

### Method

1. Boil eggs and cut half lengthwise.
2. Remove egg yolks and place in a bowl.
3. Add termites and mayonnaise, salt and pepper.
4. Mash ingredients until smooth.
5. Place the egg yolk paste in a piping bag. Pipe into the egg whites, garnish with black olives. Serve



## Non-vegan protein mix powder

### Ingredients

500g mealworm  
500g Termites  
500g Cricket powder  
Emperor moth larvae powder (Optional)  
250ml milk powder

### Method

1. Mix all ingredients in a bowl and sieve.
2. Store in an airtight container.
3. Can be used in shakes or alone with milk or water

### Serving suggestions

300ml water or milk  
4tbsp protein shake

## Protein mix shake



Figure 63: Non-vegan protein shake

### Ingredients

3tbsp protein mix  
300ml plain yoghurt

300ml plain water or milk  
strawberries

### Method

1. Blend all ingredients and serve.



## Ground Crickets Recipes





# Ground Crickets Recipes



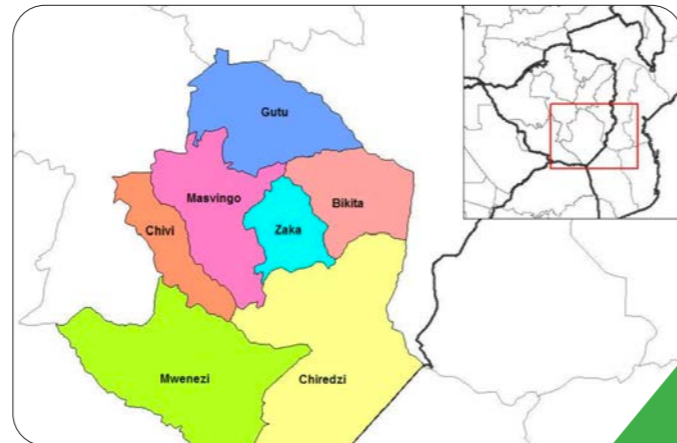
**Figure 64:** Adult *Henicus whellani*

### Method

Edible ground crickets are highly nutritious with high contents of protein, ash and fibre (Figure 64). The energy content is considerably high (263.3 Kcal/100 g) and comparable to levels of other edible insects. Higher ash content gives strong indications of rich mineral composition. This is expected as these insects feed on soil and large plant organic matter. They are however low in fat and this aids in prolonging shelf life. Energy content is also lower compared to insects with higher body fat such as termites.

Constituent	Composition (On dry matter basis) g/100g
Protein	53.6
Fat	4.3
Ash	13.4
Carbohydrates	4
Crude fibre	10.6
Moisture	14

**Table 6:** Nutritional composition of Ground Crickets



**Ground crickets:** Where to find the ground crickets?

**Figure 65:** Map showing the south-eastern districts of Zimbabwe. Ground Crickets are harvested and consumed in Bikita and Zaka districts in areas with a general altitude > 1000 m and microhabitats with annual rainfall of 650-1000 mm. Hunting your own food: the sighting that brings glory to the dining table; the tale of *nhutururu* and its significance in gathering ground crickets

Edible ground crickets live in shallow burrows with an open entrance (Figure 50). The entrance to the burrow is built in a manner that is unique to this group of insects. One male can residewith four or more females in one burrow (polygamous nature) (Figure 51) and never can two males reside in the same burrow.



**Figure 66 :** Entrance to Ground Cricket gallery (*nhutururu* in shona language). The opening is carefully shaped, compacted and smoothed to give a characteristic appearance for this insect group. Appearance of gallery entrances is unique to these insects and can be used as indicators of their presence during harvesting.



**Figure 67:** Ground Crickets emerging from an excavated burrow. One male can be found residing with more than four females in the same burrow. A hand held hoe or shovel can be used for excavation. Burrows are shallow and approximately less than 30 cm in depth, hence less effort is required for excavation

### Harvesting

Excessive rains cause flooding of the Edible ground cricket burrows prompt their outward movement. In rainy weather conditions, adult crickets are hand-picked as they migrate from their burrows. This method however, results in small quantities of insects being harvested and is dependent on probabilistic insect searches in grass velds. However, the method does not result in destruction of burrows where immature stages and eggs are housed. Therefore sustainability is assured as there is allowance of perpetuation of non-harvested cricket populations.

In dry weather conditions, gatherers locate position of cricket burrow using their unique appearance which can be excavated using a shovel or hand held hoe. Once burrows are excavated and insects are exposed, a wooden stick can be used to agitate and forcibly remove the crickets from their residence. More insects can be harvested using this method compared to fortuitous hand picking in rainy weather conditions. An individual can harvest more than 200 adults in a day as more than one adult cricket can be found in a gallery.



**Figure 68:** Removal of crickets from a burrow. A wooden stick is used instead of bare hands to minimise injury that can be inflicted by biting males.



**Caution:** Males have powerful jaws that can inflict painful bites. These insects should be handled with protective gear such as gloves. The male Ground Crickets tend to be cannibalistic; it is important to process for cooking gathered insects as soon as possible preferably within 2 hours of collection.



**Figure 62:** Harvested edible ground crickets bulked during harvesting.

### Preparation for cooking

Ground crickets are slaughtered by removing the entire gut through the back end of the abdomen. Care is taken to retain eggs within the bodies of gravid females as these are considered a delicacy. On the other hand folklore beliefs suggest that male edible ground crickets "gononóno" contain special compounds that boost stamina and vitality if consumed by men; probably due to the polygamous nature of Ground Cricket males.

De-gutted insects should be thoroughly rinsed with cold water to remove soil and undesirable foreign substances. This process is important if the desired flavour in the final product is to be obtained. Unwashed gut contents can give rise to off-flavours and bad odours and can affect the taste of the insects.

The final process of preparing crickets for consumption involves boiling with salt and water until cooked. Various methods are used depending on the intended time of consumption. For immediate consumption, boiled insets can be roasted in a small amount of fat or without fat until they become crispy dry. If long term storage is intended, boiled insects can be sun dried and stored in a cool dry place (Figure 62).



**Figure 63:** Roasted Ground Crickets prepared for storage. Excess salt can be added to deter microbial growth and prolong the shelf life. Insects can be preserved in this way for more than three weeks.

### Traditional recipes

Ground crickets are used as a relish in most communities in south-eastern districts of Zimbabwe. They are served with cereal based diets and can also be served as a side dish for main meals.

## Ground cricket crackers



**Figure 64:** Ground cricket crackers

A healthy snack made using finger millet flour, wheat flour, and enriched with ground cricket flour to boost the nutrient content. The ground cricket crackers are crunchy snacks not only served as fun treats for all age groups and a means to satisfy cravings between meals. As multi grain crackers, they are one such "grab and go" snacks to have on hand. Instead of baking them, one can also deep fry the crackers. Because of the finger millet and ground crickets used, the crackers are rich in calcium, iron, B vitamins, polyphenols and dietary fibre. This gives the product antidiabetic, antioxidant, and antimicrobial properties.

### Ingredients (Gives approximately 3 dozen crackers)

50g finger millet flour  
60g whole wheat flour  
10g ground cricket powder  
1.875g (3/4 tsp) baking powder  
10g butter  
2.5g (1 tsp) freshly crushed black pepper  
5g (1 tsp) salt  
1.875g (1 tsp) mixed herbs (rosemary or thyme)  
120 – 240ml water

### Method

1. Dry roast the finger millet flour in a wok for 4-5 minutes on a low to medium flame. This is to remove its raw smell and muddy taste. Keep stirring continuously with a spatula, so as to avoid the finger millet flour from burning.
2. Allow the finger millet flour to cool down, and in a bowl mix the roasted finger millet flour, whole wheat flour, ground cricket powder, baking powder, salt, pepper powder, and mixed herbs.
3. Rub the butter into the flour mixture, until it resembles bread crumbs. Add water and knead the dough to form a ball, and set the dough aside for 10 minutes.
4. Pinch out some of the dough to make a small ball and roll out very thin chapati without using any flour for rolling. Roll directly on parchment paper to avoid them from sticking.
5. Once rolled out, poke all over with fork (this is to avoid the crackers from puffing) and using a knife / pizza cutter divide it into triangles / diamonds / squares or any other desired shape. Repeat the same for rest of the dough.
6. Pre-heat the oven to 190 °C for 15 minutes. Arrange the cut dough on a greased baking tray and bake at 180 °C for 8-15 minutes. The baking time depends on the thickness of rolled out dough.



7. Once done baking, leave the crackers to cool completely. The crackers will turn crispy only once they have cooled completely.
8. Package the crackers in khakhi paper with plastic lining ziplock packages. Store them in air tight container.

### High protein jelly candy

High protein jelly candy made from indigenous fruit pulp (wild loquat fruit), gelatine, edible insect powder giant cricket powder, lemon juice and sweetener. Cane sugar or honey can be used as sweeteners and the main ingredient is the indigenous fruit pulp. Introduction of the edible insect powder helps to improve the nutritional value, particularly the protein and mineral content of the jelly candy. Artificial colours may be added to help the candy to have their distinct appearance, flavour and texture. These colourful fruit jellies can be cut to any size before being rolled in sugar, which is an optional step.



**Figure 65:** High protein berry jelly candy

### Ingredients

160ml smelly-berry fingerleaf fruit pulp, strained if needed  
 75g granulated sugar  
 60ml water  
 37.5g unflavoured gelatine  
 30g corn syrup  
 10g pre-processed ground cricket powder  
 5g citric acid  
 Food colouring (deep purple), optional  
 225g superfine or caster or confectioners' sugar, optional  
 Vegetable oil cooking spray

### Method

1. Prepare a 20 cm (8-inch) pan by spraying with vegetable oil spray.
2. Pour the water into a bowl and add the gelatine, let sit for about 5 minutes to soften.
3. Place the juice, sugar, ground cricket powder, and corn syrup in a medium saucepan over medium heat. Stir until the sugar dissolves.
4. Add the gelatine and continue stirring until the gelatine dissolves.
5. When the gelatine is fully dissolved, add food colouring if desired.
6. Pour the mixture into the prepared pan and leave until completely set. This will take about 4 hours in the refrigerator or overnight at room temperature.

7. When set, turn out of the pan and cut with a sharp knife or cookie cutter into desired shapes.
8. Jellies are served plain.
9. Package the high protein fruit jelly candy in an airtight PET plastic container or use polypropylene plastic bags.

**Note:** Instead of pouring mixture into a baking tray, a silicon mould can be used which has various shapes, and saves time.

### Ground cricket in garlic and butter sauce



**Figure 66:** Ground cricket in garlic and butter sauce

### Ingredients

1800g prawns  
 800g ground crickets  
 1 Onion  
 3 cloves garlic  
 200g butter

### Method

1. Melt butter in a pan.
2. Add the prawns and Emperor moth larvae toss until cooked.
3. Add onions and garlic.
4. Toss again with butter and serve.





## Giant Sand Cricket Recipes

## Giant Sand Cricket Recipes

### Hunting expeditions and kitchen stories

#### Harvesting/gathering

The sand cricket's presence is indicated by a small heap of soil (mount) pushed out from its burrow. Adults are gathered from their burrows by excavation. This is a tedious process and an individual can barely harvest more than 100 adult insects in a day. In most instances, only one adult can be found in a burrow or tunnel. One can also use the natural enmity that exists between this giant cricket and its natural enemy the stinging ant *Pachycondyla senaarensis* "Gangemukange" in shona language. If introduced into the cricket gallery, the ant naturally drives the crickets out of burrows. At the peak of adult activity (February- March), crickets can be trapped during the night by tracing mate-calling sounds produced by males. Adults can be lured out of their burrows using a light source. This process may also be aided by blocking the entrance to the burrows.

#### Preparation for cooking

Degutting is carried out by piercing the abdominal ends of crickets. Soil and gut contents should be washed with running water. Crickets can be boiled for 15 to 20 minutes in water and salt. Insects treated this way may be stored for 2- 3 days before consumption. However, if immediate consumption is preferred, crickets can be cooked for 15 to 20 minutes and roasted or fried until they are crispy dry.

#### Indigenous recipes

Giant Sand Crickets are used as relish in most communal areas of Zimbabwe. They can be used to accompany cereal based meals. Some communities detach the enlarged hind legs, grind into a fine powder and use to feed infants and the elderly.



**Figure 67:** Cricket chapati served with beef and emperor moth larvae filling

Constituent	Composition (On dry matter basis) g/100g
Protein	53.4
Fat	15.8
Ash	6.0
Carbohydrates	15.1
Crude fibre	5
Moisture	14

Energy 454.7 kcal/100g

**Table 7:** Nutritional composition of Giant Sand Crickets

The Giant Sand Cricket is rich in protein and carbohydrates (Figure 67). Although not very high in fat content, the corresponding energy level is above 350 Kcal/100g.



## Chocolate coated crickets



**Figure 68:** *Chocolate coated crickets*

### Ingredients

500g dark cooking chocolate melted on a double boiler  
750g salted cricket.

### Method

1. Use a double boiler to melt the chocolate, or microwave the chocolate for 30 second intervals, stir after every interval until the chocolate has melted.
2. Dip the salted Crickets, lift and allow excess chocolate to drop back into bowl.
3. Place Crickets on a baking paper.
4. Repeat till all Crickets are coated.
5. Serve with fresh strawberries for a delightful snack or dessert.

## Cricket muffins



**Figure 70:** *Cricket muffins*

### Ingredients

1 1/4 cup all-purpose flour  
1/2 cup cricket powder  
3/4 cup granulated sugar  
1/4 cup dutch processed cocoa powder  
1/4 teaspoon salt  
3/4 teaspoon baking powder  
3/4 teaspoon baking soda  
1/2 cup milk of choice (regular or vegan)  
1 Tablespoon vinegar  
1/4 cup canola or sunflower oil  
1 teaspoon vanilla extract  
6 Tablespoons water

### Method

1. In a large bowl add all dry ingredients.

2. Pour the milk, vinegar, oil, water and vanilla extract into the dry ingredients. Combine until the cupcake batter is smooth and there are no lumps.
3. Fill the cupcake liners until they're 3/4 full.
4. Bake 180°C for 15 min.



# Mandere recipes (White grub) *Eulepida mashona*



## White Grub Recipes



**Figure 71:** White grub – mandere

Constituent	Percent composition on dry matter basis. (g/100g)	
	Dried un-cooked insects (mean %)	Insects cooked for 30 minutes (mean %)
Protein	62.4	60.1
Fat	7.9	7.8
Ash	3.0	2.9
Carbohydrates	0.7	0.7
Crude fibre	25.4	24.6
Energy (kcal/100g)	324.9	304.6

**Table 8:** Nutritional composition of white grub

### Where to find mandere

Beetles fly at dusk and early evening at the beginning of the rainy season, and are attracted to light at night (Blair, 1990). During the day the chafers hide under clods of soil and litter. Females are generally bigger than males although this is not a reliable way of differentiating sexes.

### Harvesting/gathering

Beetles can be harvested from aggregation sites (tree branches) by knocking them off branches where they patch using vigorous force and hand picking. In hot weather, beetles are highly mobile and fly away at the slightest disturbance. The best way to harvest in hot weather is by climbing trees and shaking the patched beetles from close range into plastic containers where they are not able to escape. Adults are attracted to light and hence can also be trapped at night using light traps. It is important to keep the beetles aerated and alive after collection as dead insects have a short shelf life. Beetles should be processed for consumption within five (5) hours after harvest to ensure quality is preserved.



**Figure 73:** *Brachyteria spiciformis* L. (musasa) tree – host plant for the white grub

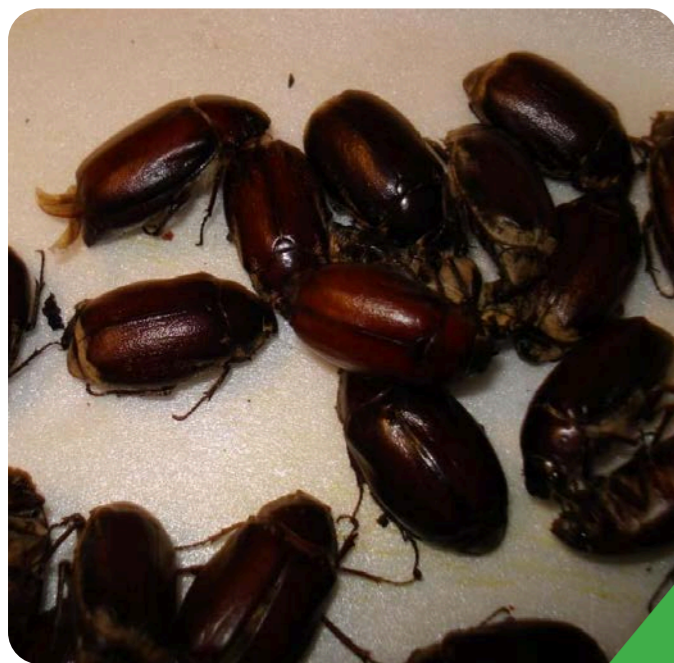


**Figure 74:** Adult white grub aggregated on a small tree branch



### Traditional recipes

After boiling, beetles can be fried or roasted until they become deep brown or blackish in colour and crispy (Figure 74). The elytra (hard fore/outer wings) and the hind wings are normally removed during consumption. However, this aspect is subject to scientific investigations. Fried/ roasted chafer beetles are mostly consumed as snacks during traditional beer drinking occasions. Various methods can be used to preserve traditionally prepared insects. These include air drying, salting and storage in dry places. Using these preservation techniques, insects can be stored for a maximum of one week. The lesser the moisture content in the insects, the longer the shelf life or storage period for the insects.



**Figure 75:** *Roasted chafer beetles ready for consumption. Beetles should be fried or roasted until they become deep brown or blackish in colour and crispy.*

### Eggless chafer small cakes



**Figure 76:** *Eggless chafer small cakes*

#### Ingredients

1 1/4 cup all-purpose flour  
 1/2 cup chafer beetle powder  
 3/4 cup granulated sugar  
 1/4 cup dutch processed cocoa powder  
 1/4 teaspoon salt

3/4 teaspoon baking powder  
 3/4 teaspoon baking soda  
 1/2 cup milk of choice (regular or vegan)  
 1 Tablespoon vinegar  
 1/4 cup canola or sunflower oil  
 1 teaspoon vanilla extract  
 6 Tablespoons water

#### Method

1. In a large bowl add all dry ingredients
2. Pour the milk, vinegar, oil, water and vanilla extract into the dry ingredients. Combine until the cupcake batter is smooth and there are no lumps.
3. Fill the cupcake liners until they're 3/4 full.
4. Bake 180°C for 15 min.





## Bullet Beetle Recipes



### Bullet beetle Recipes



**Figure 77:** *Bullet Beetles*



**Figure 78:** *Bullet Beetle*

#### *Where to find Bullet Beetles*

Adults are found on flowers, leaves, tree trunks, and stumps and logs in full sunlight. Dead or drying trees and freshly cut wood will attract these beetles.

#### Bullet beetle small cakes



**Figure 79:** *Bullet beetle small cakes*

#### Bullet beetle small cakes

##### **Ingredients**

1 1/4 cup all-purpose flour  
 1/2 cup bullet beetle powder  
 3/4 cup granulated sugar  
 1/4 cup dutch processed cocoa powder  
 1/4 teaspoon salt  
 3/4 teaspoon baking powder  
 3/4 teaspoon baking soda  
 1/2 cup milk of choice (regular or vegan)  
 1 Tablespoon vinegar  
 1/4 cup canola or sunflower oil



1 teaspoon vanilla extract

6 Tablespoons water

#### Method

1. In a large bowl add all dry ingredients.
2. Pour the milk, vinegar, oil, water and vanilla extract into the dry ingredients. Combine until the cupcake batter is smooth and there are no lumps.
3. Fill the cupcake liners until they're 3/4 full.
4. Bake 180°C for 15 min.

### Bullet beetle madeira cake



Figure 80: Bullet beetle madeira cake

#### Ingredients

100g Margarine or butter 100g Sugar

2 small Eggs

150g Self raising flour

50g Bullet beetle, powdered

1 tablespoon Milk

1 teaspoon flavouring (orange or lemon or vanilla)

#### Method

1. Heat oven to 170°C/150°C fan/gas. Butter and line the base of a 900g loaf tin with greaseproof paper.

2. Cream Margarine and sugar till light and fluffy.
3. Add eggs one at a time and mix.
4. Add dry ingredients until you have a thick batter.
5. Now add the powdered bullet beetle.
6. Lastly, add the wet ingredients and mix well. The batter should be loose enough to fall off a wooden spoon, if it is not, add some extra milk.
7. Tip the batter into the tin and smooth over the top. Bake for 35 min or until a skewer inserted in the middle comes out clean.
8. Remove from the oven then leave to cool for 15 mins then remove from the tin, peel away the paper and leave on a wire rack to cool completely before slicing.



## Farmed Insect Recipes

# Recipes





# Farmed Insects

## Field crickets

### Nutritional composition

The remarkable nutritional component of *A. domesticus* is carbohydrate (Table 8) which is found in larger proportions compared to most other edible insects in Zimbabwe. Fat, crude fibre and energy (362.3 Kcal/100g) are also in good proportions. However, the protein content is relatively low compared to other edible cricket species.



Figure 81: Field cricket

Table 9: Nutritional composition of House Crickets

Constituent	Composition (On dry matter basis)
Protein	22
Fat	10.8
Ash	12.6
Carbohydrates	47.2
Crude fibre	7.4
Moisture	0
Energy	454.7 kcal/100g

## House Cricket Snack bars

*Masking the earthy cricket flour with the sweet flour from nzvirupesu*

A snack ideal when you are hitting the gym or just need a snack that will keep you feeling satisfied all day long. Cricket snack bars are high in fiber content, antioxidant components, vitamins (especially B vitamins such as vitamin B12) and minerals, as well as high-quality protein content. The dry fruits and the roasted seeds will give the natural sweetness, flavour and chewy texture to help balance the snack bar, whilst the wild loquat fruit powder will help introduce a new and unique flavour.



Figure 82: Cricket snack bar fresh out of the oven



Figure 83: False wild-medlar fruit (*nzvirupesu*):

## Ingredients

- 125g roughly chopped nuts like almonds or pecans, or a mix
- 50g sunflower or pumpkin seeds, or mixed
- 50g rice flakes
- 50g sesame seeds
- 50g dried fruit (raisins, sultanas, or cranberries)
- 40g pre-processed crickets, crushed
- 25g false wild-medlar fruit powder
- 150g honey
- 30g peanut butter
- 5ml vanilla essence
- 2g salt
- 1.25g ground cinnamon (optional)

## Method

1. Pre-processing steps: Pre-heat the oven to 176 °C in an oven for 10-15 minutes. Spread the nuts, sunflower seeds or pumpkin seeds, rice flakes, and sesame seeds on a rimmed, ungreased baking sheet. Toast in the oven until the sesame seeds looks lightly golden and the nuts are toasted and fragrant, about 10 minutes, stirring once halfway through. Transfer the toasted nuts and seeds to a mixing bowl and add dried fruit and crushed crickets.
2. Line a 20 – 25cm (8- or 9-inch) square baking dish with parchment paper so that two sides of the paper overhang the sides like handles. Coat generously with nonstick spray.
3. Meanwhile, heat the honey and peanut butter in a medium saucepan over medium heat. Remove from the heat. Stir in the wild loquat fruit powder and salt.
4. While the combined honey and peanut butter is still piping hot, pour it into the large mixing bowl with the rest of the ingredients, stir with a rubber spatula.
5. Fold the mixture together so that the cricket flour, seeds, fruit, and nuts are covered completely.
6. Pour the cricket snack bars mixture into the lined baking pan and smooth out so that it is as even as possible.
7. Place the pan in the fridge and leave it there for at least 20-25 minutes.
8. Use the parchment paper to lift the bars out of the pan onto a cutting board. Use a sharp knife to cut the bars into 10 even and separate cricket snack bars



## Field Cricket Crackers



**Figure 84:**  
*Field cricket crackers*

A healthy snack made using finger millet flour, wheat flour, and enriched with ground cricket flour to boost the nutrient content. The ground cricket crackers are crunchy snacks not only served as fun treats for all age groups and a means to satisfy cravings between meals. As multi grain crackers, they are one such "grab and go" snacks to have on hand. Instead of baking them, one can also deep fry the crackers. Because of the finger millet and ground crickets used, the crackers are rich in calcium, iron, B vitamins, poly phenols and dietary fibre. This gives the product anti-diabetic, antioxidant, and antimicrobial properties.

### Ingredients

**(Gives approximately 3 dozen crackers)**

50g finger millet flour

60g whole wheat flour

10g ground cricket powder

1.875g (3/4 tsp) baking powder

10g butter

2.5g (1 tsp) freshly crushed black pepper

5g (1 tsp) salt

1.875g (1 tsp) mixed herbs (rosemary or thyme)

120 – 240ml water

### Method

1. Dry roast the finger millet flour in a wok for 4-5 minutes on a low to medium flame. This is to remove its raw smell and muddy taste. Keep stirring continuously with a spatula, so as to avoid the finger millet flour from

burning.

2. Allow the finger millet flour to cool down, and in a bowl mix the roasted finger millet flour, whole wheat flour, ground cricket powder, baking powder, salt, pepper powder, and mixed herbs.
3. Rub the butter into the flour mixture, until it resembles bread crumbs. Add water and knead the dough to form a ball, and set the dough aside for 10 minutes.
4. Pinch out some of the dough to make a small ball and roll out very thin chapati without using any flour for rolling. Roll directly on parchment paper to avoid them from sticking.
5. Once rolled out, poke all over with fork (this is to avoid the crackers from puffing) and using a knife / pizza cutter divide it into triangles / diamonds / squares or any other desired shape. Repeat the same for rest of the dough.
6. Pre-heat the oven to 190 °C for 15 minutes. Arrange the cut dough on a greased baking tray and bake at 180 °C for 8-15 minutes. The baking time depends on the thickness of rolled out dough.
7. Once done baking, leave the crackers to cool completely. The crackers will turn crispy only once they have cooled completely.
8. Package the crackers in khakhi paper with plastic lining ziplock packages. Store them in air tight container.

## Cricket naan bread



**Figure 86:** *Cricket naan bread*

### Method

1. Add eggs, flour, salt, yeast, cricket powder and yoghurt into a bowl.
2. Add warm water with melted butter, mix together and knead for 5 minutes.
3. Let it rise for 20-30 mins.
4. After it has risen separate the dough ball into 4, and roll out into even pieces.
5. Put pan on medium heat with little oil.
6. Toast your nun bread in the pan for 2-3 minutes on each side.
7. Remove from the pan.
8. Garnish with garlic, parsley and oil.

## Cricket sauce



**Figure 87:** *Cricket sauce*

### Ingredients

1 Butternut

1 Onion, chopped

500g Crickets

1 tsp Garlic

1 tsp Ginger

Salt and pepper, to taste

### Method

1. Boil all ingredients and blend.
2. Strain the blend into a pot with milk and cream.
3. Garnish and serve.



## Cricket flour pasta served with peanut butter sauce



**Figure 88:** Cricket flour pasta served with peanut butter sauce

### Ingredients

Ingredients for the pasta

- 1 cup wheat flour
- 1 cup cricket flour
- 1 Tsp Salt
- 2 eggs

### Ingredients for the peanut butter sauce

- 3 Tbsp Peanut butter
- 2 cloves Garlic Onion
- 60 mls Soy sauce
- 1 Tbsp sugar
- Salt and pepper to taste
- Tsp Thyme -(optional)

### Method

1. Put all dry ingredients together.
2. Make a well in the centre. Add the egg and mix from the centre inwards.
3. Once it forms a dough, knead for 10 minutes.

4. Set it aside to rest for 30 minutes.
5. Roll into a thin dough on a floured surface.
6. Cut into strips using a knife or use a pasta machine.
7. Boil for 10 -15 minutes in salted water until tender.

### Method for peanut butter sauce

1. Simmer all ingredients for the peanut butter sauce for roughly 10 minutes.
2. Add pasta, toss and serve.





# Mealworm Recipes

## Mealworm

The Yellow Mealworms are a recent entry into the edible insect sector in Zimbabwe having been widely considered as an ingredient for livestock feed. In Zimbabwe, it was first farmed and produced at Matopos Research Station.

The Yellow mealworm is now widely grown by small scale insect producers in Zimbabwe. It's popular for its easiness to rear, handling especially that it thrives on dry substrates. The golden shiny colour of mature larvae is a highly preferred trait by consumers.



**Figure 89:** Unprocessed mealworm



**Figure 89:** Fried mealworm

## High protein jelly candy



**Figure 90:** High protein Indian jujube jelly candy

High protein jelly candy made from indigenous fruit pulp (Indian jujube), gelatine, mealworm powder, lemon juice and sweetener. Cane sugar or corn syrup can be used as sweeteners and the main ingredient is the indigenous fruit pulp. Introduction of the edible insect powder helps to improve the nutritional value, particularly the protein and mineral content of the jelly candy. Artificial colours may be added to help the candy to have their distinct appearance, flavour and texture. These colourful fruit jellies can be cut to any size before being rolled in sugar, which is an optional step.

## Ingredients

- 160ml false wild medlar fruit pulp, strained if needed
- 75g granulated sugar
- 60ml water
- 37.5g unflavoured gelatine
- 30g corn syrup
- 10g pre-processed mealworm powder
- 5g citric acid
- Food colouring (yellow), optional
- 225g superfine or caster or confectioners' sugar, optional
- Vegetable oil cooking spray

## Method

1. Prepare a 20 cm (8-inch) pan by spraying with vegetable oil spray.
2. Pour the water into a bowl and add the gelatine, let sit for about 5 minutes to soften.
3. Place the fruit pulp, sugar, mealworm powder, and corn syrup in a medium saucepan over medium heat. Stir until the sugar dissolves.
4. Add the gelatine and continue stirring until the gelatine dissolves.
5. When the gelatine is fully dissolved, add food colouring if desired.
6. Pour the mixture into the prepared pan and leave until completely set. This will take about 4 hours in the refrigerator or overnight at room temperature.
7. When set, turn out of the pan and cut with a sharp knife or cookie cutter into desired shapes.

8. Jellies are served plain.
9. Package the high protein fruit jelly candy in an airtight PET plastic container or use polypropylene plastic bags.

**Note:** Instead of pouring mixture into a baking tray, a silicon mould can be used which has various shapes, which saves on time.

## High protein fruit roll-ups



**Figure 89:** Fried mealworm

A four-ingredient recipe which is simple and delicious way to make your own high protein fruit leather with the simplest equipment. With the presence of the false wild medlar fruit pulp, the fruit roll-ups are a good source of vitamin C and minerals such as copper, magnesium, and potassium. On top of that, the roll-ups contain mealworm powder which contains high protein content and as well improving on the mineral content of the product. The fruit pulp adds to the chewy texture and natural flavour of the roll-ups, together with the crushed soldier termites, whilst the honey adds to the sweetness of the product without affecting the mouth feel.

## Ingredients

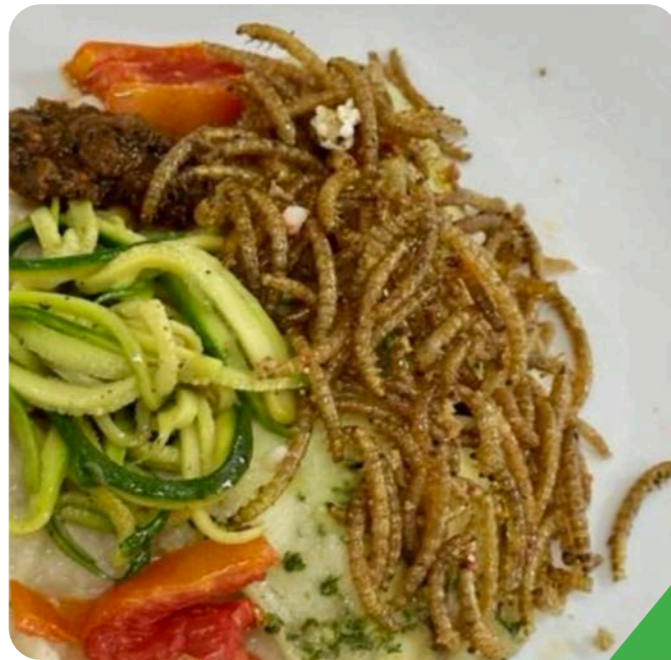
- 350g false wild medlar fruit pulp
- 50g honey
- 45ml lemon juice
- 20g pre-processed mealworm powder



**Method**

1. Blend the false wild medlar fruit pulp using a blender or food processor until smooth. For multi-fruit varieties, the fruits can be blended separately first before being combined before addition of other ingredients.
2. Add the lemon juice, honey and mealworm powder to the blended fruit. Blend together all the ingredients until smooth. The sweetness and taste can be adjusted based on preference.
3. Line a baking sheet with parchment paper. Spread the blended fruit mix to a 0.3 – 0.6 cm thickness.
4. Dehydrate the spread fruit mix in a preheated oven at 60 – 75 °C for 4-6 hours, or until the middle is not sticky. The fruit leather should look and feel dry whilst still being pliable.
5. Allow the dehydrated fruit leather to cool before cutting with clean scissors, a pizza cutter or sharp knife into 2cm strips. Roll the leathers whilst still connected to the parchment paper.
6. Package the fruit leathers in laminated aluminium foil packages. Store in a cool, dry place, or refrigerate or freeze to keep for longer.

**Note:** Other exotic fruits such as blueberries, strawberries, peaches, nectarines and berries can be used in place of the indigenous fruits mentioned above. For the purpose of blending with the insect powder, darker coloured fruits are more preferable.



**Figure 91:** Grilled tilapia with mealworm crust and savoury mealie rice porridge

**Ingredients**

- 2 Tilapia Fillets
- 1 Onion Chopped
- 2 Garlic Cloves chopped
- 1 Cup Mealie rice
- 2 Cups chicken stock
- 1/4 cup cream
- 3 Courgettes cut into strips
- 1 Tomato quartered
- 1/2 cup mealworms
- 2 tbsp cornstarch
- 1 tsp paprika
- 1/4 tsp black pepper

**Method for mealie rice**

1. Fry onion and garlic till fragrant. Add meal rice and mix for 2 minutes. Add stock and simmer till cooked and finish with cream.

**Method for mealworm crust**

1. Combine corn starch, paprika and black pepper.
2. Add pre-processed mealworm.
3. Fry meal worm for 2 minutes.

**Method for grilled fish**

1. Marinate fish in garlic and parsley for 20 minutes.
2. Grill in an oven for 6 minutes.
3. Sauté baby marrow in a pan for 2 minutes.
4. Add to fish and grill for 2 minutes
5. Plate as desired.



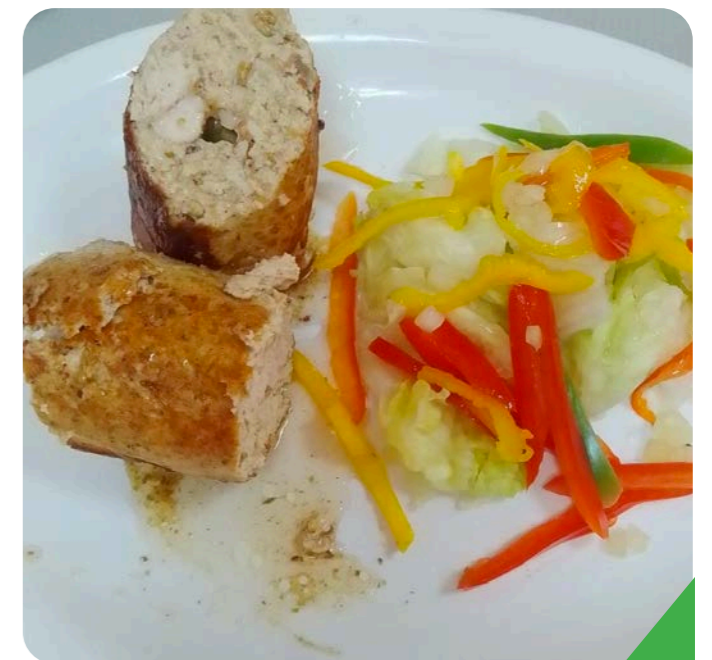
**Figure 92:** Bbq meal snack

**Ingredients**

- 500g mealworm
- 2 tsp smoked paprika
- 1 tsp onion powder
- 1 tsp brown sugar
- 1 tsp garlic powder
- 1/2 teaspoon salt
- Teaspoon chili powder
- Oil for frying

**Method for mealie rice**

1. Add mealworm to boiling water and heat for a few minutes.
2. Drain the water.
3. Add oil in a pan and fry the mealworm till crispy.
4. Season with spices and serve.

**Chicken ballotine**

**Figure 93:** Chicken ballotine



### Ingredients

500g chicken breasts  
300-500g mealworm  
100 ml fresh cream  
Salt and paper to taste  
5g BBQ spice  
5g chicken spice

### Method

1. Blend chicken breast, meal worms, spices and cream.
2. Layer on cling wrap. Put 1 or 2 pieces of chicken on the centre and roll up tight
3. Poach for 20 minutes.
4. Allow to cool in refrigerator for 2hrs or more
5. Unwrap, slice the ballotine and sear till golden
6. Serve with a salad

### Whole-wheat bread roll

#### Ingredients

6-8 slices of whole wheat soft bread  
6-8 slices mozzarella cheese  
250 g meal worms cooked 7 oz  
100 g grated cheddar cheese  
2 beaten eggs bread crumbs  
1 pinch of salt

#### Method

1. Remove the soft brown bread crust from the soft white bread.
2. Roll bread slice with rolling pin to flatten it.

3. Place the fried mealworm, mozzarella, and grated cheddar cheese on the bread.
4. Place the rolls in the refrigerator for about 2 hours.
5. In 1 side plate add beaten eggs with a pinch of salt.
6. In the other side plate put the breadcrumbs, pass the rolls in the egg first then in the breadcrumbs, and ensure that the bread roll is fully coated.
7. Fry the rolls in a pan with plenty of hot oil,
8. Remove onto a pepper towel



## Black Soldier Fly Larvae Recipes





## Black Soldier Fly

The Black Soldier Fly (BSF) larvae is predominantly considered as livestock feed due to its efficient utilization of organic waste. It can feed on a wide range of food substrates including pre-and post-consumed kitchen waste as well as animal manure.

BSF larvae are highly nutritious with protein content ranging from 45-55% on dry matter basis depending on breeding conditions. Chefs and food product designers have recently considered this highly nutritious insect as a possible candidate in the food recipes if it is reared on food substrates that are free of harmful food contaminants.

## Black 3 bean salad



Figure 96: Black 3 bean salad

### Ingredients

- Can red kidney beans
- Can chick peas
- Can Baked beans
- 500g deep fried black soldier fly
- 1/2 cup vegetable oil



Figure 95: Black soldier fly larvae

- 1/4 cup vinegar
- 1/4 cup lemon juice
- 2Tbsp sugar
- 1tsp salt
- 2 tsp crushed Cloves

### Method

1. Mix oil, vinegar, sugar, salt crushed garlic and lemon juice in a mason jar and shake well
2. Add the beans and black soldier into a salad bowl lined with Lettuce leaves
3. Dress with the Vinegrate and serve

## BSF madeira cake

### Ingredients

- Can red kidney beans
- Can chick peas
- Can Baked beans
- 500g deep fried black soldier

### Method

1. Heat oven to 170°C/150°C fan/gas 3. Butter and line the base of a 900g loaf tin with greaseproof paper.
2. Cream Margarine and sugar till light and fluffy.
3. Add eggs one at a time and mix.
4. Add dry ingredients until you have a thick batter.
5. Now add the crushed BSF.

6. Lastly, add the wet ingredients and mix well. The batter should be loose enough to fall off a wooden spoon, if it is not, add some extra milk.
7. Tip the batter into the tin and smooth over the top. Bake for 35 min or until a skewer inserted in the middle comes out clean.
8. Remove from the oven then leave to cool for 15 mins then remove from the tin, peel away the paper and leave on a wire rack to cool completely before slicing.

## Panzanella salad



Figure 97: Panzanella salad

### Ingredients

- 2 Cucumbers
- 500g Black soldier fly
- 3 slices Bread
- 2 Tomatoes, cubed
- 1/4 cup Vinegar



- 1/4 cup Oil
- 1/2 Tsp Salt
- 2 Tbsp Sugar

#### Method for vinaigrette

1. Mix the vinegar, oil, sugar and salt.
2. Shake well and set it aside.

#### Method for the Salad

1. Cut vegetables into bite size pieces
2. Put your salad ingredients into a bowl
3. Cut bread into cubes
4. Fry the bread in oil until golden brown to make croutons.
5. Fry black soldier fly larvae until they are crunchy.
6. Add croutons and black soldier fly larvae to the salad.
7. Add your vinaigrette dressing to the salad. Mix and serve.

## BSF protein shake



#### Ingredients

- 500g BSF boiled and blended
- 700mls Mango concentrate juice
- 1.2 l ice cold water

#### Method

1. Boil BSF for 10minutes and drain the water.
2. Wash the boiled BSF using clean water and add to a blender.
3. Blend the BSF and strain.
4. Add the strained juice to the mango concentrate and water, and blend till smooth. Enjoy!

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