

Mountain Chicken Live Food Manual



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1 INTRODUCTION

1.1 About this manual

- 1.1.1 This manual has been produced to provide information on the breeding requirements of live food insects for the mountain chicken. Environmental and dietary factors have been taken into account in order to design an efficient husbandry protocol for all invertebrates held in the mountain chicken live food breeding room. Details are also given on techniques and locations for collecting invertebrates as live food.

1.2 The live food breeding facility

- 1.2.1 The Live food breeding facility contains enclosures for invertebrate culture. These include dust bins (Photo 3), large tote boxes (Photo 1 & 2), small plastic food storage boxes and other suitable containers (Photo 1). Most of these containers have been modified with the inclusion of ventilation.



Photo 1: Cricket breeding containers (Left) and miscellaneous invertebrate enclosures (Right)



Photo 2: Cricket breeding containers



Photo 3: Cockroach breeding bins

1.3 Selection of live food species

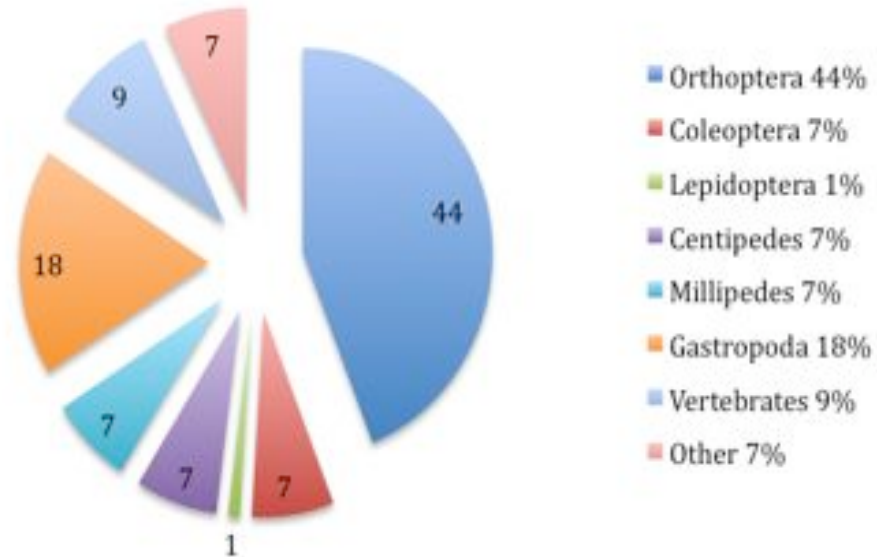
1.3.1 The species chosen as candidates for live food culture were selected based on their amenability to large-scale breeding, their suitability as a live food item and their role in the trophic ecology of the mountain chicken according to Brooks (1982)¹. The known diet of the mountain chicken is represented

1.1.1 _____

¹ Brooks, G.R. 1982. An analysis of prey consumed by the anuran, *Leptodactylus fallax*, from Dominica, West Indies. *Biotropica* 14:301-309

below in the pie chart. It should also be noted that not all live food species need to be cultured, some may be collected in large quantities provided they are searched for in the right location. Details of collection locations are given in each species account.

Pie Chart Displaying Prey Items Consumed by The Mountain Chicken.



1.3.2 Adult frogs held in the quarantine facility at ZSL are believed to eat approximately 100 adult black crickets *Gryllus bimaculatus* per frog per week. The frogs held in captivity in Dominica will receive a diet of native invertebrates it is estimated that the breakdown of prey items consumed per adult frog per week will resemble the following list:

- Crickets, Katydid, cockroaches and Grasshoppers: 35-50
- Beetles: 10-20
- Millipedes: 10-20
- Snails, slugs and earthworms: 10-20

The amount of prey items required per week should be considered in terms of this breakdown. On this basis, if six adult frogs are present then each week up to 300 adult crickets, grasshoppers and cockroaches will be required, 120 beetles etc. Live arthropods (with the exception of millipedes and centipedes) offered to the frogs should be no longer than the width of the frog’s mouth.

1.3.3 The live food species present within the facility currently include the following:

- *Gryllodes sp* – Field Cricket

- *Amphiacusta sp* – Cave Cricket
- *Pycnoscelus surinamensis* – Suriname Cockroach
- *Blaberus sp* – Forest cockroach
- Earthworms
- *Veronicella / Vaginulus sp.* Slugs
- *Austroselenites sp* snails
- 3 Species of millipede
- Assorted beetle larvae

This page will display a full page picture of the 100 insects eaten per week according to the list in 1.3.2

1.4 How to Collect Live Food

1.4.1 The invertebrate species which will need to be collected on a regular (weekly / fortnightly) basis are as follows:

- Pallot slugs
- Snails
- Amphiacusta crickets
- Blaberus cockroaches
- Grasshoppers
- Millipedes
- Beetle larvae

The following table gives details of collecting locations and techniques for each species.

Species	Location and time	Technique
Snails	Cooler regions such as Laudat at night time following rain. Snails can be found in abundance on wet rocky surfaces and paved areas adjoining grasses or low scrub. Recently disturbed habitat yields more snails.	Torchlight, collect by hand and keep in a well ventilated container until morning. Do not overfill container.
Slugs	All over Dominica, particularly areas where herbs / seasoning are grown. Check vegetable patches, make arrangements with local farmers / growers.	As with snails.
Amphiacusta crickets	Dry riverbeds, rock piles, derelict buildings, beneath cool moist rocks (including under manhole covers). Can be found in abundance in Soufriere a few hours after dark.	Collect by hand. Handle with care to avoid crushing them. Collect in well ventilated container. Return captives to enclosure in the facility ASAP.

Blaberus cockroaches	These are only known (thus far) from Morne Daniel, specifically from the poultry facility owned by Mr. E. Harris. They can be found in abundance in cavities such as between wooden boards.	As with crickets.
Grasshoppers	Occur in abundance in long grasses all over Dominica. Roadside verges and recently cleared land are good places to look. Can be heard 'chirruping' all day long, particularly on hot days. Avoid areas where agro-chemicals are used.	Using a sweep net, systematically work through grasses stopping periodically to place captives into a well ventilated container. Observe which plant species the grasshoppers are feeding on and collect a sufficient quantity to feed your captives.
Millipedes	Compost heaps and under rocks and logs. There is a huge quantity of these available in the Botanical gardens, Roseau.	Carefully work through the compost heap using a small trowel. Collect millipedes by hand into a suitable container and bring them to the facility. Take care to avoid broken glass and sharp objects in compost heaps.
Beetle Larvae	As with Millipedes.	As with Millipedes.

1.4.2 Take care to avoid making the following mistakes:

- Do not over fill collecting containers. Large numbers of invertebrates produce a lot of waste, which can be toxic to conspecifics in high concentration. (i.e. they will die in their own faeces if there are too many).
- Ensure your collecting containers are used only for that purpose and have not had contact with chemicals, detergent etc.
- Ensure you have enough collecting containers with you.
- Ensure your collecting container has adequate ventilation.

- Do not leave recently collected invertebrates in a vehicle while you go looking for more. They will perish in the heat. It is best to leave them somewhere safe and shaded.
- Ensure you have permission to access and collect from your chosen site.

1.5 How to Feed Frogs

- 1.5.1 Some simple feeding techniques and strategies can be implemented to avoid wasting food and to prevent food items escaping from the frog enclosures.
- 1.5.2 A 'slow release' feeder can be used. This is simply a container such as a plastic box with holes large enough for crickets, cockroaches, grasshoppers etc to get out. The container can be filled with a few days worth of insects and placed in the frog enclosure. Frogs will soon learn that food items come from this box and will eat them as they emerge.
- 1.5.3 Since some items such as cockroaches may be too fast moving for the frogs to catch it may be necessary to offer these items in an escape proof bowl such as a ceramic dog bowl with steep smooth sides. Frogs can feed on cockroaches before they have a chance to disappear into the substrate.

SPECIES ACCOUNTS

2 FIELD CRICKETS - *GRYLODES SP.*

2.1 General species information

- 2.1.1 A medium sized Orthopteran (cricket, cockroach and grasshopper order) feeding mainly on forest detritus, organic material and carrion. Orthopterans comprise 44% of the diet of the mountain chicken and therefore represent an important food item.

2.2 Photographs of species



Adult Grylodes – note ovipositor (egg laying apparatus) protruding from rear of female



3rd and 4th instar Grylodes

2.3 Housing

- 2.3.1 Crickets of all life stages can be kept in the large blue breeding boxes. These are well ventilated, incorporating mosquito netting held in place by the lid. The top of each container has a line of red tape extending all the way around. This tape creates a smooth surface, which young crickets cannot climb.
- 2.3.2 A substrate (bottom layer) of newspaper should be added and replaced as necessary.
- 2.3.3 Hiding places are provided by using egg crates. These have a large surface area giving crickets the chance to find their own space away from each other. A ready supply of egg crates should be available at all times.
- 2.3.4 Adult crickets should always have access to an egg-laying site. This can be provided by means of a small container of sandy soil. (see breeding process).

2.4 Diet & Feeding Techniques

- 2.4.1 Food should be offered in a shallow container such as a Petri-dish. These dishes should be checked on a daily basis and replaced as necessary. The whole dish should be cleaned and replaced if any food becomes mouldy.
- 2.4.2 The following items will be accepted by *Gryllus sp* Crickets:

Fruit, Vegetables and Greens

- Carrot

- Apple
- Papaya
- Pumpkin
- Guava
- Cucumber – A good source of water
- Lettuce
- Water grass – Only the leaves are eaten, be careful not to feed more of this than the crickets will eat as young crickets will hide in it and may be accidentally thrown away when replacing food .
- Orange – This should be offered as a 2-3cm thick slice. A fresh piece of orange should be offered every day. Orange becomes mouldy after 48 hours.
- Oats – These should be crushed using a pestle and mortar and do not need to be replaced unless they become wet and subsequently mouldy

Dry food

- Rabbit pellets – An alphanalpha pellet which should be crushed before feeding
- Chicken laying pellets – A pellet containing calcium for chicken egg production. These pellets should also be crushed before feeding to crickets.
- Crushed dry dog food – This should be ground as fine as possible. Do not allow this to become wet as it will become mouldy very quickly
- Tropical fish flake – This should be crushed to a fine powder for young crickets. Do not allow fish flake to become wet as it will clump together and will not be eaten.

Care should be taken to only offer as much food as the crickets will eat. It is difficult and time consuming to separate tiny crickets from a bowl full of mouldy food.

2.5 Watering

- 2.5.1 One side of the enclosure should be sprayed daily using the fine mist spray bottle. Note: It should be given a light spray for a second or two, NOT soaked. Care should be taken not to spray the food bowl. It is best to spray before the food bowl is replaced in the breeding container.

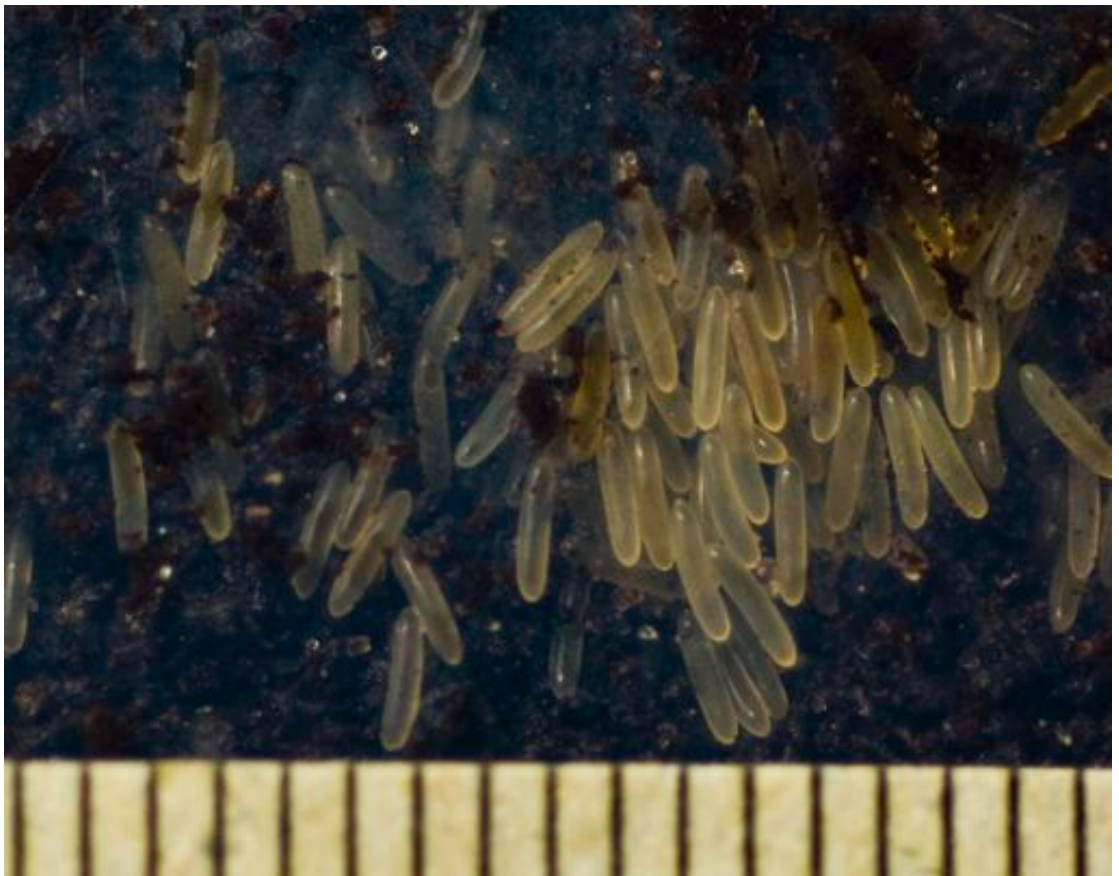
2.6 Daily Husbandry

- 2.6.1 The following procedure should be carried out daily.
- Observe general behaviour of crickets. (i.e. are they active and moving around or sluggish)
 - Check air quality within container (this cannot really be measured but make sure it does not smell rotten, musty etc.)

- Check sandy soil in egg laying box is damp, not wet.
- Check food. Are the crickets eating the food being offered? Alter feed accordingly.
- Remove mouldy food.

2.7 Breeding Process

- 2.7.1 Adult females can be easily identified by the ovipositor protruding straight from the back of the abdomen. This is the egg laying tube which is inserted into the ground in order to deposit ova. If ample food is provided then crickets will breed and produce eggs year round in Dominica.
- 2.7.2 A small plastic food storage container of sandy soil should be provided to all adult crickets as an egg laying substrate. Females will lay 2-3mm long cream coloured eggs resembling a small grain of rice into this, which will hatch within 2 weeks.



Cricket eggs as viewed through the side of egg laying container (ruler increments = 1mm).

2.8 Rotation System

- 2.8.1 Egg laying boxes should be removed from the adult crickets' container after 14 days and placed into an empty breeding container in order to start a new generation. Egg laying boxes should be removed prior to baby crickets hatching because adults are capable of eating babies as they hatch.

- 2.8.2 The eggs usually hatch 15-20 days after being laid. Drying of the substrate seems to stimulate hatching, so it is not necessary to re-moisten the egg laying substrate after removal from the breeding container unless it has become dry and dusty prior to removal.
- 2.8.3 By harvesting eggs and introducing them to a new breeding box, a new generation can be started every two weeks or so. In doing so, each box will contain crickets a little older and larger than those in the previous container. Under ideal conditions crickets reach breeding size at approximately 3-4 months of age.
- 2.8.4 On the basis of a new generation being started every two weeks, twelve large tote boxes can be used to maintain a breeding population with crickets of every size class continually available.
- 2.8.5 It is important that data is kept on hatching date and dates between which eggs are laid. This is all important information in terms of maintaining accurate notes on the progress of the colony.
- 2.8.6 Grylodes crickets will not be required for food until they reach adult size. It is important NOT to harvest the adult crickets until they have been given an opportunity to lay eggs so that another culture can be started first.

2.9 How to feed to the Crapaud

- 2.9.1 Crickets fed to the frogs should be well fed themselves. Ensure the crickets have eaten well for a couple of days prior to feeding (This is a technique called gut-loading to ensure that food items contain sufficient nutrition). There is little point feeding frogs with crickets that have not eaten for two days over the weekend because these will be of low nutritional value.
- 2.9.2 A 'slow release' feeder can be used. This is simply a container such as a plastic box with holes large enough for crickets, cockroaches, grasshoppers etc to get out. The container can be filled with a few days worth of insects and placed in the frog enclosure. Frogs will soon learn that food items come from this box and will eat them as they emerge.

3 CAVE CRICKETS - *AMPHIACUSTA SP.*

3.1 General species information

- 3.1.1 A large Orthopteran feeding mainly on forest detritus, organic material and carrion. Orthopterans comprise 44% of the diet of the mountain chicken and therefore represent an important food item. These crickets are slower growing than *Grylodes* crickets but grow much bigger.

3.2 Photographs of species



Adult male Amphiacusta



Amphiacusta juveniles - Mixed stages

3.3 Housing

- 3.3.1 Crickets of all life stages can be kept in the large breeding boxes. These are well ventilated, incorporating mosquito netting held in place by the lid. Unlike the *Grylodes* crickets, these crickets can easily climb smooth surfaces so care must be taken to avoid escape when opening containers.
- 3.3.2 A substrate (bottom layer) of newspaper should be added and replaced as necessary.
- 3.3.3 Hiding places are provided using egg crates. These have a large surface area giving crickets the chance to find their own space away from each other. These crickets are cannibalistic and display aggressive tendencies, as such they cannot be kept at the same high stocking density as *Grylodes* crickets.
- 3.3.4 Adult crickets should always have access to an egg-laying site. This can be provided by means of a small container of sandy soil (see notes on breeding process below).

3.4 Diet & Feeding Techniques

- 3.4.1 Food should be offered in a shallow container such as a Petri-dish. These dishes should be checked on a daily basis and replaced as necessary. The whole dish should be cleaned and replaced if any food becomes mouldy. Care must be taken when working with baby crickets to ensure that none are accidentally thrown away with old food.
- 3.4.2 The following items will be accepted by *Amphiacusta sp* Crickets:

Fruit and Vegetables

- Carrot
- Apple
- Papaya
- Guava
- Cucumber
- Water grass – Only the leaves are eaten
- Orange – This should be offered as a 2-3cm thick slice. A fresh piece of orange should be offered every day. Orange becomes mouldy after 48 hours.

Dry food

- Oats – These should be crushed using a pestle and mortar and do not need to be replaced unless they become wet and subsequently mouldy
- Rabbit pellets – An alpha pellet which should be crushed before feeding
- Chicken laying pellets – A pellet containing calcium for chicken egg laying. These pellets should also be crushed before feeding to crickets.
- Crushed dry dog food – This should be ground as fine as possible. Do not allow this to become wet as it will become mouldy very quickly
- Tropical fish flake – This should be crushed to a fine powder for young crickets. 1st and 2nd Instar crickets will not eat fish flake. Do not allow fish flake to become wet as it will clump together and will not be eaten.

Care should be taken to only offer as much food as the crickets will eat. It is difficult and time consuming to separate tiny crickets from a bowl full of mouldy food.

3.5 Watering

- 3.5.1 One side of the enclosure should be sprayed daily using the fine mist spray bottle. Note: It should be given a light spray for a second or two, NOT soaked. Care should be taken not to spray the food bowl. It is best to spray before the food bowl is replaced in the breeding container.

3.6 Daily Husbandry

- 3.6.1 The following procedure should be carried out daily.
- Observe general behaviour of crickets. (i.e. are they active and moving around or slow and sluggish)
 - Check air quality within container (this cannot really be measured but make sure it does not smell rotten, musty etc.)
 - Check sandy soil in egg laying box is damp, not wet.

- Check food. Are the crickets eating the food being offered? Alter feed accordingly.
- Remove mouldy food.

3.7 Breeding Process

- 3.7.1 Adult females can be easily identified by the ovipositor protruding straight from the back of the abdomen. This is the egg laying tube which is inserted into the ground in order to deposit ova. If ample food is provided then crickets will breed and produce eggs year round in Dominica.
- 3.7.2 A plastic container of sandy soil should be provided to all adult crickets as an egg laying box. Females will lay 4-5mm long cream coloured eggs into this, which will hatch within around 35 days.

3.8 Rotation System

- 3.8.1 Egg laying boxes should be removed from the adult crickets' container and placed into an empty blue breeding container in order to start a new generation. Ideally boxes should be removed prior to baby crickets hatching because adults are capable of eating babies as they hatch.
- 3.8.2 The eggs usually hatch within 35 days after being laid. Drying of the substrate seems to stimulate hatching, so it is not necessary to moisten the egg laying substrate after removal from the breeding container unless the soil is already very dry and dusty.
- 3.8.3 A new breeding container is filled each month; therefore each container contains crickets 1 month older than the previous container. The age at which crickets reach adult size is yet to be determined. This will be an important factor in determining the total number of breeding containers required to maintain a self sufficient supply of crickets.
- 3.8.4 It is important that data is kept on hatching date and dates between which eggs are laid. This is all-important information in terms of maintaining accurate notes on the progress of the colony.
- 3.8.5 Crickets will not be required for food until they reach adult size. It is important NOT to harvest the adult crickets until they have been given an opportunity to lay eggs so that another culture can be started first.

3.9 How to Feed to The Crapaud

- 3.9.1 Crickets fed to the frogs should be well fed themselves. Ensure the crickets have eaten well for a couple of days prior to feeding. There is little point feeding frogs with crickets that have not eaten for two days over the weekend because these will be of low nutritional value.
- 3.9.2 A 'slow release' feeder can be used. This is simply a container such as a plastic box with holes large enough for crickets, cockroaches, grasshoppers etc to get out. The container can be filled with a few days worth of insects and placed in the frog enclosure. Frogs will soon learn that food items come from this box and will eat them as they emerge.

4 GRASSHOPPERS AND KATYDIDS.

4.1 General species information

- 4.1.1 A huge array of species of grasshoppers and katydids can be found in Dominica. Many of them have specific dietary requirements which are difficult to meet in captivity making them breeding difficult, They can however be collected in large quantities by sweep netting around disturbed ground, roadside verges and areas of tall grasses and low scrub at night.

4.2 Photographs of species



Green leaf katydid - Phanopterinae



Pseudophylline katydid, possibly *Nesophyllidium fulvicosta*.

4.3 Container

- 4.3.1 Grasshoppers must be kept in spacious ventilated enclosures. A large mesh enclosure similar to those used for stick insects is ideal. These are commonly available in the herpetoculture trade, marketed as ‘flexariums’. The container should contain a number of upright branches, hiding places and ample food.

4.4 Diet & Feeding Techniques

- 4.4.1 Grasshoppers maintained in the facility will eat cabbage, lettuce, grated carrot, water grass, water cress and some local foliage. When collecting grasshoppers, take note of food plants. Collect a large quantity of the plants the grasshoppers were eating when they were collected.

4.5 Watering

- 4.5.1 The enclosure should be sprayed daily to prevent desiccation. Providing the enclosure is not sensitive to rain (i.e. won't rust) it can be kept outside to allow rain to fall through it (this is a possibility – not a necessity). Obviously do not leave it where it can blow away or be damaged / stolen.

4.6 Daily Husbandry

- 4.6.1 Feed and check behaviour, remove any dead animals.

4.7 How to Feed to The Crapaud

- 4.7.1 Introduce animals to the enclosure. Some of the grasshoppers' food plants can be placed in the crapaud enclosure to create areas where these insects will congregate. This will make them easier for the frogs to find.

5 SURINAME COCKROACH *PYCNOSCELUS SURINAMENSIS*

5.1 General species information

- 5.1.1 A burrowing cockroach measuring up to 3cm in length. This species reproduces asexually, producing many offspring with a very fast lifecycle. They can be found and collected around rabbit and chicken manure in large quantities. According to Brooks, cockroaches are not known to be a prey item of the mountain chicken in Dominica, however this is most likely because cockroaches spend much of their time below ground. This species of cockroach is used widely in herpetoculture and will be suitable for use as a food item for the mountain chicken.

5.2 Photographs of species



Mixed stages of Pycnoscelus surinamensis

5.3 Housing

- 5.3.1 These can be housed in the large dustbins. Because these cockroaches spend nearly all their time in compost, it is necessary to provide a layer of substrate approximately 30cm deep. The substrate should be acquired from an agricultural store and not from the compost heaps within the gardens in order to reduce contamination from mites and other unwanted invertebrate pests. Layers of cardboard or egg crates can be laid flat above the substrate. Cockroaches can be harvested from this and shaken off into a separate container to avoid the need to dig them up from the substrate.

5.4 Diet & Feeding Techniques

- 5.4.1 This species feeds predominantly on detritus and can be found in abundance near rabbit faeces and soiled chicken bedding. A staple of mixed fruit and vegetables as fed to crickets will be adequate to sustain a colony. Rotten food should be monitored to avoid problems with mites and mould, which can accumulate quickly and effectively wipe out a colony over a weekend.

5.5 Watering

- 5.5.1 The water contained in the vegetables offered is adequate for this species, no additional water bowl is required. Care should be taken however to ensure the substrate is not allowed to become too dry, this can be achieved by spraying as required.

5.6 Daily Husbandry

- 5.6.1 Check the animals overall behaviour. Do they appear lively and healthy or slow and sluggish? Is adequate food available? These animals do not require feeding daily but should be checked regularly.
- 5.6.2 In the event that large numbers of mortalities are noted, try to find the reason why. Is there a large amount of mould? Is the enclosure too wet? Remove all surviving individuals and set up a new container for them with clean soil and fresh cardboard / egg boxes.

5.7 Breeding Process

- 5.7.1 This species can reproduce parthenogenesis. Females produce an ootheca which is stored inside the abdomen. When the ootheca hatches inside the female, live young emerge and under ideal conditions they may reach maturity within 1 month.

5.8 Rotation System

- 5.8.1 Since nymphs (babies) can be housed with the adults without any problems, a rotation system is not required.

5.9 How to Feed to The Crapaud

- 5.9.1 A deep smooth sided bowl can be used to prevent escape. These cockroaches cannot climb smooth ceramic surfaces and therefore a large dog bowl or similar may be used to avoid escape and wastage.

6 FOREST COCKROACHES- *BLABERUS SP.*

6.1 General species information

- 6.1.1 These large cockroaches were collected from Morne Daniel. Cockroaches of the genus *Blaberus* are present throughout the neo-tropics and will be eaten by most reptiles and amphibians in captivity. Since these cockroaches attain an adult size of 5-6 cm they represent a very valuable food item for large frogs.

6.2 Photographs of species



Adult female *Blaberus* Cockroach.



Week old nymphs of *Blaberus* produced by the female photographed above.

6.3 Container

6.3.1 A large dustbin modified to incorporate ventilation is the best container for these roaches. A substrate of mushroom compost and leaf litter approximately 15cm deep should be included to offer the young roaches the opportunity to burrow into a cool moist retreat. Egg crates should also be included to offer hiding places and also as a means of harvesting roaches (i.e. they can be shaken off egg crates instead of having to dig them up by hand).

6.4 Diet & Feeding Techniques

6.4.1 Food should be offered in a bowl so mouldy or rotten food can be removed easily. All of the foods mentioned for crickets are suitable cockroaches with a higher emphasis on fresh vegetables. It is vitally important to ensure that dry food is not allowed to become mouldy in the humid environment of the enclosure.

6.5 Watering

6.5.1 Water can be provided by means of a light spray as required. Water will also be provided by offering fresh vegetable matter. Spraying will be required to ensure the enclosure does not dry out.

6.6 Daily Husbandry

- 6.6.1 Check the animals overall behaviour. Do they appear lively and healthy or slow and sluggish? Is adequate food available? These animals do not require feeding daily but should be checked regularly.
- 6.6.2 In the event that large numbers of mortalities are noted, try to find the reason why. Is there a large amount of mould? Is the enclosure too wet? Remove all surviving individuals and set up a new container for them with clean soil and fresh cardboard / egg boxes.
- 6.6.3 Look out for abandoned egg cases. *Blaberus* cockroaches will abort egg cases as a result of stress or if environmental conditions are unsuitable. Finding aborted egg cases is an indicator that the diet is inadequate or that the enclosure is too hot or too dry.

6.7 Breeding Process

- 6.7.1 Females produce an egg case, which is stored in the abdomen until live young emerge, this is a breeding process known as ovoviviparity. Eggs can be stored in the female for as long as 9 months in some species of *Blaberus* which can make establishment of a colony a slow process until a sufficiently large number of breeding adults have been produced.

6.8 Rotation System

- 6.8.1 Since nymphs (babies) can be housed with the adults without any issues with cannibalism or other problems, a rotation system is not required.

6.9 How to Feed to The Crapaud

- 6.9.1 A deep smooth sided bowl can be used to prevent escape. These cockroaches cannot climb smooth ceramic surfaces and therefore a large dog bowl or similar may be used to avoid escape and wastage.

7 EARTHWORMS.

7.1 General species information

- 7.1.1 Earthworms are present in large numbers in compost heaps within the botanical gardens. Earthworms feed on detritus and decaying organic material and can be collected in large quantities from areas where detritus is present – i/e forest floor and compost heaps.

7.2 Photographs of species



7.3 Container

- 7.3.1 Earthworms can be maintained in the large dustbins in the facility. The dustbins must contain a mixture of soil, leaf litter and rotten vegetables. Layers of cardboard can also be included to separate layers of substrate. This makes earthworms easier to pick out. Keeping layers separate also allows proper aeration of substrata. This prevents smelly anaerobic conditions from occurring in the enclosure.

7.4 Diet & Feeding Techniques

- 7.4.1 Add vegetables as described for crickets and more leaf litter as required taking into consideration that fresh food may not be eaten immediately.

7.5 Watering

- 7.5.1 If sufficient rotten organic material is added, regular watering should not be required, however if the enclosure does become too dry it can be sprayed

with the hand sprayer. Ensure the enclosure is not allowed to become too wet as conditions can become foul very quickly.

7.6 Breeding Process

7.6.1 Females lay large numbers of eggs, which hatch within a few weeks. Offspring do not need to be removed and mixed life stages can be kept together.

7.7 How to Feed to The Crapaud

7.7.1 Earthworms can be offered in a deep smooth sided bowl to make it easier for frogs to find them. Worms will still be able to climb the sides of this bowl and therefore should only be fed in the early evening.

8 PALLOT SLUGS - *VERONICELLA* / *SARASINULA* SPP.

8.1 General species information

- 8.1.1 A large slug known to be a prey item of the Crapaud. These slugs are prolific breeders and can be found in huge quantities in Dominica. They are a pest of vegetables and growers often pick them off their produce. These slugs can be collected in large quantities from vegetable patches following rain in the evening.

8.2 Photographs of species



Vaginulus occidentalis collected at Laudat from a log pile.



Adult *Sarasinula* after laying eggs



Newly hatched *Sarasinula* Slugs.

8.3 Container

- 8.3.1 Slugs can be kept in well-ventilated plastic containers, A large bin is ideal. A 10-15cm deep layer of soil can be used as a substrate and kept moist. Large pieces of cardboard can also be included as a hiding place although these will degrade over time. Layers of corrugated plastic are ideal to create moist retreats and avoid accumulation of mould and pests.

8.4 Diet & Feeding Techniques

- 8.4.1 These snails will feed on a variety of fruit and vegetables in captivity, all of those mentioned for crickets are suitable although feeding too much fruit should be avoided. The wet leaf litter at the bottom of the enclosure will also be eaten.

8.5 Watering

- 8.5.1 The enclosures should be sprayed as required, A moist environment should be maintained for most of the week however a day or two of drying can help prevent mould and fungus growth.

8.6 Daily Husbandry

- 8.6.1 Spray the enclosure and check sufficient food is available. A full strip and clean of each enclosure will be required at regular intervals since these slugs produce a considerably large amount of faeces.

8.7 Breeding Process

- 8.7.1 A large cluster of 30-50 yellow eggs are laid in the leaf litter which hatch within 2 weeks. The newly hatched slugs can be looked after in the same way as the adults.

8.8 How to Feed to The Crapaud

- 8.8.1 A 'slow release' feeder can be used. This is simply a container such as a plastic box with holes large enough for the slugs to exit. The container can be filled with a few days worth of slugs and placed in the frog enclosure. Frogs will soon learn that food items come from this box and will eat them as they emerge.

9 SNAILS - *AUSTROSELENITES SP.*

9.1 General species information

- 9.1.1 A medium snail, which is abundant in Dominica. These can be collected in huge numbers on bare rock surfaces following rain. Molluscs form approximately 7% of the diet of the mountain chicken.

9.2 Photographs of species



Austroselenites sp snails collected in Laudat following rain

9.3 Container

- 9.3.1 These snails can be contained in well ventilated plastic enclosures, large plastic bins are ideal. A 10-15cm deep layer of soil mould should be included as a substrate.
- 9.3.2 Layers of wet cardboard can be used to provide both surface area and a cool, moist and humid refuge. Cardboard is preferable to wood bark since it is less likely to introduce fungi to the enclosure. Layers of corrugated plastic are ideal to create moist retreats and avoid accumulation of mould and pests.

9.4 Diet & Feeding Techniques

- 9.4.1 These snails will feed on lettuce, cabbage and carrot in captivity. The wet leaf litter at the bottom of the enclosure will also be eaten.

9.5 Watering

- 9.5.1 The plastic boxes should be sprayed as required, A moist environment should be maintained for most of the week however a day or two of drying can help prevent mould and fungus growth.

9.6 Daily Husbandry

- 9.6.1 Spray the enclosure and check sufficient food is available. A full strip and clean of each enclosure will be required at regular intervals since these snails produce a considerably large amount of faeces.

9.7 Breeding Process

- 9.7.1 A small cluster of up to 20 white eggs are laid in the leaf litter which hatch within 2-3 weeks. The tiny snails can be looked after in the same way as the adults.

9.8 How to Feed to The Crapaud

- 9.8.1 A 'slow release' feeder can be used. This is simply a container such as a plastic box with holes large enough for the snails. The container can be filled with a few days worth of snails and placed in the frog enclosure. Frogs will soon learn that food items come from this box and will eat them as they emerge.

10 *MILLIPEDES.*

10.1 General species information

- 10.1.1 3 unidentified species of millipede are present in the botanical gardens at Roseau. One is suspected to be introduced from Guadeloupe. These millipedes are mostly concentrated in the compost heaps in the gardens where they can be found in large quantities. Millipedes form approximately 7% of the diet of the mountain chicken.

10.2 Photographs



Unknown millipede species (believed to be introduced) collected from the compost heap in Roseau Botanic Gardens.



Unknown millipede, currently referred to as, 'Red millipede'.



Unknown millipede, currently referred to as, 'Yellow millipede'.

10.3 Container

10.3.1 Millipedes can be kept in the large plastic flat boxes. They should be maintained in at least a 15cm deep layer of compost. Addition of cardboard laid flat on the substrate will provide hiding places for millipedes.

10.4 Diet & Feeding Techniques

- 10.4.1 Millipedes feed on rotten organic material and will eat decaying wood and leaf mould, cabbage, carrot, dasheen and most other vegetables. Citrus should be avoided.

10.5 Watering

- 10.5.1 The enclosure should be sprayed as required to maintain a moist humid environment. Note, as the millipedes excrete the vegetable matter they are fed, large amounts of water will accumulate in the substrate. If the substrate becomes too wet then add some dry sand and do not spray again until it begins to dry.

10.6 Daily Husbandry

- 10.6.1 Spray the enclosure and check sufficient food is available. A full strip and clean of each enclosure will be required occasionally however some of the old substrate should be added to the clean container since this will contain bacteria beneficial for digestion in millipedes.

10.7 Breeding Process

- 10.7.1 Millipedes can be very slow growing, taking even the smaller species up to 18 months to reach breeding size, for this reason it will be necessary to collect them in large quantities within the gardens. They can be kept in captivity until they are required as food.

10.8 How to Feed to The Crapaud

- 10.8.1 A 'slow release' feeder can be used. This is simply a container such as a plastic box with holes large enough for the millipedes to escape. The container can be filled with a few days worth of millipedes and placed in the frog enclosure. Frogs will soon learn that food items come from this box and will eat them as they emerge.

11 SOFT BODIED COLEOPTERA LARVAE

11.1 General species information

- 11.1.1 Soft bodies beetle larvae are widely used as a supplemental live food in herpetoculture. The most commonly used beetles are of the African genus *Pachnoda*. Obviously these are not available in Dominica however a number of other carabidae larvae can be found in compost heaps in large quantities year round.

11.2 Photographs of species



Beetle larvae kept in the facility on a mixture of compost and sandy soil.



Beetle Larva



Beetle pupa, these can still be offered as food but should be placed with moving larvae since frogs are unlikely to eat motionless prey items.

11.3 Container

- 11.3.1 Beetle larvae can be kept in well ventilated plastic shoe boxes for a number of weeks. The box should contain a mixture of compost, leaf mould and

sandy soil. Take care not to overstock these boxes with larvae as they can be cannibalistic.

11.4 Diet & Feeding Techniques

11.4.1 Larvae will feed on detritus such as rotten wood, leaves and tubers such as Irish potatoes and sweet potatoes. Carrots can also be given.

11.5 Watering

11.5.1 Water can be provided by means of a regular spraying, do not allow the substrate to become too wet.

11.6 Daily Husbandry

11.6.1 Check animals, remove dead individuals and rotten food. Spray as necessary.

11.7 Breeding Process

11.7.1 Since beetle larvae can be collected in large quantities with ease, it is not necessary to breed them, however if larvae begin to pupate then it may be possible to allow them to metamorphose and allow imagos (adults) the opportunity to breed. Keep records of this since it is very useful information and could help devise a breeding protocol.

11.8 How to Feed to The Crapaud

11.8.1 A deep smooth sided bowl can be used to prevent escape. These beetle larvae cannot climb smooth ceramic surfaces and therefore a large dog bowl or similar may be used to avoid escape and wastage.

11.8.2 As larvae these beetles have strong mandibles and can deliver an unpleasant bite, posing a threat to captive frogs. To avoid damage to frogs ensure the heads of these larvae are gently crushed before they are introduced to the frog enclosures.

12 'SUPER MEAL WORMS' ZOOPHOBAS ATRATAS.

12.1 General Species Information

- 12.1.1 These are the larvae of a large black beetle originating from the neo-tropics, known as the darkling beetle. The hard bodied larvae are produced in large quantities once sufficient numbers of breeding adults are established. The adult beetles secrete a musk, making them distasteful to predators so only larvae should be used as food. As larvae these beetles have strong mandibles and can bite frogs so care should be taken to avoid harm to frogs.
- 12.1.2 Darkling beetle larvae are commonly used as a livefood in herpetoculture, however the species favoured is *Zoophobas morio*. Since tis species s not available in Dominica, its cogener, *Zoophobas atratus* will be used as a subsitute.

12.2 Photographs of Species



Zoophobas Imago (adult)



Zoophobas morio larva.

12.3 Container

- 12.3.1 Large plastic boxes providing greater surface area than depth should be used to maintain larvae and adults. A culturing medium as describes below should be used as a substrate. Egg crates can be added to increase surface area.

12.4 Diet & Feeding Techniques

- 12.4.1 An 'edible substrate' or culturing medium should be used to allow the larvae to continually feed as they move through it. This can be made from a layer of cereal, oats, crushed dog biscuits and dry vegetable peelings (potato, carrot, sweet potato) The dry foods should be crushed as fine as possible to make harvesting larvae possible with a sieve.

12.5 Watering

- 12.5.1 A light spray can be given to the egg crates every few days. Do not allow the culturing medium / substrate to become wet as it will accumulate mould quickly.

12.6 Daily Husbandry

- 12.6.1 Check activity, check for mould and foul smells.
- 12.6.2 Every two weeks the substrate should be changed. Use a sieve to remove beetles and larvae. Since some tiny larvae and eggs could potentially be thrown away during the cleaning out procedure, keep the old substrate for a week or two until tiny larvae are big enough to remove.

12.7 Breeding Process

- 12.7.1 Large larvae (5-6cm) should be collected and housed individually in small containers such as small plastic food containers. After about 3-4 weeks the larvae will pupate and metamorphose when housed individually (they will NOT do this in the presence of other individuals). When the adults emerge they are ready to breed almost immediately.
- 12.7.2 Place fresh adults into the breeding container. Adult females can produce in excess of 1000 eggs in a 12 month period. These eggs will be deposited in rotten wood, damp egg crates. The eggs hatch and larvae can be observed in the substrate after 2-3 weeks. Harvest some larvae for food and harvest some for metamorphosis to create more breeding adults.

12.8 Rotation System

- 12.8.1 As described in breeding process. Large larvae (5-6cm long) should be removed and housed individually to allow them to metamorphose.
- 12.8.2 When adults emerge they are placed in the breeding container and allowed to lay eggs, which hatch into the culturing medium.
- 12.8.3 Harvest some larvae for food and some for breeding stock. Begin new cultures by adding fresh adults to a new container every 2 months or so until sufficient larvae are being produced to draw from sustainably.

12.9 How to Feed to The Crapaud

- 12.9.1 A deep smooth sided bowl can be used to prevent escape. These beetle larvae cannot climb smooth ceramic surfaces and therefore a large dog bowl or similar may be used to avoid escape and wastage.

12.9.2 As larvae these beetles have strong mandibles and can deliver an unpleasant bite, posing a threat to captive frogs. To avoid damage to frogs ensure the heads of these larvae are gently crushed before they are introduced to the frog enclosures.

- 1 *SPECIES.***
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