

# Husbandry Manual for

## Giant Burrowing Cockroach

### *Macropanesthia rhinoceros*



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February - August 2006  
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Thank you to the Keepers at the Education Centre, Taronga Zoo for their help and support.

Thank you to Geoff Thompson and Queensland Museum for their permission to use their copyright images.

# TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION.....</b>	<b>2</b>
<b>2</b>	<b>TAXONOMY.....</b>	<b>6</b>
2.1	NOMENCLATURE .....	7
2.2	SUBSPECIES .....	<b>ERROR! BOOKMARK NOT DEFINED.</b>
2.3	RECENT SYNONYMS .....	7
2.4	OTHER COMMON NAMES.....	7
<b>3</b>	<b>NATURAL HISTORY .....</b>	<b>8</b>
3.1	MORPHOMETRICS .....	8
3.1.1	<i>Mass And Basic Body Measurements.....</i>	9
3.1.2	<i>Sexual Dimorphism.....</i>	9
3.1.3	<i>Distinguishing Features.....</i>	9
3.2	DISTRIBUTION AND HABITAT .....	10
3.2.1	<i>Burrows.....</i>	11
3.3	CONSERVATION STATUS.....	11
3.4	DIET IN THE WILD .....	11
3.5	LONGEVITY .....	12
3.5.1	<i>In the Wild.....</i>	12
3.5.2	<i>In Captivity.....</i>	12
3.5.3	<i>Techniques Used to Determine Age in Adults.....</i>	12
3.5.4	<i>Nymphal Growth.....</i>	12
<b>4</b>	<b>HOUSING REQUIREMENTS .....</b>	<b>13</b>
4.1	EXHIBIT/ENCLOSURE DESIGN.....	13
4.2	HOLDING AREA DESIGN .....	13
4.3	SPATIAL REQUIREMENTS.....	144
4.4	POSITION OF ENCLOSURES.....	14
4.5	WEATHER PROTECTION .....	14
4.6	TEMPERATURE REQUIREMENTS.....	14
4.7	SUBSTRATE.....	14
4.8	NESTBOXES AND/OR BEDDING MATERIAL.....	14
4.9	ENCLOSURE FURNISHINGS.....	14
<b>5</b>	<b>GENERAL HUSBANDRY .....</b>	<b>15</b>
5.1	HYGIENE AND CLEANING .....	15
5.2	RECORD KEEPING.....	15
5.3	METHODS OF IDENTIFICATION.....	15
5.4	ROUTINE DATA COLLECTION .....	15
<b>6</b>	<b>FEEDING REQUIREMENTS.....</b>	<b>16</b>
6.1	CAPTIVE DIET.....	16
6.2	SUPPLEMENTS.....	<b>ERROR! BOOKMARK NOT DEFINED.</b>
6.3	PRESENTATION OF FOOD .....	16
<b>7</b>	<b>HANDLING AND TRANSPORT.....</b>	<b>17</b>
7.1	TIMING OF CAPTURE AND HANDLING.....	17
7.2	CATCHING BAGS .....	17
7.3	CAPTURE AND RESTRAINT TECHNIQUES.....	17
7.4	WEIGHING AND EXAMINATION.....	17
7.5	RELEASE.....	17

7.6	TRANSPORT REQUIREMENTS .....	17
7.6.1	<i>Box Design</i> .....	177
7.6.2	<i>Furnishings</i> .....	18
7.6.3	<i>Water and Food</i> .....	18
7.6.4	<i>Animals per Box</i> .....	18
7.6.5	<i>Timing of Transportation</i> .....	18
7.6.6	<i>Release from Box</i> .....	18
<b>8</b>	<b>HEALTH REQUIREMENTS .....</b>	<b>19</b>
8.1	DAILY HEALTH CHECKS .....	19
8.2	DETAILED PHYSICAL EXAMINATION .....	19
8.2.1	<i>Chemical Restraint</i> .....	19
8.2.2	<i>Physical Examination</i> .....	19
8.3	ROUTINE TREATMENTS .....	19
8.4	KNOWN HEALTH PROBLEMS .....	19
8.5	QUARANTINE REQUIREMENTS .....	19
<b>9</b>	<b>BEHAVIOUR .....</b>	<b>ERROR! BOOKMARK NOT DEFINED.</b>
9.1	ACTIVITY .....	20
9.2	SOCIAL BEHAVIOUR .....	20
9.3	REPRODUCTIVE BEHAVIOUR .....	20
9.4	BEHAVIOURAL INTERACTIONS .....	<b>ERROR! BOOKMARK NOT DEFINED.</b>
9.5	BEHAVIOURAL PROBLEMS .....	21
9.6	SIGNS OF STRESS .....	21
9.7	BEHAVIOURAL ENRICHMENT .....	21
9.8	INTRODUCTIONS AND REMOVALS .....	211
9.9	SUITABILITY TO CAPTIVITY .....	211
<b>10</b>	<b>BREEDING .....</b>	<b>222</b>
10.1	MATING SYSTEM .....	222
10.2	EASE OF BREEDING .....	222
10.3	TECHNIQUES USED TO CONTROL BREEDING .....	222
10.4	OCCURRENCE OF HYBRIDS .....	233
10.5	TIMING OF BREEDING .....	233
10.6	AGE AT FIRST BREEDING AND LAST BREEDING .....	233
10.7	ABILITY TO BREED EVERY YEAR .....	233
10.8	NESTING, HOLLOW OR OTHER REQUIREMENTS .....	233
10.9	BREEDING DIET .....	233
10.10	INCUBATION PERIOD .....	233
10.11	CLUTCH SIZE .....	233
10.12	AGE AT WEANING AND REMOVAL FROM PARENTS .....	244
10.13	NYPHAL MORTALITY RATE .....	<b>ERROR! BOOKMARK NOT DEFINED.4</b>
10.14	GROWTH AND DEVELOPMENT .....	244
<b>11</b>	<b>ARTIFICIAL REARING .....</b>	<b>255</b>
11.1	INCUBATOR TYPE .....	255
11.2	INCUBATION TEMPERATURE AND HUMIDITY .....	255
11.3	DESIRED % EGG MASS LOSS .....	255
11.4	HATCHING TEMPERATURE AND HUMIDITY .....	255
11.5	NORMAL PIP TO HATCH INTERVAL .....	255
11.6	DIET AND FEEDING ROUTINE .....	255
11.7	SPECIFIC REQUIREMENTS .....	255
11.8	DATA RECORDING .....	255
11.9	IDENTIFICATION METHODS .....	255
11.10	HYGIENE .....	<b>ERROR! BOOKMARK NOT DEFINED.5</b>
11.11	BEHAVIOURAL CONSIDERATIONS .....	266
11.12	WEANING .....	266

**12 REFERENCES..... 27**

**13 BIBLIOGRAPHY ..... ERROR! BOOKMARK NOT DEFINED.**

**14 GLOSSARY ..... ERROR! BOOKMARK NOT DEFINED.**

**15 APPENDIX ..... 311**

# 1 Introduction

There are more than 4000 different species of cockroach in the world. Here in Australia we have around 450 known species. To most people even the name “cockroach” is enough to bring on an immediate revulsion.

However the fast moving shiny, black or brown cockroaches that are commonly encountered by people in their homes are not our native species but one of the six different types that have been introduced. Generally introduced cockroaches have long antennae with downward facing triangular heads. Their eyes sit up in the top two corners, and their chewing (mandibles) mouth parts at the bottom. The head is then partially or completely hidden underneath their thorax (mid-body). Their body is commonly flattened and oval in shape, and their legs being made for speed are of similar size.

The *M. rhinoceros* is slow moving, wingless and clean. Many native Australian species are either wingless or have reduced wings this occurring in both males and females. Also, many native species of cockroach look more like a beetle being brightly coloured with orange, red, yellow and even blue. Some have distinctive spots or bands and even pale bordering. They emit no foul odours nor do they bite, sting or fly.

Most native Australian cockroaches live in the bush under logs, rocks, leaf litter and under the bark on trees. They range in length from 3mm- 80mm and are generally flat, robust and round in shape which assists them with crawling into crevices in the wild. Giant burrowing cockroaches are ground dwellers with a diet consisting mainly of decaying plant material.

In recent years, *M. rhinoceros* have become popular pets, not only in Australia but overseas as well. This is because they are clean, disease free, odourless, easy to look after, they can't climb or fly (and therefore can't escape), they don't bite, they live for a long time and they only have a few live young each year. (Aust Museum)

## 2 Taxonomy

### 2.1 Nomenclature

<b>Class</b>	Insecta
<b>Order</b>	Blattodea
<b>Family</b>	Blaberidae
<b>Genus</b>	<i>Macropanesthia</i>
<b>Species</b>	<i>M. rhinoceros</i> (Binomial name; <i>Macropanesthia rhinoceros</i> )

### 2.2 Sub Family

Panestiinae  
Panchlorinae  
Geoscapheinae

### 2.3 Recent Synonyms

Unknown

### 2.4 Other Common Names

Giant Burrowing Cockroach  
Litter Bug  
Rhinoceros Cockroach  
Cucaracha (Spanish)

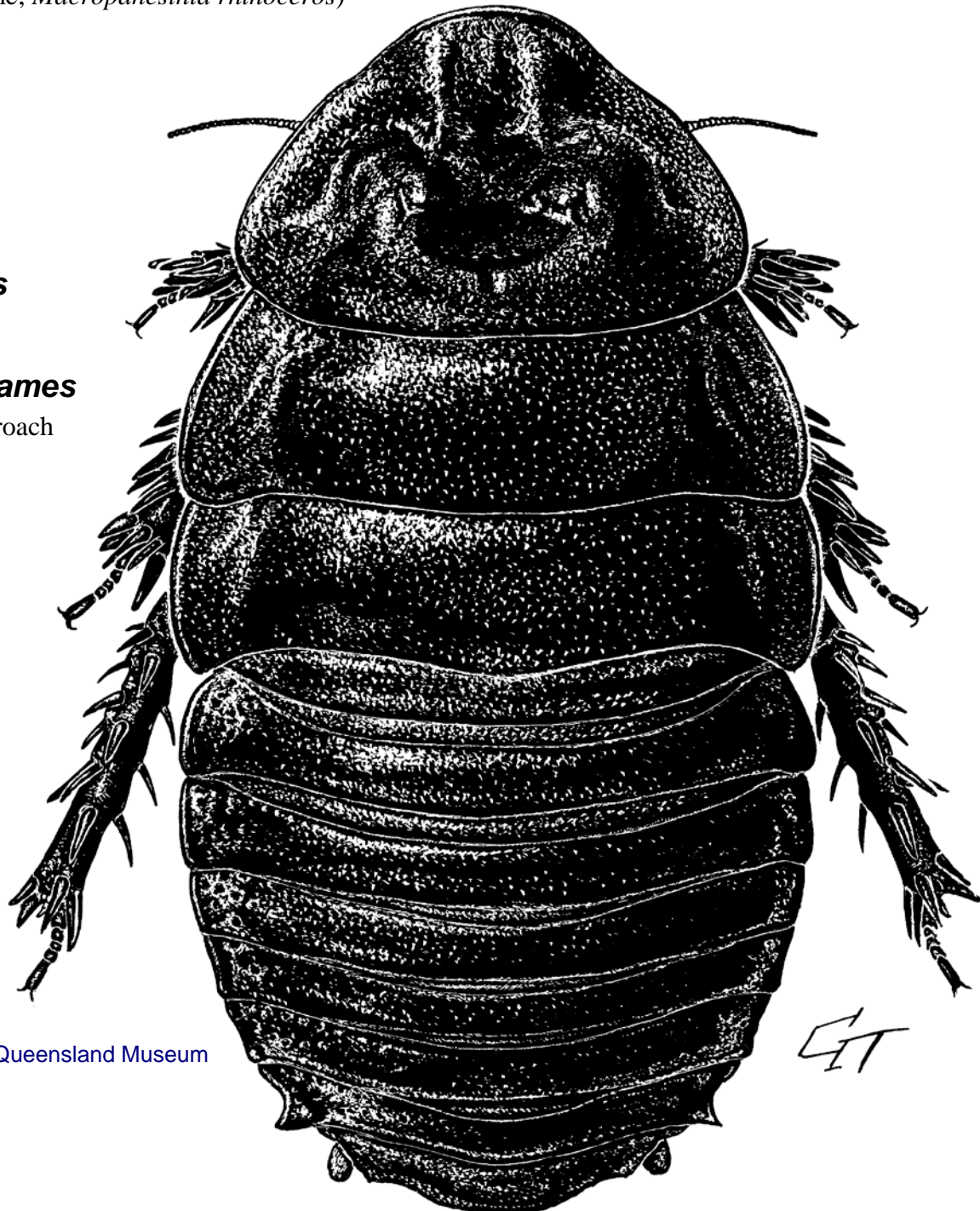


Illustration: Geoff Thompson © Queensland Museum

### 3 Natural History

Blaberidae is the second largest family of cockroaches world wide, although Australia has only a few of these one being the *Macropanesthia rhinoceros*.

Like other bush cockroaches, the *M. rhinoceros* are essential to the environment. They fulfill an important ecological role, recycling nutrients in the forest. Bush cockroaches should not be confused with the household inhabitants.

Many species in the Blaberidae family are well adapt for burrowing into soil having robust body shapes and short powerful legs. This includes species in the sub families Panestiinae, Panchlorinae and Geoscapheinae (Composed of 10 species).

The following observations were made by W.A. Henderson in north Queensland (Day 1950). He found that *M. rhinoceros* was observed infrequently during the dry season. He noted that they burrowed to an average of 60cm below the surface in sandy soil in stands of cypress pine, *Callitris* sp., and made a nest of grass, roots, dead leaves, etc., often among the pine roots. He also reported that young nymphs were rarely found above ground and that adults burrowed to the surface following rain, mainly at night.

#### 3.1 Morphometrics

*M. rhinoceros* has c. 79-80 chromosomes, among the highest number found in cockroaches (Cohen and Roth 1970).

##### **Male;**

Dark brown colour.

Head hidden completely by the overlapping hood like pronotum, face between antennae and basal half of clypeus slightly excavated.

On lower abdomen males have an extra segment, subgenial plate. This is quite obvious in adults.

##### **Female;**

Dark brown colour.

Pronotum flat not excavated.

According to Day, *M. rhinoceros* lacks a proventriculus, and its ventral nerve cord does not contain giant nerve fibres, the latter fact possibly explaining the slowness of reaction of this large species, since the speed of conduction by a nerve fibre is correlated with its diameter.

##### **Nymph;**

Reddish brown in colour,



### **3.1.1 Mass and Basic Body Measurements**

The *Macropanesthia rhinoceros* Saussure is the largest cockroach in the world weighing in at up to 35grams and length of 80 mm, growing as big as the palm of your hand (Queensland Museum).

### **3.1.2 Sexual Dimorphism**

Adult males can be identified by their deeply concave pronotum.

Adult females cannot be identified from large female nymphs by exterior characteristics. This can however be determined by opening up the posterior plates of an anesthetized insect to determine the development of the ovipositor ( Rugg & Rose 2006). This procedure has also been used to examine females for the presence of eggs.

### **3.1.3 Distinguishing Features**

Blaberidae cockroaches are unique in their burrowing habits (Rugg & Rose 1984), for these cockroaches live in permanent burrows in the soil, rather than burrowing into soil to escape predation or for casual shelter.

The *M. rhinoceros* cockroach is one of the many native Australian cockroaches that do not have wings and therefore do not fly.

Adults and large nymphs can produce an audible hiss. This is produced by the expulsion of air through the last air of abdominal spiracles, when the abdomen is strongly contracted anteroposteriorly (Rugg & Rose). This type of sound production is reminiscent of species of Gromphadorhina, which hiss by expelling air through the second abdominal spiracles (Dumortier 1965; Roth and Hartman 1967). *M. rhinoceros* will hiss during courtship, if physically disturbed and in aggressive interactions with other cockroaches.

## 4 Distribution and Habitat

*M. rhinoceros* can be found widely distributed through Northern Queensland, although most commonly from Cooktown to Rockhampton. The distribution of *M. rhinoceros* does not apparently correlate with any specific type of vegetation however the distribution is probably limited by the soil type as these cockroaches are only found in light sandy soils.

Field observations have been conducted within the vicinity of Innot Hot Springs, this area mainly consisted of *Eucalyptus* woodlands, *Callitris* and areas of thick grass cover. Other areas examined have been Forty Mile Scrub which is a dry vine scrub area containing dense thickets of Acacia, and Bald Hills where the vegetation type is rainforest. The soil at all sites was basically sandy, grading to at most a light sandy loam. The areas receive summer rainfall, with the majority of rain occurring from November to March. Cockroaches were found to be distributed throughout all areas with a number of local concentrations. The maximum density of cockroach burrows was two per square meter; however; the average density was an average of 0.33m<sup>2</sup> (Rugg & Rose)(Ann. Entomol. Soc. Am. 84(6): 575-582 (1991)).

### **3.2.1 Burrows**

The burrow entrance of the *M. rhinoceros* has a characteristic shape, resembling a flattened semi-circle. Entrances can be easily seen when cockroaches have been active. However, if not they can generally be difficult to locate because the entrance may have collapsed or been covered by litter. Often burrows are more readily detected by finding a line of cracked or raised earth, created by the cockroach digging just below the surface. The dimensions of the burrow entrance made by an adult are on average 5cm wide by 2cm high.

Burrows occasionally descend directly, but more commonly meandered just below the soil surface for up to one meter before sloping steeply downwards. Burrows do not appear to follow any apparent pattern or direction. Burrows widen considerably (up to 12cm) at an average 15cm below the surface. This widened portion extends for up to 1m and continues deeper, where the burrow usually finishes in a relatively short and narrow dead end at a depth of up to 1m (Rugg & Rose, 1990).

The widened portion of the burrow usually contains debris as well as leaf litter collected by the cockroaches, and is thought to be the part normally occupied by adults and nymphs. This is still not known for certain as, as the tunnel is excavated the cockroaches retreat and are almost always found at the end of the burrow when collected. Material found in the burrow comprised virtually of any surface debris (e.g., leaves, twigs and occasionally grass). This was generally old dry litter; fresh material has rarely been found.

Other insects are collected occasionally from the burrows; these are a scarab, *Dasygnathus blattocomis* Carne; aleculid beetles; tenebrionid larvae; caesmaking moth larvae; silverfish; and a blaberid cockroach, *Calolampra* sp. Centipedes can also be encountered occasionally in the burrows. The insects were collected from the gathered leaf litter; centipedes were generally found in the lower part of the burrow, often with the cockroaches (D.Rugg & H.A.Rose)(Ann. Entomol. Soc. Am. 84(6): 575-582 (1991).

### **3.3 Conservation Status**

The *M. rhinoceros* currently has no status with the ICUN Red listing.

### **3.4 Diet in the Wild**

Their diet consists mainly of dry, dead eucalypt leaves, bark, dried grass and twigs. They play an important ecological role of recycling nutrients back into the environment where they can be used by the surrounding vegetation.

*M. rhinoceros* shed their outer skin up to 14 times during their life they will eat this as it is highly nutritious.

## **3.5 Longevity**

### **3.5.1 In the Wild**

”Unknown”

### **3.5.2 In Captivity**

M. rhinoceros cockroaches have been known to live up to 8 years in captivity (Queensland Museum).

### **3.5.3 Techniques Used to Determine Age in Adults**

Studies conducted by D. Rugg and H. A. Rose (1984-1989) had the following results;

For all molts in the laboratory, the rate of increase in frons width was regressed against the previous frons width. This was done for male and female field collected nymphs, and these regressions were tested for equality of slopes and elevation (Snedecor & Cochran 1980). Starting from the known frons width of the first instars, the regression equation can be used to determine the rate of increase to the next instar stage, and the expected frons width can be calculated.

Nymphs were slow growing and their instars highly variable. Therefore, field collected individuals were assigned to instars by the following procedure modified by Rugg and Rose (1990).

Field collected nymphs could then be placed into a known instar.

Laboratory results were compared with a wild population by regular field sampling in 1988-1989.

### **3.5.4 Nymphal Growth**

Field data indicate that M. rhinoceros grows at a faster rate in its natural environment. However, the only nymphs that can be aged with any certainty are those collected with adult females. It has been found that field nymphs on average reach the eighth instar in 5 months. This data also shows the large variation in growth rates; some nymphs have only reached the ninth instar after 1 year.

Laboratory data on the nymphal period of M. rhinoceros indicate that they are slow growing cockroaches with highly variable growth rates. Summation of the median duration of the 14 possible instars gives a total nymphal

period of more than 7 years. However, by using minimum duration and assuming that individuals may molt to adult from the 11<sup>th</sup> instar, a nymphal period of an average 2.5 years is calculated.

Alternatively, examining maximum duration, the indication is that nymphs could require an average of 14 years for development. This high variation in growth rates and polymorphism has been noted in a number of cockroach species (see biological data in Cornwell 1968, Guthrie & Tindall 1968, Rugg & Rose 1990).

Table 6 (Rugg & Rose 1991).

## **4 Housing Requirements**

### ***4.1 Exhibit/Enclosure Design***

Ideally a large terrarium or medium fish tank should be used, dependent on how many cockroaches are being kept per enclosure. Males are generally aggressive towards other males so if a few are being kept in the same enclosure more space is needed to help avoid conflict. Also it is important that the females outnumber the males as they will fight each other over the females.

The enclosure needs to be laid with 100mm of clean, fine to medium grain river sand.

It is best to have a wet and dry end to the enclosure. At the wet end have a flat lid or small container with water soaked cotton wool or tissue (sphagnum moss can make a great substitute for cotton wool), this is to stop spillage and to prevent drying out. Cockroaches require a warm, humid environment.

It is important that the leaves do not become moist.

It is optional to use a heat mat at the dry end, making sure to cover only half the base of the enclosure.

### ***4.2 Holding Area Design***

See 4.1

### ***4.3 Spatial Requirements***

See 4.1

### ***4.4 Position of enclosures***

It is important that neither the enclosure nor cockroaches be kept in full sun for extended periods of time.

### ***4.5 Weather Protection***

See 4.4

### ***4.6 Temperature Requirements***

In the wild, burrow temperatures stay consistent at an average of 20degrees (68degF).

In captivity it is important to keep their temperature between 18-26 degrees. If the temperature surrounding the enclosure drops to 10deg or lower it is advised that a 40 watt bulb be used to regulate the temperature.

They require humidity levels of 80%. This is most easily achieved by covering 80% of the enclosures lid with a plastic or non- breathable material (Aust Insect Farm).

### ***4.7 Substrate***

Substrate should be clean fine to medium grain river sand, laid up to a depth of 100mm. This sand is available from pet stores and building supply stores.

### ***4.8 Nestboxes and/or Bedding Material***

M. rhinoceros cockroaches will use their substrate and eucalyptus leaves and twigs.  
They do not require a nest box.

### ***4.9 Enclosure Furnishings***

See 4.1

## **5 General Husbandry**

### **5.1 *Hygiene and Cleaning***

The sandy substrate needs to be changed every few months depending on how large the enclosure is and how many animals are being held there. When changing food be sure to remove all old remains.

### **5.2 *Record Keeping***

Follow institutional policies and procedures for record keeping. Include Daily diary; births, deaths, general behaviour.

### **5.3 *Methods of Identification***

“Unknown”

### **5.4 *Routine Data Collection***

As in 5.2

## **6 Feeding Requirements**

### **6.1 Captive Diet**

The main stable diet of *M. rhinoceros* is dry, dead Eucalyptus leaves, they prefer leaves that are less aromatic but this is not crucial. It is important to supply a variety of barks and twigs from Gum trees. Do not feed leaves that are yellow, green or damp.

A variety of fruit and vegetables such as banana, apple, carrot, lettuce and potato should be occasionally included in their diet.

When caring for young nymphs it is important to crush all dried leaves finely as they are unable to eat from whole ones.

Avoid dog pellets as they may contain chemicals that are harmful for the cockroaches.

Change leaves and twigs twice a week or as they lose their crisp. Fruits and vegetables should be removed after a few days as they will become mouldy. *M. rhinoceros* will die without their stable diet of leaves.

### **6.2 Supplements**

“Unknown”

### **6.3 Presentation of food**

Presentation of food is only important for the purpose of peoples viewing. The cockroaches only require that their food be dry and crisp.



## **7 Handling and Transport**

### ***7.1 Timing of Capture and Handling***

Capture of *M. rhinoceros* can be conducted at any time. Due to the nature of this animal there is no danger to the keeper performing the capture. They are nocturnal creatures and this could be taken into consideration.

### ***7.2 Catching Bags***

Bags are not required, only a sturdy pair of gentle hands.

### ***7.3 Capture and Restraint Techniques***

Pick animal up by wrapping hands around from the sides and lifting from underneath. Whilst supporting with one hand gently cover with other blocking forward motion.

### ***7.4 Weighing and Examination***

For weight, place cockroach into container on scales.

Examinations can take place while holding animal.

### ***7.5 Release***

Place animal gently.

### ***7.6 Transport Requirements***

Unfortunately for insects there are currently only basic regulations in place.

Due to the frequent disinsecting of aircraft holds and the residual nature of the insecticides used, insects cannot be carried other than in airtight containers in certain aircraft (consult the airline for their container and handling requirements).

Recently I received Giant burrowing cockroaches through the mail. The mail carrier was Australian Air Express. I have written this experience as examples below.

#### ***7.6.1 Box Design***

A small terrarium 20cm long, 13cm wide and 15cm high was used. This was then placed inside a larger cardboard box and held into place by scrunched newspaper. The terrarium was plastic and contained air holes in the lid.

## **7.6.2 Furnishings**

Leaf litter was used. I believe this to be important as it gives the insects a food source, coverage and it is light enough to not cause any damage when shifted around.

## **7.6.3 Water and Food**

Dry, dead eucalyptus leaves are used as this is their predominant feed.

A wet cotton wool ball is needed to supply cockroaches with enough fluid and moisture to last approximately two days.

## **7.6.4 Animals per Box**

As there are no regulations in place this is up to your discretion. I received three 14 month old nymphs in a terrarium (dimensions listed in 6.6.1) which would also be enough room to hold one adult cockroach.

Males often show aggression towards each other and should ideally be transported in separate enclosures.

## **7.6.5 Timing of Transportation**

There is no specific time for transport.

## **7.6.6 Release from Box**

When a new enclosure is prepared, remove animal (see 6.3 capture and restraint) and gently place.

## **8 Health Requirements**

### **8.1 Daily Health Checks**

General daily check to confirm animal is alive and is not showing exterior signs of trauma.

### **8.2 Detailed Physical Examination**

“Unknown”

#### **8.2.1 Chemical Restraint**

“Not applicable to this species”

#### **8.2.2 Physical Examination**

After a cockroach has shed its skin it will be white in colour except for its eyes. At this time it is important that it not be held as it becomes extremely fragile and can be easily harmed.

### **8.3 Routine Treatments**

“Unknown”

### **8.4 Known Health Problems**

M. rhinoceros often have mites, this is normal.

Protozoan and Helminth have been listed (Roth & Willis (1960), but there are few records.

Presence of a large species of amoeba, ciliates belonging to Clevelandellidae were recorded by Day (1950) also, nematodes (gordid worms) in the hind gut and body cavity (Day 1950).

### **8.5 Quarantine Requirements**

“Unknown”

## **9 Behaviour**

### **9.1 Activity**

Surface activity coincides with wet weather, with most activity occurring with the onset of the summer rains. Cockroaches remain in the burrows during the dry season and feed on litter accumulated in the burrow (Rugg & Rose (1991)).

### **9.2 Social Behaviour**

Rugg & Rose (1984) observed that *M. rhinoceros* are not generally found in family groups of two adults plus progeny. However, young nymphs remain with the adult female for some months

Adult males have often been observed living with late instar females nymphs. Otherwise cockroaches are solitary.

**Wandering:** predominantly observed in adult males. The cockroaches would walk randomly and occasionally pause and remain motionless for several minutes. It was possible for these individuals to be approached quite closely without them being alarmed. Observation results showed they did not appear to be aware of their surroundings and generally did not attempt to escape. After sunrise these cockroaches became more active and began to dig or else descended a nearby burrow. A few males were observed fighting at the entrances of burrows, with the resident attempting to prevent the intruder from entering the burrow. The two adversaries would butt each other with the forward edge of the pronotum to force the other backwards or to the side. The general aggressiveness of individual is consistent with a solitary existence (Rugg & Rose (1991)).

**Foraging:** The active collection of surface litter is predominantly observed in adult females. These cockroaches were up to 50cm from the entrance of the burrow. The cockroach would grasp a piece of litter in its mandibles and drag it backward down into the burrow. Cockroaches were most commonly observed carrying dead leaves (Rugg & Rose (1991)).

### **9.3 Reproductive Behaviour**

*M. rhinoceros* main elements of courtship are based on scent, taste and touch. This is not too surprising as their mating activities go on after dark.

Field and laboratory studies conducted by Rugg & Rose (1984) on courtship behaviour are as follows; Courtship behavior was observed a total of 24 times between adult males and females that had been separated for more than 30 days. On seven of these occasions females were observed to respond to male courtship advances by raising the tip of the abdomen and opening the posterior plates.

Males exhibited a number of courtship behaviors including hissing, posturing (male raised his body into a convex arch), antennating, and grooming the female, and pushing where the male would push the female and attempt to lift her body with his pronotum. Males would attempt to copulate by turning 180 degrees and thrusting with the tip of the abdomen.

Copulating pairs were observed on three occasions, though the courtship was not followed.

All couples were in a posterior-to-posterior attitude and remained connected for more than 30 minutes. No significant interactions were observed between the males and females after separation.

#### **9.4 Behavioral interactions**

Fighting is most common amongst adult males. This behavior persists for a relatively short period after which males will cease fighting.

Adult females with nymphs are also very aggressive towards other adults both male and female.

Aggressive behavior is limited to butting, barging and hissing. This is initiated upon antennal contact with the other cockroach. The cockroaches hiss and barge against each other with their pronota lowered. This will often result in one of the cockroaches being overturned (Rugg & Rose (1991).

The hissing sound produced by *M. rhinoceros* is caused by the expulsion of air from the posterior spiracles and is a behaviour commonly observed in blaberid cockroaches (rapid breathing or respiratory pulsing)(Wendelken & Barth 1987). This audible hiss in *M. rhinoceros* may be attributed to the large size of the insect, as similar behavior has been observed in smaller Geoscaphinae species but do not produce any sound audible to humans.

#### **9.5 Behavioural Problems**

See 9.4

#### **9.6 Signs of Stress**

“Unknown”

#### **9.7 Behavioural Enrichment**

“No data available”

#### **9.8 Introductions and Removals**

“Unknown”

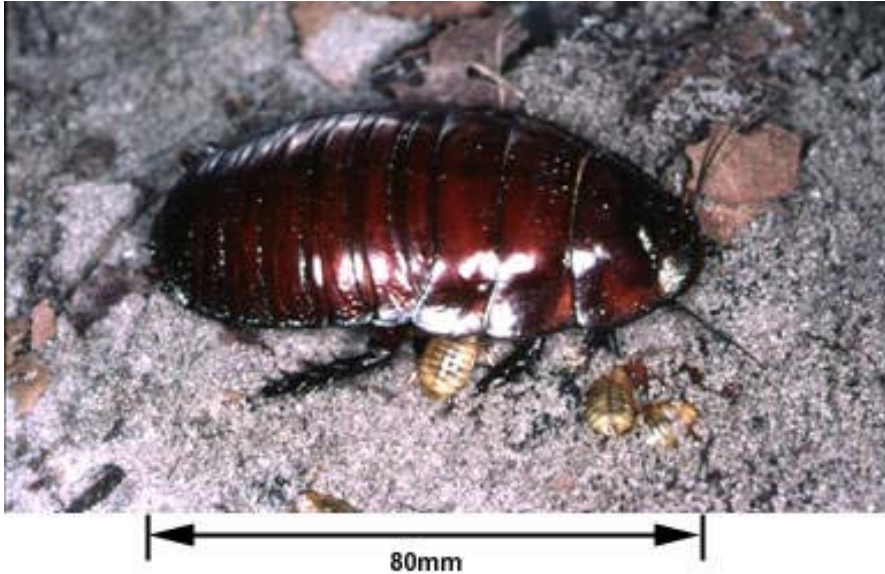
#### **9.9 Suitability to Captivity**

*M. rhinoceros* are suitable to captivity. They are easy to care for and do not require too much space.

They are becoming popular pets.

## 10 Breeding

Unlike other cockroaches, which produce eggs in capsules, *M. rhinoceros* cockroaches are born live.



Photo; Queensland museum.

### 10.1 Mating System

Both the males and females emit pheromones. Female pheromones act primarily to release male courtship efforts, while the male pheromones release the female mounting and feeding responses. Sexually receptive males often respond with side-to-side oscillations of the body before adopting a special courtship posture.

### 10.2 Ease of Breeding

After reaching maturation at three- four years of age females can produce up to 30 young in a single clutch, annually.

### 10.3 Techniques used to control Breeding

“Unknown”

#### **10.4 Occurrence of Hybrids**

“Unknown”

#### **10.5 Timing of Breeding**

M. rhinoceros have a regular breeding cycle, mating during winter with birth during late spring.

#### **10.6 Age at First Breeding and Last Breeding**

M. rhinoceros cockroach reaches maturation at around 3-4years old. It is at this stage that they will start to breed.

#### **10.7 Ability to Breed Every Year**

Female M. rhinoceros have a well defined reproductive cycle (Rugg & Rose), producing only one brood per year in late spring after an average incubation period of 3months.

#### **10.8 Nesting, Hollow or Other Requirements**

“Unknown”

#### **10.9 Breeding Diet**

Normal

#### **10.10 Incubation Period**

The average incubation period is 3months.

#### **10.11 Clutch size**

On average a brood of 30 nymphs is produced, these nymphs are born a creamy white colour. Immediately after birth these small nymphs will find security and warmth under their mother.

### **10.12 Age at Weaning and Removal from Parents**

Newborn nymphs will commonly cluster under and around their mother this had been reported for a number of species (Roth & Willis 1960, Schal et al. 1984). *M. rhinoceros* nymphs will remain with their mother for 5-7 months. During this time she will care for them and supply food. They will molt up to seven times during this period.

Studies have shown that females with young tend to be more aggressive than lone females possibly suggesting high levels of maternal care. If so, this level of maternal care is unusual among blaberidae cockroaches. Only one other species is thought to surpass this level of care, this being the primitive cockroach *Cryptocerus punctulatus* Scudder, which provides parental care for a number of years, providing gut symbionts, nutrients, and protection (Nalepa).

### **10.13 Nymphal Mortality Rate**

The average mortality rate of *M. rhinoceros* is 40% during the 5-7 month period when the nymphs remain with the adult female. This mortality rate could be expected to rise once the nymphs leave the burrow (Rugg & Rose 1984).

Nymphs that are bred in captivity can be separated from the mother after four months of age (Aust Insect Farm) this is because at this stage the parents tend to become vicious towards their young.

### **10.14 Growth and Development**

Laboratory data on the nymphal period of *M. rhinoceros* indicate that they are slow growing cockroaches with highly variable growth rates (Rugg & Rose (1984).

See 3.5.4



## **11 Artificial Rearing**

### ***11.1 Incubator Type***

“Unknown”

### ***11.2 Incubation Temperature and Humidity***

“Unknown”

### ***11.3 Desired % Egg Mass Loss***

N/A for this species

### ***11.4 Hatching Temperature and Humidity***

N/A for this species

### ***11.5 Normal Pip to Hatch Interval***

N/A for this species

### ***11.6 Diet and Feeding Routine***

“Unknown”

### ***11.7 Specific Requirements***

“Unknown”

### ***11.8 Data Recording***

“Unknown”

### ***11.9 Identification Methods***

“Unknown”

### ***11.10 Hygeine***

“Unknown”

### **11.11 Behavioural considerations**

“Unknown”

### **11.12 Weaning**

“Unknown”

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# Glossary

*Abdominal spiracles:* Any of several abdominal tracheal openings in the exoskeleton of an insect.

*Anteroposteriorly:* Relating to both front and back.

*Basal:* Lower/ Bottom

*Clypeus:* A shieldlike plate on the front of the head of an insect.

*Convex:* Having a surface or boundary that curves or bulges outward, as the exterior of a sphere.

*Frons:* The anterior, uppermost part of the head of an insect.

*Instar:* A stage of an insect or other arthropod between molts.

*Mandibles:* Any of various mouth organs of invertebrates used for seizing and biting food, especially either of a pair of such organs in insects and other arthropods.

*Molts:* To shed or cast off (a bodily covering).

*Nymph:* The larval form of certain insects, usually resembling the adult form but smaller and often not fully developed. Also called *nympha*.

*Ovipositor:* A tubular structure, usually concealed but sometimes extending outside the abdomen, for containing or depositing eggs.

*Pheromones:* A chemical secreted by an animal, especially an insect that influences the behaviour or development of others of the same species, often functioning as an attractant of the opposite sex.

*Polymorphism:* The occurrence of different forms, stages, or types in individual organisms or in organisms of the same species, independent of sexual variations.

*Progeny:* Offspring or descendants derived from another, considered as a group.

*Pronotum:* The dorsal plate of the prothorax in insects.

*Prothorax:* The anterior division of the thorax of an insect, bearing the first pair of legs.

*Proventriculus:* The division of the stomach that secretes digestive enzymes and passes food.

*Sphagnum moss:* a large genus constituting the order Sphagnales: atypical mosses of temperate bogs with leaves that can hold much water.

*Terrarium:* A small enclosure or container.

*Thorax:* The second or middle region of the body between the head and the abdomen, in insects bearing the true legs and wings.

*Ventral nerve*: a bundle of nerve fibers running to various organs and tissues of the body through the abdominal segment.

## **Appendix**

(e.g. equipment details, suppliers and drug details)

Australian Insect Farm, Innisvale Queensland- [www.insectfarm.com.au](http://www.insectfarm.com.au)