# Husbandry Manual
# for
# Exotic Tarantulas

**Order:** Araneae
**Family:** Theraphosidae
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# Introduction

Tarantulas' of the family Theraphosidae have long held the publics' imagination, inducing feelings of fear, revulsion and awe. They are the largest and hairiest of all spiders and have long been surrounded by myths and misconceptions. With over 850 species in 111 genera tarantulas have been able to colonise nearly every habitat on Earth from the deserts to the rainforests. Since the 1980's tarantula keeping has exploded in popularity in Europe and North America with many species being available as captive breeding techniques improve. In Australia we've seen a massive growth in native spider keeping with just about every pet shop holding a native "birdeater". This manual was intended to encourage this interest further and to also provide a clear-cut document covering the basic care and maintenance of these ancient creatures.

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# 1 TAXONOMY

## 1.1 Nomenclature

**Class:** Arachnida
**Order:** Araneae
**Family:** Theraphosidae
**Genus:** commonly kept species from the following: Avicularia, Brachypelma, Citharishchius, Lasiodora, Nhandu, Phrixotrichus (Grammastola), Poecilotheria, Psalmopoeus and Theraphosa

**Species:** including A.avicularia, B.smithi, C.crawshayi, L.parahybana, N.carapoensis, P. (G) pulchra, Poecilotheria regalis, Psalmopoeus irminia and T.blondi

## 1.2 Common Names

The naming of tarantulas is a notoriously confusing issue especially when the systematics of tarantulas is constantly under review by the experts. See. Bonnet (1945-51), Roewer (1942), Brignoli (1983), Raven (1985), Smith (1984, 85, 87) and Platnick 1989).
Common names are often created by animal traders and generally reflect colouration and habitat. Often they can be quite exotic like 'Venezuelan Tiger Tarantula' or 'Giant Pinkstarburst Tarantula' and are meant to sell spiders. They are prone to error when a species has a wide range of colour or habitat variants, *Phrixotrichus spatulata*, or the Chilean Flame, Chilean Rose or Chiliean Redback Tarantula is an example (Schultz 1998).

In Africa tarantulas are called Baboon Spiders, in Asia often Earth Tigers, Australians have called them Whistling or Barking Spiders whilst the rest of the world Bird-eating Spiders or Tarantulas. Officially many common names aren't recognised by the Committee on Common Names of Arachnids of the American Arachnid Society, even the words 'tarantula' and 'mygaolomorph' are technically wrong (see Appendix 1).

Below is a list of some of the tarantulas held in the only exotic tarantula exhibit in Australia (Tarantulaville at the Australian Reptile Park –ARP), their official common names and some unofficial ones.

| **Species Name** | **Common Name** | **Other Names** |
|---|---|---|
| *Avicularis versicolor* | Antilles Pinktoe T | RedbirdSpider |
| *Brachypelma smithi* | Mexican Redknee | Mex Redleg,Orange Knee |
| *Citharischus crawshayi* | King Baboon T | Drumstick Baboon spider |
| *Nhandu carapoensis* | Brazilian Red T | Brazilian Orange T |
| *Lasiodora parahybana* | Brazilian Salmon T | Salmon Pink Birdeater |
| *Phrixotrichus pulchra* | Brazilian Black T | Uruguay Black |
| *P.spatulata* | Chilean Rose T | Chilean Beautiful/Flame |
| *Poecilitheria regalis* | Indian Ornamental | Royal Indian Tree Spider |
| *Psalmopoeus irminia* | Suntiger Tarantula | Venezuelan Tiger |
| *Theraphosa blondi* | Goliath Birdeater | Brazilian Goliath |

# 2 Natural History

While amongst the most famous of the spiders tarantulas remain the least studied. Much work has been done on the systematics of Theraphosidae: Bonnet (1945-61), Brignoli (1983), Raven (1985) Smith (1984-88) and Platnick (1989). Captive behaviour including incubation times and egg numbers: Galiano (1973), Baerg (1958), Bucherl (1971) and Perret (1974); growth and development: Celerier (1981 & 1988), Baerg (1928) and Buchli (1970); and adult life cycles: Dresco-Derouet (1970) and Celerier (1981). Other studies have been done on urticating hairs (Stradling 1978) and venom toxicity Ori (1982) and Ibister. (2002).

Outside the lab very few extensive behavioural studies have been conducted. Stradling (1978) conducted an interesting 18month study on *Avicularia avicularia* within a fixed plot on Trindad, observing such things as preferred tree girths, height of retreat, juvenile habits and prey capture. *Brachypelma smithi* population density, distribution and burrow design were detailed in a report by R. Smith etal (1988) for their debut on the IUCN Red List. Many other studies have been short (only conducted when conditions suit us eg dry season) or restricted to a single species or regions, which may not be representative to the whole genus.

There is much scope for future field study, for example the methods and preferences for burrow building, or the behavioural differences between obligate burrowers and the so called nomads. Also, following around a newly matured male *Theraphosa blondi* or *Lasiodora parahybana* would be useful in learning distances traveled to find mates, predator avoidance and possibly number of females mated. In captivity growth rates, courtship rituals, food supplements and the use of vet procedures and drugs are all in need of further study and can be done by amatuers.

## 2.1 Basic Anatomy

Tarantula bodies can be divided into two parts: the cephalothorax (or prosoma) and the abdomen (or opisthosoma). I will briefly discuss the roles of the external parts and their appendages.

**Cephalothorax:** This is the combined head and thorax of all spiders and houses the nervous system, sucking stomach, eyes, and both venom and digestive fluid reservoirs. The dorsal shell is called the carapace and is usually covered in short fine hairs and is dominated by the central apodeme, a deep indentation that corresponds with the muscle attachment point for the sucking stomach. The ventral surface consists of a central sternum, an anterior labium all surrounded by the ten coxa which form the anchor points for the legs and pedipapls (Brunet 1994). In some African species, most notably the *Ceratogyrus* genus, this indentation is replaced by a horn. The significance of this vast difference is unknown.

**Eyes:** A diagnostic characteristic of the family Theraphosidae is the extremely tight cluster of eight small eyes perched on a tubercule. These eyes are fairly rudimentary only detecting contrasts between light and dark (Preston-Mafham 1984).

**Mouth parts:** The most obvious feature here are the massive chelicerae and the long curved fangs. These fangs, which can measure over 10mm, are hollow and work like a hypodermic needle delivering venom from the glands, via the chelicerae, to the fang tip. They are also used for food manipulation and as a digging tool (Lund 1977). Between the chelicerae is the mouth itself (called the labrum), where digestive fluid is expelled and liquid food taken in.

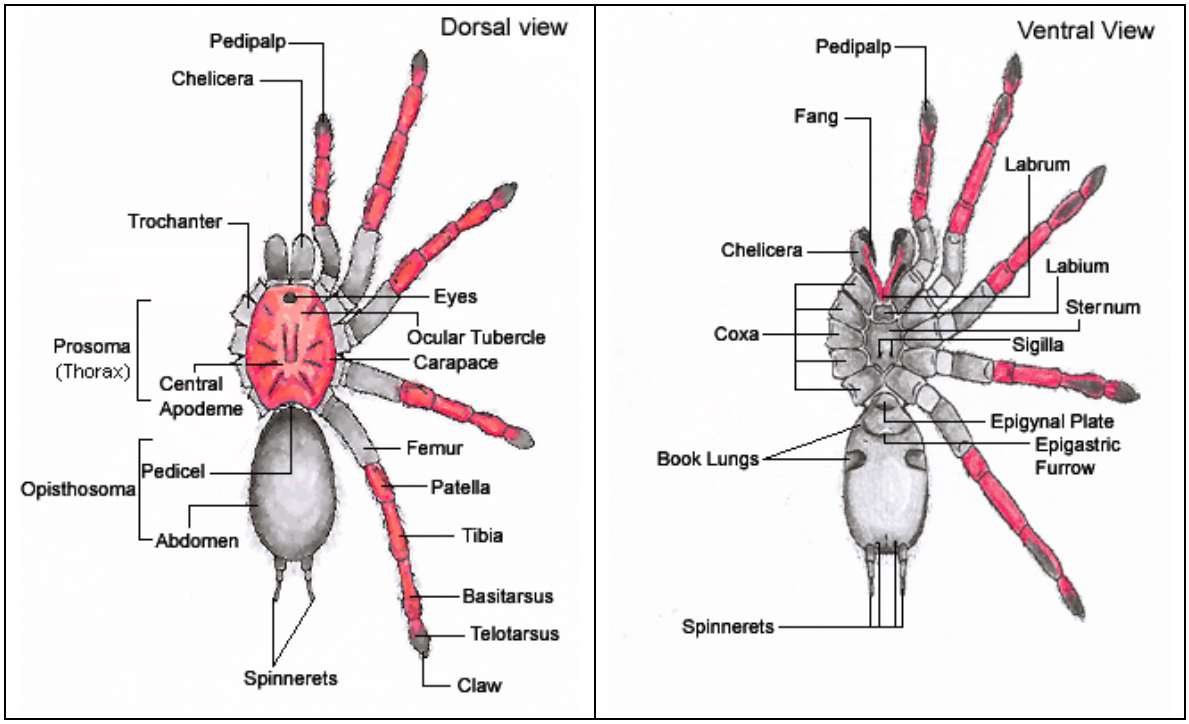
**Pedipalps:** These important appendages, also called 'palps', appear either side of the chelicerae and consist of seven segments including the terminal plate that bears two pads of bristles and a claw. These digits are used to feel the area in front of the tarantula much like insects' antennae but are also vital feeding implements, as the bristles at their base are used for straining food. After a meal they are used to clean the mouth parts, as well as general grooming. The pedipalps also serve two more radical purposes. Firstly, the mature male will

develop an emboli and palpal bulb on the end of each pedipalp, these represent the external reproductive organs. Secondly many tarantula species including *C. crawshayi* and *Selenocosmia* species possess specialised bristles on the base of the pedipalp and when rubbed against corresponding bristles at the base of the chelicerae produce a whistling sound called stridulation (Hawkeswood 2003). This is meant to serve as a warning to potential predators.

**The foot of a Brazilian Black Tarantula *(Phrixotrichus pulchra)* showing the scopula pads, tarsal claws and sensory hairs.**
**Photo by Nathan Psaila.**

**Legs:** Tarantula legs have eight segments which, starting from the body, are called the coxa, trochanter, femur, patella, tibia, tarsus, pretarsus and claw (Snodrass 1967). Each foot ends with a special paired cluster of bristles called scopulae (shown above), and a pair of tarsal claws. These mechanisms allow the tarantula to climb smooth surfaces (including glass) and assist with prey capture and climbing. Mature male tarantulas possess a tibial hook on each tibial segment of the second pair of legs. This hook may be reduced to a tuft of bristles in some species eg. *T.blondi* and are used during mating (Marshall 1996). Like the fangs, pedipalps, spinnerets and all of a tarantulas legs can be regenerated over several moults if lost. We have a Venezuelan Suntiger *(Psalmopoeus irminia)* who once lost both of her fangs during a moult, we had to place stunned crickets right under her mouth so she could manipulate them with her palps. Seven

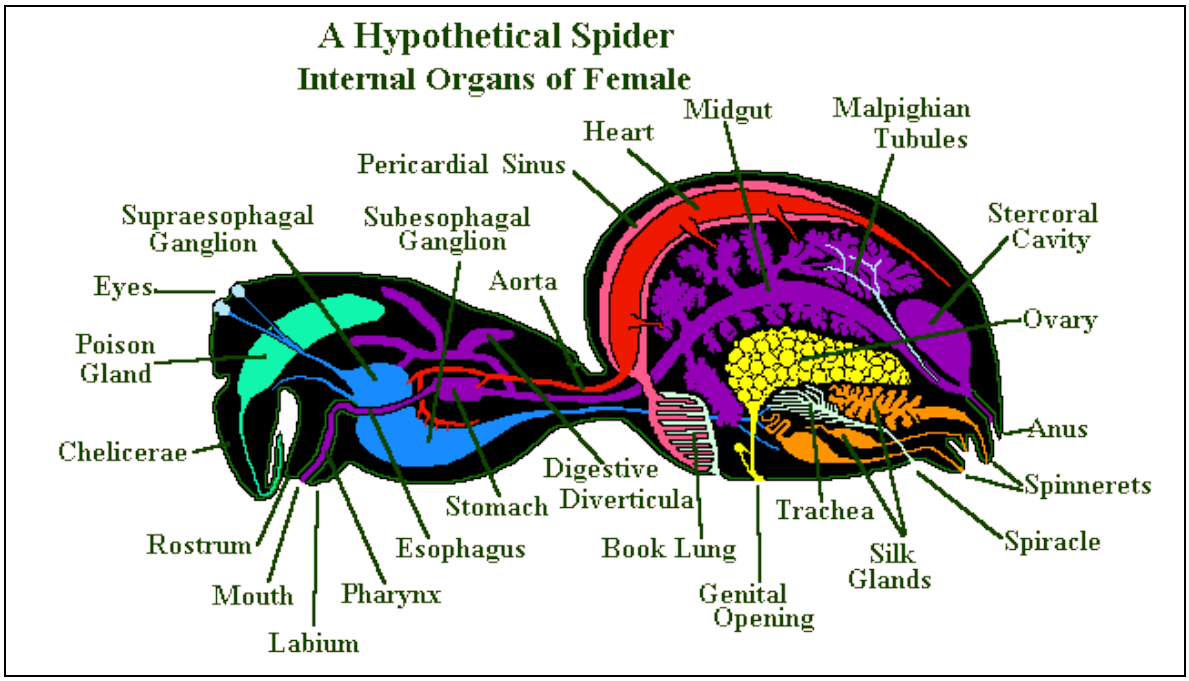
months later, in a show of the legendary regenerative powers of spiders, she moulted again this time with a pair of perfect fangs!




**Abdomen:** The abdomen houses the heart, intestines, liver, primary reproductive organs, respiratory system and the silk manufacturing system. The abdomen of all tarantulas is covered in long hairs and is connected to the cephalothorax by the pedicel. On the ventral surface two pairs of book lungs are present, each appearing as a yellowish square with a slit shaped opening called the spiracle. Between the first pair is the epigastric furrow, representing the external genital opening (Schultz 1998). Further along the abdomen, above the spinnerets the anus is located.

**Spinnerets:** The most obvious appendages on the abdomen are the spinnerets, which are the external parts of the silk machine. Tarantulas have four, with the posterior two being the largest. While these spiders do not make webs to capture prey they have a few other uses for silk. Terrestrial species will line their burrows with silk in, effect waterproofing them, while arboreal species will construct a fully enclosed weather proof sack to live in (Stradling 1987). Other

uses for silk are sperm webs, food mats, eggsacs, guidelines and trip wires (Preston-Mafham 1985).




**Hairs:** Possibly the most important sensory feature is their body and leg hairs. These fine bristles act as receivers for both air and substrate borne vibrations and can tell a tarantula the direction and size of an incoming threat or prey item. As mentioned above they have evolved into many forms and functions including scopula for climbing and bristles for straining food (Schultz 1998). The most suprising use of hairs is in self defense.

**Urticating hairs:** All New World tarantulas except for the *Psalmopoeus* genus possess the ability to flick stinging hairs at intruders. They do this by flicking their rear most legs against the abdomen, thus disturbing a cloud of the loosely connected urticating hairs. Each hair has a series of barbs and one end is harpoon shaped allowing them to penetrate up to 2mm into human skin (Schultz 1998). The effect of these hairs depends on the species and the victim. Usual symptoms are itchiness (including eyes), redness and swollen mucous membranes. Some species possess more potent hairs than others, and in my experience the Brazilian Red *(Nhandu carapoensis)*

seems to affect me more than other tarantula hairs. Other species known to be especially virulent or at least very keen to flick are the Goliath Tarantula *(T.blondi)*, Painted Red Leg *(Brachypelma emilia),* Curly Hair *(B. albopilosa),* and the Salmon Pink *(Lasiodora parahybana)*. (Gurley, 1994-95).

## 2.2 Mass and Basic Body Measurements

If there is one thing everybody knows about tarantulas, it's that they're huge hairy spiders! This of course is true considering most of the other 37000+ species of spiders are hairless and no bigger than a thumbnail.

The heaviest weight recorded for a tarantula is 122.2grams and is from an unspecified female from Suriname (Guiness 2002). Most of the species commonly kept are medium to large and will weigh in at 20-60g. Males are about 40-60% lighter than their mates (Schultz 1998).

Spiders are measured from the front of the chelicerae (jaws) to the tip of the abdomen (also known as the opisthosoma). Tarantulas range from the diminutive Tanzanian Dwarf *(Heterothele losella)* at 25mm to the Goliath Birdeater *(Theraphosa blondi)* at over 90mm, both are adult female lengths (Marshall 1996). Males may be 80-90% this length (Hillyard 1997).

Another often quoted measurement is legspan. The record leg span is a huge 280mm for a male *T.blondi* (Guiness 2002). A medium sized species such as a female *Brachypelma* or a *Phrixotrichus* may attain a 160mm legspan (pers. observations).

## 2.3 Sexual Dimorhpism

As immature spiderlings it is difficult to determine between the sexes only close examination of the inside of a freshly moulted skin can give any reliable clue. The epigastric furrow (see Appendix 2 for anatomy diagrams) on a male is only a simple slit whereas females possess two pockets where sperm is stored (Clarke 1987).
It is only after the ultimate moult that major changes are discernable. While the females continue looking like giant versions of their babies the males undergo several important changes.

Firstly the males cephalothorax and abdomen will appear narrower and the legs longer than his female siblings. This streamlining of the form makes it easier to move rough terrain or trees while searching for a female.

Secondly each of the males pedipalps will undergo major changes. Instead of being rounded off appendages used to manipulate food they develop an emboli and bulb. These appendages are now the males external sex organs. This change occurs in all male spiders (Preston-Mafham 1984).


***Phrixotrichus rosea*** **showing the palpal bulb and spur.**

Lastly the second pair of legs of most species develop tibial spurs. These vary in shape from the classic hook eg *Brachypelma sp* to a tuft of stiff hairs. Some genus lack any spur including *Hysterocrates, Citharischus* and *Poecilotheria*.

## 2.4 Distribution and Habitat

The tarantula family (Theraphosidae) has a worldwide distribution mainly between the latitudes 40N and 40S. They are found on all continents except Antarctica, and many islands including Madagascar, Sicily, Cypress, Indonesia, Philippines, New Zealand, New Guinea, some Pacific islands and all the Caribbean islands Roewer (1963). They are found in a wide range of habitats, with the greatest diversification in the tropics.

Within this range terrestrial tarantulas have managed to colonise arid scrublands, grasslands and all types of forest. Arboreal species are restricted to moister environments' especially tropical rainforests.

**Tarantula burrow, Cape Tribulation Nth Qld. Photo by N.Psaila**

Tarantulas will generally avoid areas that are regularly inundated like swamps and river deltas or are prone to frost or extremely low temperatures.

## 2.5 Conservation Status

The main threat to all Theraphosid spiders is habitat destruction and alteration. Rainforest species are most vulnerable but even grassland species' are affected by soil compaction from livestock (Schultz 98).

Over collecting has been a problem in the past most notably with the famous Mexican Redknee Tarantula (*Brachypelma smithi)*.

In 1973 the Convention on International Trade in Endangered Species (CITES) was created to control the trade in threatened or endangered species. Of the tarantula family only the *Brachypelma* genus, and *Aphonopelma albiceps* and *A. pallidium* are listed. They appear under Appendix Two meaning that they're not in imminent danger of extinction but may be, if current international trade continues.

This basically means these spiders cannot be collected from the wild and all imports must be accompanied by the appropriate paperwork and pre-approval from national governing bodies (Dept. of Agriculture, Australian Custom Services, and the Australian Quarantine and Information Service on our end). It is also illegal to trade in deceased specimens such as the mounted tarantulas available in most markets.

## 2.6 Diet in the Wild

Tarantulas will generally eat anything they can overpower. Their usual diet consists of invertebrates captured at the burrow entrance or the immediate surrounds. Of course some are big enough to catch and kill frogs, small lizards, snakes, rodents and nestling birds (Platnick 2000).

## 2.7 **Longevity**

**Wild.** Under natural conditions a tarantulas' longevity is connected directly to climate and environment it lives in. Spiders from temperate areas and those that experience seasonal periods of inactivity due to drought tend to live longest (Schultz 1998). Faster growing species from the tropics where prey is abundant tend to live shorter lives but produce more offspring (Smith 1984).

Few studies have been conducted on tarantula longevity in the field but *Aphonopelma hentzi* studied in Arkansas showed males maturing at 10-12 years (Baerg 1958), this seems true with many North Amercian species. In contrast the tropical Pinktoe Tarantula (Avicularia avicularia) matures at only 2 years old (Dresco-Derouet 1970). After maturation males will only live 1 to 18 months depending on species while females can live twenty years longer (Millot 1943).

**Captive.** One the reasons for the tarantulas popularity as pets is the extreme longevity of the females. There are numerous examples of Mexican Redkneeds and Mexican Redlegs (*B. emilia*) living over 20 years within the hobby. A female Redknee in the ARP collection was an estimated 18 years before dying in 2002 (personal communication with J. Adams-Maher of ARP and D. Miller TAFE NSW 2004). Even faster growing tropical species like Pinktoes and Goliaths can live over 8 years after maturation (Baerg & Peck 1970).

Unfortunately captive males fare as badly as their wild brethren, slower growing species will mature many years after tropical ones but will still die within 2 years (Marshall 1996, Schultz 1998). It is advisable to continue feeding captive males to keep them as healthy as possible, this will at least allow them to continue normal behaviour (personal observations of Sydney Funnelwebs *Atrax robustus* and other native mygalomorphs).

**Aging Adults.** Due to the process of moulting there are no annual growth characteristics with which to age adult tarantulas. With males this isn't a problem on completion of the ultimate moult the clock is ticking and you know its adult age. On acquiring an adult female you'll never know her exact age.

# 3 Housing Requirements

## 3.1 Exhibit/Holding Area Design

In Australia exotic tarantulas must be housed in a Quarantine facility separated from the rest of the institution. The Australian Quarantine and Information Service (AQIS) is the governing body regarding approval of such a construction and the importation of the animals. Appendix III contains a summary of our AQIS Arachnid Quarantine Facility Procedures Manual and gives a good idea of the level of isolation required with keeping exotic tarantulas in Australia.

Ideally the main tarantula room- which by law will be the exhibit and the holding room in one- will have a large window space for the public to view. Tarantulaville has four dedicated viewing windows with 1 or 2 tarantulas displayed in each one as well as a larger window giving view to the whole room. Specimens off display are housed individually on shelving opposite the main window and are visible to the public. The shape and size of the room will depend on the space, existing buildings and money available but should maximise the visibility of the subjects to the public.

**View of the back wall holding area. Arboreal tanks at top. Photo by N.Psaila.**

Being an official quarantine facility means the main room must be self-sufficient. It must have an independent air-conditioning system approved by AQIS a self-contained sink, autoclave, refrigerator, electric heaters and dedicated arachnid and cleaning equipment. Unless it's disposable, any piece of equipment brought into the facility must remain there unless prior permission from AQIS has been sought.

As you can imagine all of this means getting a camera or scales in, or taking records out requires a lot of management help, so be nice! The procedure I used to take the photos in this manual are as follows: Outside the facility the camera was placed in a large resealable bag that was wiped down with 70% ethanol. All photos were taken through the clear plastic bag (hence the 'softness' of some of the shots) then the camera was taken out to the first airlock. At this point I took the camera from the bag and handed it to a colleague waiting at the last door. I then took the bag back inside for sterilisation in the autoclave.

## 3.2 Enclosure Design

Originally we housed each specimen in large plastic Pen Pals but these scratch easily and become clouded because of the cleaning chemicals (pers obs.) We have since changed over to a commercially available glass tank made by Exo-Terra with removeable micro-mesh lids and opening side panels. We have two types: a cubic shaped tank for terrestrial species and a taller version for our arboreals. This change has made a huge difference to both the look and the maintenance of our arachnids.

## 3.3 Spatial Requirements

There are no EAPA (Exhibited Animal Protection Act) guidelines for arachnids housed in Australia. It is accepted that floor space is more important than height with terrestrial species. Large ground dwelling species like *B. smithi* or *L. parahybana* require room to roam around their enclosures, a good guide is one and a half times the spiders largest known leg span (Marshall 1996). Our enclosures are 300mm square and 300mm high, though many experts including Schultz and Marshall say height should be no more than one leg span due to the risk of falling. We have to compromise here because we are exhibiting tarantulas and lower tanks don't display as well.

Floor space is important when the spider moults as it must have room to work its way out of the old skin. A cramped cage can result in deformations or even death during moulting (Schultz 1998).

Arboreal species require a taller enclosure that allows for more ventilation and the option to live off the ground, around 500mm tall is ideal. Our Exo-Terra enclosures for arboreals are 300mm square and 450mm high. The side doors of our enclosures allow easy access even if a nervous *P.regalis* has taken residence under the lid and they make cleaning the lower corners of the cage easier.

Spiderlings of all tarantula species require high humidity, so if you're breeding native tarantulas any small glass or plastic jar will do as long as air holes are provided. The larger the jar the more susceptible to drying out it is.

## 3.4 Temperature Requirements

Almost all tarantulas will do well in temperatures between 25 and 30C, (de Vosjoli 1991). At ARP we aim for a cage temperature of 27C. Rather than heating individual cages we maintain the room at around

this temperature. We do this by having two thermostatically controlled electric heaters in the room. The larger one is set at 27C and a smaller one in the farthest corner set at 30C, though this would vary on the size of your room and position of displays. During hot weather we turn the smaller heater off and use the air-conditioning system to keep the room around 27C.

While temperate and some montane species can tolerate temperature drops to as low 18-19C, tropical species tend to require a more constant temperature range, this is especially true with *C. crawshayi* and *T. blondi*, (Lund 1977). It has also been found that spiderlings kept at a higher temperature will develop faster than ones kept at the lower end of their range (Schultz 1998). Conversely, temperate species like *Aphonopelma* and *Brachypelma* kept at lower temperatures may actually live longer, (Schultz 1998, Marshall 1996).
We do temperature and humidity checks at least once a week on every specimen and may adjust the room temperature accordingly.

If you have to heat each tank separately use heat mats. Our shelves include a single heat strip glued to the far end. The tanks are positioned with the back half in contact with the strip. This was how we provided heat for many years but on consultation with American keepers we were told to focus on the whole room. Today we use the heaters explained above.

### 3.4.1 Temperature problems

Improper heating can lead to many problems with your tarantulas, some of which can become worse with time. A common misconception is that desert or arid zone species like *B. smithi* or the Mexican Redleg, *B.emilia* can tolerate hot, dry conditions but this is not so. These tarantulas, like all their brethren, are nocturnal choosing only to be active when it's cooler. Research has shown that a burrow 10cm or so deep enjoys temperatures of around 22C and a relative humidity of between 60 and 70%, while the outside temperature may approach 50C and only 10% humidity (Benton 1987). This shows that, like most desert creatures, tarantulas prefer their own microclimate much

cooler and moister than the surrounding daytime environment provides. The same can be applied to tropical rainforests- it's cooler underground than above it.

**High temperatures**
Some of the signs of excessive heat are:

Excessive drinking
Increased activity
Wall climbing (terrestrial species)
Abandonment of burrow
Aggressiveness- keen to flick hairs, stridulate or rear-up
Reduction of humidity

All of these behaviours are sure signs of stress. The last point is of serious concern and will be dealt with in the next topic. If conditions aren't changed quickly the tarantula may succumb to dehydration (especially if it's gone off food) or could be seriously injured by a fall. Also you won't have much fun dealing with a hyped up, stressed out King Baboon with half-inch fangs!

**Low temperatures**
On the other side of the coin temperatures that are too low will force a tarantula to become lethargic and less inclined to eat. This is more of a concern with tropical species, especially those from rainforests, as they tend to experience a lower annual temperature difference than temperate environments. As many captive tarantulas will fast for weeks or months for no apparent reason the best way to deal with temperature problems is to regularly check the enclosure.

## 3.5 Humidity Requirements

Humidity is generally thought to be the most important aspect of tarantula husbandry. As previously mentioned even spiders from arid zones prefer a microclimate that is much more humid than the macroclimate.

As a general guide arid zone and temperate species should be kept at between 40 and 60%, (Schultz 1998) while tropical species a much higher 75 to 90%, (de Vosjoli 1991). It is extremely important that you conduct a fair bit of research on the species you have or are importing; especially look the microcosm they're found in eg. rotting logs, under stones or deep burrows. Also look at the areas they come from, taking note of annual relative humidity and temperature ranges and seasonality within rainfall patterns eg. summer wet/winter dry.

At the ARP we make a point of taking a humidity reading at least once a week in each cage. We do this by placing a hygrometer close to where the spider spends most of its time, though we may choose a different position, for at least 20mins. Both humidity and temperature as well as gauge position is recorded on the spiders' individual card. Humidity is also recorded on a 'Humidity Checklist' along with position, gauge number and any water added to the substrate to increase humidity.

We keep our tarantulas humidity under control using several techniques. Firstly our substrate contains water we added during the mixing process (see 4.7 Substrate) and we always have a water dish available for drinking. We have also developed a watering regime where we add a certain amount of water weekly or fortnightly depending on the species and the relative humidity of the enclosure. Below is an outline of our watering regime.

| | | | |
|---|---|---|---|
| REDS | *N.carapoensis,* | B | 75ml/week |
| | *B.smithi* | B | 75ml/fortnight |
| GOLIATHS | *T.blondi,* | A | 150ml/Fortnight |
| BABOONS | *C.crawshayi* | IAB | 150ml/Fortnight |
| | Juvenile *C.crawshayi* | IAB | 75/Fortnight |
| PHRIXOS | *P.pulchra, P.spatulata* | B | 75ml/week |
| SALMONS | *L.parahybana* | B | 100ml/Fortnight |
| ORNAMENTALS | *P.regalis,* | WA | 150ml/Fortnight |
| PINKTOES | *A.versicolor, A.urticans* | WA | 200ml/Fortnight |

KEY: A= all over, B= back, IAB= in and around burrow, WA= under web and all over.

Of course this is only a guide and we may add less water or none at all if the readings are high, or more if the cage seems dry.
We have been trained to use our knowledge of the spiders and our senses.

**SMELL:** Does it smell moist, dusty or mouldy?
**SIGHT:** Does it look moist/dry? Are mould, condensation or mites present?
**TOUCH:** Does it feel moist or dry?

Another method of maintaining humidity is to cover most of the air vents with clear food wrap like Glad Wrap. This will most definitely be necessary if your using plastic Pet Pals, as their lids allow too much ventilation. This was another major reason for us abandoning them,

keeping 75% of the lid covered with plastic was clumsy and encouraged mould to grow. We eventually had to peel the covers back during the day to allow more airflow.

The cages we now use have two rectangle sections of fine mesh, which we cover with laminated paper. Each day we remove one or both of the laminates to allow for air transfer. The beauty of these cages is that there is a millimetre gap around the side doors, which is good for ventilation.

So by starting with a moist substrate, periodically adding water to the substrate, providing standing water and covering up part or all of the air holes we can maintain a relatively constant humidity that suits our tarantulas.

## 3.5.1 Humidity problems

**Low Humidity**

Evidence of low humidity may be a drying of the substrate, which may appear dusty, depending on the type of substrate this could cause fatal damage to the tarantulas' book lungs. Also because tarantulas' don't warm and humidify the air as they breathe (like most animals do) dry air will cause respiratory difficulties, (Schultz 1998).
Spiders that drink constantly are probably dehydrated and may be suffering because the humidity is too low. Again, it will be the large tropical species and arboreals that will suffer first and worse.

It is especially important to keep the humidity at the higher end of the range when the tarantula is in pre-moult. A dry cage can cause terrible moulting problems as the new skin can stick to the old before the spider can escape it. This can lead to a loss of limbs, tearing wounds and, if the book lungs aren't freed quickly enough, suffocation.

Below is a guide to ideal humidity ranges for commonly kept species:

| | | |
|---|---|---|
| Avicularia spp | 60-85% | (Arboreal tropical American) |
| Brachypelma spp | 40-60% | (can tolerate lower) |
| B. albopilosa | 70-80% | (Moist E. Mexico) |
| Citharcanthus crawshayi | 75-80% | (in burrow) |
| Ceratogyrus spp | 50-60% | (East and South African) |
| Delopelma cyanopubescens | 50-60% | (Venezuelan dry zone) |
| Hysterocrates spp | 80-90% | (West African wet tropics) |
| Haplopelma lividus | 80-90% | (wet tropics Malaysia) |
| Lasiodora parahybana | 50-70% | (wanderer- Brazil) |
| Nhandu carapoensis | 40-50% | (S. Brazil and Paraguay) |
| Pamphobeteus wallacei | 70-80% | (moist forest Columbian) |
| Phrixotrichus spp | 30-50% | (grasslands s. of Brazil) |
| Poecilotheria regalis | 30-60% | (SE Indian forests) |
| P. ornata | 60-70% | (wet Sri Lankan forests) |
| Psalmopoeus spp | 60-70% | (moist Central America) |
| Theraphosa blondi | 80-90% | (High rainfall Brazil) |

Sources: ARP records, R. Gurley 1994-95, J. Fouskaris 2000.

**High humidity**

Lack of adequate ventilation in a humid environment can lead to several problems these may include:

Condensation
Moulds or funguses on substrate
Excessive mite populations
Stress and aggressiveness
Wall climbing

Most of these problems can be easily combated by increasing the air-flow, and removing the water dish periodically. Removing any plastic coverings over the air vents, even for one working day, can greatly reduce the humidity. If a section of substrate appears wet it should be scooped out and discarded, dryer material can then be added.

If you don't cover the vents and the humidity is too high ie there is mould growing, mites present or the animal is constantly trying to get out a complete substrate change may be in order. Use a dryer mix then add small amounts of water until you get the desired humidity.

Moulds and fungi are serious if they get into the spiders' mouth or book lungs and there is little that can be done to treat this (Lund 1971). Hygiene is extremely important in a small, humid environment and the immediate removal of uneaten food, food boluses and faeces will greatly reduce the incidence of both moulds/fungi and mites (see chapter 8 regarding parasites).

## 3.6 Substrate

When choosing a substrate you must consider the purposes of your exhibit. If you are going to allow your tarantula to form a burrow then you need a deeper, form holding substance. Species like *C. crawshayi* must be allowed to burrow but most species will consider their entire enclosure a burrow and will be happy with a shelter placed in the cage (ARP observations).

At the ARP we use a sterilised peat/sand mix at a ratio of 3:1, which we mix with water. We test the saturation by squeezing a handful, it should not drip water but still hold its shape. We have a depth of about 60-80mm for our terrestrial species and around 30-40mm for our arboreals. We tamp the substrate so its firm underfoot.

To get the spider to burrow where you want it ie at the front where the public can see it, we install a half-cut hollow log shorter than the tank. This log is buried with the open end up against the glass and an access hole to one side. The tarantula will find the hole and subsequently use silk to make the burrow more comfortable. Other materials for artificial burrows can be carved foam blocks or PVC pipes. Of course if viewing the tarantula isn't important it can be allowed to dig its own burrow providing the substrate is deep enough.

Opportunistic burrowers like *L.parahybana* or those that choose not to burrow (most *Brachypelma* and *Phrixotrichus* spp) can be kept on shallower substrates with a bowl shaped depression covered by a piece of curved bark.

Other types of substrate have been used including potting mix, aquarium sand, fine bark chips, smooth aquarium gravel, clay based cat litter and vermiculite. All of these can be OK providing they're sterile and contain no toxic additives such as odor masking agents or anti wetting agents. Avoid any abrasive gravels, as they will cause damage to the tarantulas book lungs and any cedar based products as cedar oil is an insect repellant. For more details on the pros and cons of these substrates see The Tarantula Keepers Guide by S & A Schultz (1998).

The type of substrate you choose will help determine the enclosures' ability to maintain an ideal humidity. So experimentation may be necessary to get that right mix.

## 3.7 Enclosure Furnishings

Apart from a shelter and a water dish tarantulas require no fancy extras or behavioral enrichment. The shelter needs only to be a piece of curved wood or old terracotta pot for terrestrial species. Arboreals housed in tall cages do better with a curved piece of wood that is as high as the tank.

Any additional furnishings like rocks of fake plants are purely aesthetic and have no effect in settling in a captive tarantula. In fact many species will either trample anything you put in eg. *L.parahybana* or cover it in soil *C.crawshayi* and *N.carapoensis.* Having said that we do use a variety of fake plants with some of our arboreal and small to medium sized terrestrial species. This is a purely personal decision the tarantulas really don't care!

Living plants are fairly difficult to maintain in a tarantula cage mainly because of space, moisture and lighting requirements. Although they can help keep the humidity up it is not recommended to use living plants as its too much maintenance for too little gain (Schultz 1998). Also rotting vegetation is a great vector for moulds and fungi.

## 3.8 Lighting

While tarantulas themselves require no lighting some considerations need to be addressed when lighting the room. The spiders will be more comfortable in a lower light setting so avoid using bright, especially white, globes for general lighting. We use a combination of low watt coloured bulbs, black lights and UV florescent tubes to light the room. On some of our display cages we have low power shop display lights that we turn on during the day. These are situated on the air vent pointing into the cage but only produce a low level of illumination that doesn't seem to bother the tarantulas.

Some tarantulas, especially Old World species, absolutely hate bright light and will react violently to it. Species from the *Hysterocrates, Citharischius, Heteroscorda* and *Selenocosmia* genera are particularly famous for their aggressiveness towards bright light, (Marshall 1996).

# 4 General Husbandry

## 4.1 Hygiene and Cleaning

Because we are keeping an animal in a small space with relatively high temperatures and humidity keeping cages clean is extremely important. Any faeces, dead crickets or food parcels will quickly become infested with mites, mould or fungi. Prevention is definitely the best cure when dealing with potential tarantula medical problems and hygiene seems to be a key factor.

To this end staff in Tarantulaville adhere to a strict cleaning regime in conjunction with AQIS guidelines (see Appendix III). A roster has been developed that divides our spiders into four groups, which are fed over four days. Keepers who feed one group of tarantulas' one day, are responsible for cleaning the group that was fed the previous day. The roster changes each month so everybody gets to feed and clean.

Below is a list of enclosure cleaning items permanently located in Tarantulaville:

Latex gloves
Forceps
Paper Towel
Large Garden Spray Pump (H2O)
Three small spray-bottles (F10, Metho, H2O)
Cotton buds
Metal teaspoons and larger spoons
Maglite torch
Toothbrush

We are bound by AQIS guidelines to use a 340ppm sodium hypochlorite solution (SHS) for all surface disinfection. We use the commercial brand 'HYPO', which is 12.5% diluted on a 1:420 ratio. We mix 10ml of hypo with 1 litre of water.

Tarantulas are very susceptible to any agent designed to kill invertebrate or microscopic pests. Household cleaners like dish washing liquid, bathroom/kitchen surface cleaners are definitely not recommended as they usually leave a residue that is invariably toxic to your tarantulas.

**Cleaning equipment. Photo by N.Psaila**

**Cleaning Procedures**

A lab coat and latex gloves must always be worn within the quarantine facility as per AQIS regulations. Upon entering the first airlock you must step into a footbath and don a lab coat. To maintain hygiene the workbench is covered in layers of butchers' paper and our utensils are laid out the same way the previous afternoon. We use different forceps for each activity: a set for feeding, removing items (cleaning) and replacing items (new water dishes). If forceps contact the substrate they are dipped in a dish of Hypo that is kept with the 'out' forceps.

Each spider that was fed the previous day is brought to the workbench and using the 'out' forceps any food remains (called boluses or parcels) and dead or live crickets are removed. A small torch is

handy for checking dark corners and the substrate itself. Live crickets must be killed before disposing into our bin. Faeces can be scooped out with a teaspoon using a separate spoon for each cage. Arboreal tarantulas especially *P.regalis* tend to spray their faeces down a cage wall where it quickly hardens. In this situation we use a cotton bud dipped in water to scrub away the mess.

After this we spray the inside walls with water and wipe them down with paper towel. The outside walls are sprayed with methylated

**Cleaning. Photo by N.Psaila**

spirits and also towel dried.
In addition to rostered cleaning every other cage is checked and those in obvious need (especially display specimens) are also cleaned.

Any moulted skins should be removed immediately and placed in the freezer if used for display purposes. Otherwise they are treated as solid waste and autoclaved accordingly.

At the end of each day all utensils and used water dishes are bathed in Hypo, rinsed, and allowed to air dry overnight. The workbench and floors, including both air locks, are swept and mopped and the bench is set up for the next day. Liquid waste and the garbage bag are autoclaved for 30 minutes at 120C and 18kpa of pressure as per AQIS rules (see Appendix III).

## 4.2 Record Keeping

It is extremely important to keep detailed records of our spiders as they are unique to collections in Australia and we'd like to know as much about them as possible. Apart from the official records required by AQIS, (entry logs and waste disposal logs to name a couple), we keep detailed records of all of our arachnids. Each spider has its own plastic sleeve containing an identity card on which we record all kinds of routine information.

We record how many of what was eaten, food parcels removed, temperature and humidity, including gauge number and position and temp/humidity problems like mould removed, water added (or not) or vent covers removed/replaced. Any medical information is also summarised on this card.

Staff also add general observations like aggressiveness, wall climbing, pre-moult stages/date of moult, position of spider (if unusual) and feeding patterns.

When a spider looks like it may be moulting, or has been acting strangely for a while a sheet is created for it in either the 'Moult List' or the 'Sick List' and a card bearing the word MOULTING? or OBSERVATION is placed in the ID card sleeve. Keepers are encouraged to check on these individuals more regularly and record any relevant observations on the lists.

## 4.3 Methods of Identification

Upon delivery each spider was formerly identified and given a health check by an appointed entomologist. An ID card was created and each

spider given a three- digit number. Over time, as keepers became more familiar with each spiders personality, they were christened with a name. An example of how the title of an ID card may look like could be:

Indian Ornamental 023
*Poecilotheria regalis* "Shiva"

## 4.4 Routine Data Collection

All the spider related data that is collected is recorded in the above mentioned ways. We do not weigh or measure our tarantulas', or conduct routine medical check-ups. A future project I have is to map out the moulting times of all of our tarantulas so we can predict if its coming up or the spider is acting up for another reason. This will also highlight the fasting periods before and after the moult.

# 5 Feeding Requirements

## 5.1 Captive Diet

Tarantulas are opportunistic ambush predators, relying heavily on their hairy legs to relay vibrations to their brains, for this reason live food is essential (Brunet 1994). In captivity tarantulas will thrive on a diet of insects alone and as they are readily available and easy to breed the humble house cricket (*Acheta domestica*) will be the main fare. At the ARP we use crickets about 90% of the time, which are readily accepted due to their movement. The remainder of food items would be cockroaches, mealworms and, extremely rarely, pink mice. The only other public facility with tarantulas in Australia (the Victorian Museum) also uses this diet. Little is known of tarantulas' exact dietry needs, so whether this relatively unvaried diet is detrimental needs to be ascertained.

**Crickets eye view *(Phrixotrichus pulchra)* Photo by N. Psaila**

As mentioned earlier, wild tarantulas' will eat almost anything they can overpower so during summer it may be worth capturing things like grasshoppers, locusts, cicadas, other spiders, phasmids and various beetles. You must be 100% sure that pesticides haven't been used in the collecting area or you'll end up with some very sick (and most likely) very dead spiders.

Our captive bred specimens tend not to show any seasonality in feeding so will eat the same amount all year round. This would also be due to the fact that we keep our quarantine room around the same temperature all year. If breeding was permitted we would look at lowering the room temperature over winter to simulate wild conditions, which would also mean withdrawing food for the period, much like reptile breeding.

Overseas tarantula keepers generally feed their charges the same food as we do (crickets, roaches and mealworms) and as they breed their spiders this seems to be an adequate diet (Schultz 1998; de Vosjoli 1991 and Marshall 1996). Some amateur overseas keepers have also used waxworms, grasshoppers, cicadas, earthworms, goldfish, crayfish, moths and lizards with varying success (Schultz 1998). It must be said that in Australia it is illegal to use native frogs or reptiles as food items as these creatures are protected and must be held on license (pers comm J. Weigel 2005).

Some creatures should never be fed to tarantulas due to their toxicity, aggressiveness or weaponry. Rodents over half grown can inflict serious wounds or kill your tarantulas and should never be left alone with the spider, in fact rodents, even 'pinkies' should be avoided. While large tarantulas will readily eat them, rodent remains are pungent and quickly attract flies (see chapter 8 regarding parasites). Invertebrates that should be avoided include large centipedes and scorpions (poisonous and known tarantula killers), bees and wasps (well-armed) large mandibled insects, and ants. Ants pose a particular danger to tarantula collections as carnivorous and omnivorous species can swarm a captive tarantula, ripping it apart limb for limb, some species also posses bad tasting formic acid as well as jaws and stingers- bad news! (Schultz 1998)

**Fasting:** Due to their low metabolic rate tarantulas are able to fast for long periods with no ill effects, in fact many adults will fast during pre-moult and post- moult (pers observation). As long as fresh drinking water is available the spiders will eventually feed again losing no body weight at all (for information on moulting see chapter 8). On average I've found that juveniles will eat closer to the event and soon

after it. Our youngest spider 'Popsicle'- a juvenile King Baboon, averages 14 days of fasting before moulting and 15 days after, while 'Jaffa' one of our older Mexican Redknees' averages 46 days pre and 64 days post. In addition to this some spiders may go off food for a number of weeks due to a major disturbance like re-housing or illness.

## 5.2 Supplements

The idea of giving tarantulas' food supplements hasn't been properly investigated. The fact that they are readily bred overseas and live out their expected long captive lives with no apparent health problems seems to suggest special supplements are unnecessary. As an animal is only as healthy as its food it is prudent to gut load insects before feeding them off, we give our crickets fish flakes or crushed dog kibble as well as fruit and vegetables.

## 5.3 Presentation of Food

Until recently we would unceremoniously dump a few crickets in each enclosure and allow the tarantulas to hunt them down, we stopped doing this for three reasons. Firstly female crickets would lay their eggs in the substrate resulting in dozens of pinheads hopping about and annoying the tarantula, these eventually would die creating an ideal place for mould and fungus to grow. Secondly if the spider wasn't hungry the crickets would have to be chased down, captured and euthanased. Also if the spider moulted hungry crickets could attack the soft cuticle, injuring or killing it. Lastly we decided the public could watch as we forecep fed each spider. It took some of our spiders a while to adjust to this change, many seemed either nervous at the approach of our hands or weren't stimulated enough by the relative lack of cricket movement. If the spider refused to take the cricket it was offered again the next week and a 'no feed' recorded on its card. After about a month all of the tarantulas had become accustomed to the new feeding regime.

As mentioned in the cleaning section our spiders are broken down to four groups of 6-8 specimens and fed over four consecutive days. Our technique involves selecting a large cricket and removing one back leg and the ovipositor if it's a female, we then offer the cricket (on the end of the 'feeding' forceps) to the tarantula. We position the cricket between the spiders' pedipalps, where it will grab it with its front legs and pedipalps. The spider will manouvre the food item to its jaws and begin masticating it. In the meantime we'll grab a second cricket and repeat the process (often to awed gasps from the public peering through the window). We'll feed our medium sized tarantulas like *B. smithi*, *P. pulchra* or *A. urticans* two or three large crickets or roaches. Larger species like *T. blondi*, *L. parahybana* and *C. citharischus* will receive four or five food items. Some specimens of any size may retreat or show no interest after only one or two crickets in which we will offer them no more. In the case that a tarantula refuses any food it is left for next week and a note put on its card.

In the wild tarantulas are boom or bust feeders. If a number of insects come within range they will quickly attack, grabbing as many as they can in their jaws and masticating the whole thing into one large food parcel (Gurley 1996). Their low metabolic rates allow them to survive long periods without food to cope with seasonal changes in prey availability. Captive specimens act the same way, preferring their meals offered in rapid succession followed by periods of fasting.

***Poecilotheria regalis* with 3 crickets. By N.Psaila**

After accepting the food items the tarantula will spend a couple of hours breaking the food down with digestive acids and siphoning the liquid by product up through the mouth. Many wild caught tarantulas, and even some captive bred ones will construct a food web on which to place the masticated food ball during feeding (Schultz 1998), though I've never seen one our tarantulas make a complete food web.

# 6 Handling and Transport

**Warning:** Although many species of tarantula are docile and handleable, **all** species possess venom glands and very large fangs. While not known to be seriously dangerous to humans the venom can produce painful and lasting effects (Ibister et al 2002).

## 6.1 Timing of Capture and Handling

Like all nocturnal creatures daytime is usually the best time to catch tarantulas and also the most convenient for us. As exotic arachnids aren't allowed out so to speak, the whole process must be done within the quarantine facility. Recently we thinned out our collection, sending unwanted individuals back to the Victorian Museum and the packing had to be done within the facility.

## 6.2 Catching Equipment

Depending on your reason for removing the tarantula from its enclosure, eg. export or rehousing (substrate change), you will require some of the items from the following list:

| | |
|---|---|
| Spare enclosure | Lge plastic jars with screw lids* |
| Forceps | Tappers |
| Goldfish Nets | Metal spoons |
| Perspex Shield | Cotton gloves |
| Wooden Crate* | Newspaper* |

* Will be needed if exporting out of facility.

## 6.3 Capture and Restraint Techniques

If the tarantula is leaving the facility permanently the best way to capture it is to place a large jar into the enclosure and using a tapper, coax the spider into the jar. A tapper is a piece of PVC pipe with a plastic foam covered spatula (or paintbrush) lodged down one end. If

the jar is large enough the spider can be transported in it provided air holes are supplied.

In the case of rehousing to a new enclosure different methods are available. Firstly you could set up the new enclosure (we always keep spare tanks in Tarantulaville) and place it hard up against the old one. The Exo-Terra tanks are excellent for this, as their side doors can be opened with the two tanks facing each other. Then, accessing the old tank from above the spider can be gently tapped through the doors into its new home. Arboreal tarantulas are treated the same way but the perspex shield can be used to coax them in the right direction. We use this method almost exclusively now that our whole collection is housed in Exo-Terra tanks but it wasn't always so easy.

Pen Pals' and other types of enclosures with top only access require slightly different techniques. The method above was still used with arboreal tarantulas but coaxing a large terrestrial like *L. parahybana* or *C. crawshayi* to climb even 30cm is down right dangerous for the spider as a fall from even this height could be fatal. Our preferred method for the larger species was cornering them with a large goldfish net, forcing them to step into it. The net was then quickly and carefully transferred into the new enclosure and the spider allowed too climb out.

Some of our more docile charges like our B. smithis' and Phrixotrichus spp can sometimes be coaxed onto their shelters then picked up and placed into the new enclosure. Of course you wouldn't do this if you were worried about contaminating the new substrate and the first technique discussed would be the best option. Another method possible with docile specimens is to place your cotton-gloved hand into the tank, then tap the spider onto it (you may need a helper as its best to use both hands). The spider can be removed, and closely examined, before placing it into its new enclosure.

***Brachypelma smithi* one of the friendly ones. By N. Psaila**

Sometimes a tarantula will have burrowed deep into the substrate or utilised a burrow you provided, in this case you will need a metal spoon to dig away most of the cover. As you can imagine no one likes their home torn up, so once you reach the spider chances' are it will be highly irritated! I recommend that you use the jar or net method if transferring the tarantula from a top access tank if it appears aggressive.

Arboreal tarantulas provide a different problem. If given a standing piece of curved bark some will totally seal up a section of with a silk tube, especially *Avicularia* spp. You must decide whether its' really necessary to destroy this structure. If a substrate change is required and the log is clean and free of mould, then the whole thing can be lifted into the new enclosure. If this cant be done, perhaps due to a parasite problem, then the log should be transferred to a separate holding tank. Using forceps, and with a second person patrolling the top with the perspex screen, carefully open one end of the silk tube. The spider can then be coaxed out without opening the whole tube, then transferred to its new tank using one of the above methods.

Some Arboreal tarantulas will make their own silk tubes in the upper corners of the tank including *Psalmopoeus, Avicularia* and *Poecilotheria* spp. If you do need to remove a spider that has done this it is best to try and make hole at the bottom of the web, facing down. The spider can be coaxed out by applying pressure over other exits. Once its out it will be especially flighty and will require two keepers to control

proceedings, placing a tall dark jar under the burrow may encourage it to seek refuge there, allowing for an easy capture.

## 6.4 Weighing and Examination

At the Reptile Park we don't do any weighing or special examinations. All of our charges are considered to be under constant observation so the general condition of our spiders is well known. If a tarantula required expert assessment it would be transferred to a bare holding tank and an entomologist called in. Tarantulas that leave the quarantine facility never come back.

Weighing tarantulas could be useful for historic records and could easily be done, though the scales would have to become a permanent fixture.

## 6.5 Transport Requirements

### 6.5.1 Box Design

The basic IATA (International Agreement for the Transport of Animals) principles for the shipping on tarantulas are as follows.

- Each specimen is to be housed separately
- The inner container/s are escape proof and ventilated
- Packaging used around each specimen container
- Outer container sturdy (wood/plastic) and properly sealed
- The outer container must be airtight as pesticides are used on many airlines

### 6.5.2 Furnishings

Each tarantula must be housed in a sturdy plastic jar no objects should be placed with the spider as they may be injured. If the trip is a long one, a small amount of moist substrate can be added.

### 6.5.3 Water and Food

As mentioned earlier tarantulas can endure long periods without food. So as long they're well fed, food and water is not a concern.

### 6.5.4 Release from Box

When they've reached their destination the tarantulas should be immediately housed into their future homes and disturbed as little as possible. A water dish should be placed with them as soon as they're housed. Food may be offered but don't be surprised if they refuse to eat for many weeks.

**Moving King Baboon *(Citharischus cramshayi)* By N.Psaila**

# 7 Health Requirements

## 7.1 Daily Health Checks

As there is very little professional help available in Australia it is important all staff are trained in identifying potential health problems. When an enclosure is accessed for feeding, cleaning or humidity checks observations are made regarding the tarantulas' condition, disposition and any irregular behaviour displays. These observations are noted on the spiders ID card and if on going, also recorded on a 'Sick List'.

Physical changes such as a loss of hairs on the abdomen followed by a darkening of the skin are precursors to moulting and are duly noted on a 'Moult List'. Specimens that have an entry in either the Moult or Sick list are given a tag with their ID card alerting staff to the fact that extra observations must be made on these separate lists.

Some observations that are noteworthy include wall climbing by terrestrial spiders, sitting in or near water dishes all day, hanging around moister areas of the enclosure, aggressiveness, and any physical changes.

Generally these problems can be fixed by adjusting the humidity and temperature of the enclosure.

## 7.2 Detailed Physical Examination

In the event that a tarantula appears to have an acute health problem external help may be required. This entails contacting an AQIS accredited entomologist to make a house call. The entomologist will examine the spider and make a diagnosis, we do not conduct annual check ups on our spiders and only use professional help if all other options are exhausted.

## 7.3 Chemical Restraint

If the tarantula needs to be restrained for a detailed examination some options are available, though this has never been done at the ARP. Carbon dioxide and Nitrogen gas have successfully been used in overseas collections (Schultz 1998), though due to the equipment involved must be done in a vet surgery. To do this in Australia requires permission from AQIS as the spider would have to leave the quarantine facility and special requirements imposed on its movements and housing while off-site. If the problem is deemed infectious AQIS may order us to immediately euthanase the spider.

Many authors recommend cold as a form of restraint and anesthesia but there are some ethical concerns about this method. Experiments have shown that unless near fatal cold extremes are reached cold anesthesia only dulls the motor neurons ability to activate muscle movement. Thus a spider may be able to feel everything your doing to it but is unable to react (Schultz 1998).

## 7.4 Routine Treatments

Upon diagnosis of a relatively simple medical problem, the entomologist may recommend medication for the tarantula. We have a *B.smithi* with a problematic book lung that we treat with Neospernum each time the problem flares up. This is a fairly simple procedure as we can get the spider to climb up one of its walls then access the affected area with a cotton bud. This, fortunately, is the only medical

problem we have with any of our tarantulas and the individual generally exhibits normal *B.smithi* behaviour.

## 7.5 Known Health Problems

Many of the health problems associated with tarantulas are due to incorrect husbandry. This mainly boils down to the enclosure being kept too dry, too moist, to warm or too cold as was discussed in chapter 3. Some of the effects of these problems are outlined below.

### 7.5.1 Dehydration

The major problem that arises from keeping the tank too hot and dry is dehydration. Early signs of this problem may be a tendency for the spider to constantly drink, or more obviously sit in its water dish.

If the tarantula displays a shriveled abdomen the problem is more advanced and the spider is probably starving as well. In this case the spiders cephalothorax should be physically placed in the water dish for at least half an hour. It is important that the tarantula is supervised while doing this because if the abdomen slides into the water, being weak, the spider may flood its book lungs and drown. After this period if the spider is actually drinking allow it to continue, otherwise leave it there until the end of the day then remove the water dish. The next day repeat the process, the spider should be able to sustain itself by the third or fourth day. In the meantime ventilation holes may be blocked and water added to the substrate to increase the relative humidity.

### 7.5.2 Punctures and Lesions

Ruptures generally occur as a result of moulting problems, rough handling or falls. If the problem occurs on the legs or palps it is not considered to be serious. Small punctures that stop bleeding quickly should be left alone and the tarantula should be spared from any handling until after its next moult. Sometimes the legs can be deformed or broken during moulting and be leaking hemolymph (spider blood). In this case it is better to amputate the limb as they're

designed to come off at the joint between the coxa and trochanter. This feature, called autotomy, allows tarantulas to escape predators and even ravenous mates. Amputation is best done by gripping the effected leg around the femur and pulling downwards (Schultz 1998).

A puncture to the cephalothorax or abdomen is far more serious and usually results in death. Some techniques have been used overseas with varying results including Liquid Band Aid, non-scented tissue paper and Superglue (Marshall 2001). The use of glue is tedious as its fumes are lethal and must be used with good ventilation, you'll need to continuously blow the fumes away from the spider until it sets.

If successful the tarantula will repair itself during the next moult, though legs can take several moults to reach full size especially with older specimens (de Vosjoli 1991).

### 7.5.3 Parasites

Due to the quarantine restrictions placed on exotic tarantulas' parasite problems here are minor and rare. Once permission has been granted to import the spiders you can request that only captive bred individuals are sent, immediately eliminating the risk of tropical nasties being imported too. Wild tarantula's, especially rainforest species, can carry alarmingly high pest loads and coupled with the stress of capture and transport, these organisms can get the better of the spider (Swerdlow 1992). So as a rule it's best to avoid purchasing wild caught tarantulas.

After the collection is set up in Australia you will have very few parasite problems though there are a couple of things to be aware of. Mites are a common arthropod in all habitats worldwide and can easily find their way into a quarantine facility, with the usual vector being the feed crickets. A few mites running around a cage don't present too much of a problem as they can actually aid in cleaning the enclosure, but an infestation can cause great stress to the tarantula. The best way to avoid this problem is by keeping the terrarium clean. If an infestation is found the tarantula must be rehoused and all the old substrate and furnishings destroyed by autoclaving. Drying out a

cage also works for lower densities (Baker 1987). Another method of treatment used over seas is the introduction of a cannibalistic mite called *Hypoaspis miles.* These mites will feed on other mites as well as small arthropods but seem not to affect the tarantulas (Elliot 1996, West 1995). To do this in Australia would require permission from AQIS.

Poor hygiene also encourages the prescence of scuttle flies (*Megacelia scalaris*) which are small brown flies that scurry around and are attracted by rotting flesh. Although we have never seen any in Tarantulaville we do get them in our non-quarantine native spider collection. They're small enough to crawl into air holes and lay their eggs on dead crickets. The maggots have been known to enter a spiders' mouth and eat it inside out, entire collections in the USA have been decimated by this parasite. Again hygiene is the key to avoiding this problem.

Ants can also be a problem especially for spiderlings and must be controlled immediately. Carnivorous and omnivorous ants can swarm even adult tarantulas', ripping them apart limb for limb. We mop our floors every afternoon with Hypo and this seems to help destroy any scent trails, as we've never had this problem. Spiderling jars can be kept perched in a tray of water which the ants' wont cross.

### 7.5.4 Moulds and Fungi

Again high humidity will encourage the growth of moulds and fungi and care must be taken not to keep a cage too wet. Although there is no concrete evidence that tarantulas' have died from these organisms (Schultz 1998) its is unhygienic and a sure sign that something is wrong with the humidity/ventilation situation. If mould is detected it should be scooped out with a spoon immediately the humidity can then be reduced by increasing the ventilation (pers. experience). If the problem continues a full rehouse will be necessary, discarding the old substrate.

# 8 Behaviour

## 8.1 Activity

Both wild and captive tarantulas don't do very much on a daily basis and are usually content to sit in their burrows or enclosures. This is normal behaviour for an animal with a low metabolic rate and probably helps them live longer lives. Some of the terrestrials like *C.crawshayi, S.crassipes* and *N. carapoensis* will move considerable amounts of soil around, while arboreals like *A. versicolor* and *P.regalis* will make silken tubes to live in. Most of this activity will be conducted at night (pers. obs)

## 8.2 Moulting

Considering we aren't allowed to breed exotic tarantulas in Australia, moulting is probably the biggest event in our tarantulas' captive life. Juvenile specimens will moult about every three months while mature adult females every year to two years (pers. obs.). Some signs that a moult is on its way are fasting (as mentioned in the Feeding chapter) and a tendancy to seek moisture. As the moult approaches hairs may be shed from the abdomen and the skin beneath will noticeably darken, this is called premoult. On the big day the tarantula will roll onto it's back and begin separating from its old exoskeleton, this process can take up to 24 hours (a dead spider will remain upright with its legs tucked underneath) (pers. obs.)

**Brazilian Black *(P. pulchra)* moult. By N.Psaila**

The tarantula will then crawl up through the cast off carapace, dragging all its appendages through. The dorsal surface of the abdomen will also separate, allowing the new body through. The entire moult process tends to happen overnight with our specimens and has rarely been observed. The spider will then rest for several days while its fangs and exoskeleton harden. The cast of skin is called an exuvia. The tarantula may wait up to one month before feeding again, though this will be considerably less for juveniles.

## 9.3 Reproductive Behaviour

Females will show no sign that they are ready to mate and can usually be mated successfully during spring/ early summer when they have been well fed and between moults. Newly matured males on the other hand have a short time to do what nature intended and immediately show signs of reproductive readiness. Firstly they will create a sperm web onto which they deposit a few drops of seminal fluid from the epigastric furrow. This web is sack like and the male crawls in upside down, depositing the fluid on a special silk patch on the roof. He then climbs out, and using his newly acquired palpal bulbs, sucks the fluid into each palp from an opening in the top of the web. After destroying the sperm web the spider is ready to mate. A male tarantula can repeat this process several times (Minch 1979).

## 8.4 Behavioural Problems

The only behavioural problems we have with our collection are wall climbing and burrowing. Wall climbing for large terrestrial species is dangerous due to the risk that a fall may puncture the abdomen. It is usually associated with incorrect temperature or humidity and inappropriate substrate. If an individual is always perched high on a wall, check the humidity and substrate, as you may need to increase the ventilation or dry out the substrate a little.

Burrowing is more an aesthetic issue as tarantulas can cover their furnishings in dirt and remain invisible during opening hours. This is overcome by burying a curved piece of bark with the open side hard up against the glass. Soil is put into the burrow, which helps with humidity and gives the spider something to dig at.

## 8.5 Signs of Stress

The most common signs of stress in tarantulas are:

Bald patch on abdomen
Aggressiveness (stridulation, flicking hairs)
Excessive digging
Excessive pacing/wall climbing
Sitting in water dish

Many of these behaviours are directly related to the cage conditions and are usually a result of incorrect temperature or humidity. Other causes may be poor substrate condition or inappropriate substrate (too course, fine, shallow, toxic etc), and parasites. White light will also stress out taranulas especially Old World species (Marshall 1996)

## 8.6 Behavioural Enrichment

This aspect of captive husbandry is irrelevant to tarantulas' as they will cover anything in their enclosure with silk and dirt. Fake plants can be used to 'pretty up' a cage but are totally ignored by the inhabitants. In fact too cramped an enclosure can cause problems during the spiders moult.

## 8.7 Intra-specific and Inter-specific Compatability

Tarantulas' are nomadic and cannibalistic so keeping a colony even in a large enclosure is not recommended. Many authors have written about keeping juvenile *P. regalis* and *A. avicularia* specimens together in large well planted terrariums with some success (Marshall 1996). As they get older though, they tolerate the company less so and eventually you may end up with one large fat specimen (de Vosjoli 1991, Gurley 1995).

The same goes with other non tarantula species- if its small enough to be eaten it will be! Woodlouse have been kept as clean-up crews in tarantula enclosures in US collections as they feed only on detrius but to me seems a cop out for not keeping the cages clean yourself.

**Wall climbing by a terrestrial sp. By N. Psaila**

# 9 Breeding

**NOTE:** Due to the strict quarantine laws imposed by the Department of Agriculture and AQIS it is currently illegal to breed exotic arachnids in Australia. Our license requires us to euthanase any juveniles that mature into males, thus maintaining a single sex collection. As I wanted to concentrate on exotic tarantulas in this manual I will only briefly discuss tarantula breeding, although much of the information can be related to native tarantulas as well.

## 9.1 Mating System

Tarantulas can be best described as being polygamous in there breeding nature. The females may accept more than one male over the course of a breeding season, though once she is inseminated all prospective males will be considered dinner (Clarke 1987). Males, assuming they live through the ordeal, will construct another sperm web and seek another female.

## 9.2 Ease of Breeding

Up until 1984 very little captive breeding was achieved by overseas keepers, but as more has been learnt successful breeding of most regularly kept species is common (Schultz 1998). With such a wide range of species there are going to be some that are more difficult to breed and for this reason are usually hard to acquire.

There is not much detailed information for breeding Australian tarantulas and most large-scale breeders are quite secretive about their methods and the little quirks associated with the various species. Considering all Theraphosids mate in the same way, native species shouldn't be that difficult to breed and the information given here would be applicable.

## 9.3 Age at First and Last Breeding

This is hugely variable depending on the species and its biology. All males will mature before their sisters, which is natures' way of avoiding inbreeding (Baerg 1928). As a general rule, tarantulas from the humid tropical forests grow quicker and therefore mature younger than species from more temperate areas. Male Pinktoe Tarantulas (*Avicularia avicularia*) for example were found to mature in 18months to 2 years while the females took about 3 years to mature (Stradling 1978). On the other hand species from drier habitats like the Texan Brown Tarantula (*Aphonapelma hentzi*) may mature at 10-12 years.

The age of last breeding for females is really not known. It is suspected that they can continue producing viable eggsacs until the year they die (Celerier 1987). Males on the other hand will definitely breed to death, which is 1-24 months after maturation.

## 9.4 Ability to Breed Every Year

Faster growing species from tropical regions are able to breed every year, though there are a few considerations. The warmer months are the preferred times but if the tarantula chooses to moult during the breeding season any stored sperm will be lost. Slower growing species may be bred every second year (Marshall 1996).

## 9.5 Ability to Breed More than Once per Year

As female tarantulas can produce up to 2000 eggs in one clutch most have evolved to breed annually or every second year (Lund 1971). Some smaller tropical species like *A. avicularia* have been known to breed twice in one year in the wild (Stradling 1978).

## 9.6 Reproductive Condition

**Females:** Mature females ready for breeding should be well fed, though not over weight and within two or three months from their last moult. An overfed individual may decide to moult after a successful mating thus losing the stored sperm (Clarke 1987).

**Males:** The male will be ready for pairing after he has constructed a sperm web (see chapter 2) and has charged his emboli with sperm. This is usually done at night and the web is destroyed but usually some evidence remains against the side of the tank (Marshall 1996). If in doubt a two week lapse from his final moult to pairing with a female will give him plenty of time to charge his emboli.

## 9.7 Timing of Breeding

The time to introduce tarantulas is when the conditions described above are reached. Generally the males will complete their ultimate moult in late winter or early spring and many females will moult around this time too, so mid to late spring would be a good starting point for introductions. Before the introduction the cage should be thoroughly cleaned to reduce the occurrence or parasites.

## 9.8 Copulation

Before introducing the male to the female (always within the females' enclosure) remove all furnishings like fake plants and water dishes. You should always be ready to intervene with a wooden spoon, shield or jar in case things go wrong.


***B. smithi* mating.**

One surprising aspect of tarantula behaviour is their elaborate courtship ritual. When the male is introduced he will remain still, sensing the female chemically. He may then start drumming the ground with his forelegs and waiving his palps around. The male will advance until the female reacts, sometimes signaling in a similar way. If all goes well she will move towards him so they are face to face and the male may gently stroke her forelegs. Ironically her sign of acceptance is to drop her fangs- for once not a sign of aggression!

The male will then push forward, forcing the females' body upwards while rapidly stroking the ventral surfaces of the cephalothorax. In the mean time he locks her fangs together with his tibial spurs. The male continues pushing until the females' body is nearly at right angles to her abdomen, continually probing with his pedipalps. Once he has located the epigastric furrow he will insert one then, the other palp into the epigyne for a few seconds, depositing sperm. When he is finished the male quickly breaks the embrace and retreats at speed (Clarke 1987, Schultz 1998, Brunet 1994).

Fertilisation of the eggs doesn't occur at this point but rather as the eggs are being produced (Marshall 1996).

The substrate should be relatively firm to allow the male some grip while holding the heavier female in place and arboreal species will mate vertically so should be provided with a large piece of bark (Clarke 1987).

## 9.9 Brooding Requirements

Once inseminated the female should be disturbed as little as possible and her enclosure should be maintained at a relatively high humidity. If the cage is too dry the eggs may shrivel and die within hours, too moist and they may be attacked by fungi and bacteria and rot (Schultz 1998). A humidity of 70% seems ideal for most species (Celerier 1987).

For species that have not bothered to construct a burrow something like a small flowerpot or sterilised half-coconut shell should be placed in with her. The tarantula will construct an elaborate 'cocoon' within the hide and she may seal off the entrance (Schultz 1998). Larger species may convert a corner of the tank into an impenetrable cave of silk where nesting will occur and arboreal species will construct their chamber within their vertical log or high up against the tank (Lund 1971).

## 9.10 Breeding Diet

I have found no information regarding what to feed a female tarantula before or after she constructs her egg sac. Since many wild species seal off their burrows while brooding (Baerg 1958), I assume this is one of the fasting periods tarantulas endure much like reptiles. This seems very likely because, as mentioned earlier, an over fed female may choose to moult rather than produce an egg sac, losing all the stored sperm in the process.

## 9.11 Incubation Period

Depending on the species and the conditions they are kept in, incubation lasts between one and three months (Clarke 1987). Most authors recommend artificial incubation for several reasons: many females will abandon or eat their eggs for no apparent reason; it may be difficult to maintain the humidity at a constant 70%; and any stress caused to the female could make her drop or eat the eggs. Below is a table showing the artificial incubation periods of some species and is adapted from Schultz, S and Schultz M., The Tarantula Keepers Guide 1998.

| SPECIES | DAYS |
|---|---|
| *Aphonopelma seemanni* | 86 |
| *Avicularia avicularia* | 52 |
| *Brachypelma auratum* | 76 |
| *Brachypelma emilia* | 92 |
| *Brachypelma smithi* | 91 |
| *Phrixotrichus cala* | 54 |

## 9.12 Clutch Sizes

Clutch size varies enormously between species with some like *Avicularia spp* producing as few as 50 eggs, while the giant *L. parahybana* can produce 3000 eggs in one sac (Marshall 1996). The egg sacs will range in size from a small wallnut up to a tennis ball (Schultz 1998). Some clutch sizes are shown in the table below.

| Species | No. of eggs | Author |
|---|---|---|
| *Aphonopelma chalcodes* | 450-555 | Minch 1979 |
| *Avicularia avicularia* | 70-120 | Drescoe-Derouet 1970 |
| *Brachypelma smithi* | 1000 | Marshall 1996 |
| *Citharischius crawshayi* | 200 | Marshall 1996 |
| *Lasiodora parahybana* | 2000+ | Fouskaris 2000 |
| *Phrixotrichus pulchra* | 200 | Reed 2004 |
| *Psalmopoeus cambridgei* | 100+ | Marshall 1996 |
| *Pseudotheraphosa apophysis* | 75-125 | Gurley 1995 |

## 9.13 Age at Removal from Female

Depending on the species spiderlings (called instars at this age) will either emerge bald and defenseless, or having moulted within the sac, more developed and tarantula like. Those from the former group will be able to stay with the female longer than the further developed second group (Marshall 1996).

Within the first couple of weeks the spiderlings will seem sociable, crawling over eachother and resting together but their true natures are still concealed. After a period of about 3 weeks they will begin demanding their own space and dispersing around the cage, this is a good time to remove them to their own quarters (Schultz 1998).

Some keepers who wish to reduce the numbers may house them in groups and allow a certain amount of cannibalism to occur. It is known that arboreal species like *Avicularia* and *Poecilotheria* are more tolerant to each other than terrestrial species (Stradling 1987, Gurley 1994/95).

In the meantime the female may be offered food and in some species she may feed her babies with liquid from the food items (Gurley 1995).

## 9.14 Growth and Development

Once the decision has been made on how many spiderlings will be kept they will all need to be housed separately. A variety of jars can be used for this purpose, with taller ones being ideal for arboreal species. Each jar should have a screw top lid with ventilation holes and the substrate should be moist sphagnum moss, vermiculite or peat moss (Schultz 1998).

Keeping the humidity up is essential, as spiderlings are more prone to dehydration than adults. The jars should not hold condensation or the substrate allowed to dry out, so be prepared to add more holes or block some up as required.

As with adults, the enclosures should be upsized each time the floor space becomes less than one and a half times the leg span (de Vosjoli 1991). No water dish should be put in with the tarantulas during these early stages as they are likely to drown in it and the animals will draw all of their water needs from their prey. It is not recommended to use a small dish with a wet piece of sponge as this provides an excellent area for pests to breed (Schultz 1998).

Within the first 2-3 months the spiderlings may moult several times, eventually slowing down to once a month for the faster growing species. The more food they receive, the faster and larger they will grow so it is virtually impossible to over feed spiderlings (Marshall 1996).

At these tiny sizes the best food items readily available are pinhead crickets, wingless fruit flies, small mealworms and roaches (de Visjoli 1991, Marshall 1996). The spiders can be given a few of these items every 2-3 days, depending on the individuals eating habits.

# 10 Artificial Rearing

## 10.1 Incubator Type

For the reasons mentioned in the previous chapter, many European and American collectors prefer to incubate all of their egg sacs artificially. The main problem with this is the fact that the eggs need to turned and agitated regularly. Under natural conditions the female will rotate the sac in her jaws and palps so that no egg remains in the middle or bottom of the clump for too long (Schultz 1998).

At present there are no commercially available incubators designed to deal with spider eggs, although a few designs have been published by the experts. The plans for these designs are fairly complex and can be purchased from the American Tarantula Society at http//atshq.org under the ATS Shop link. The manual is called 'A Mechanical Mom for Tarantulas', by Schultz & Schultz.

A simpler but more labour intensive technique called the Pedestal Method is also available. This entails setting up an enclosure with a few centimetres of moist substrate. The humidity should be maintained at 60-70% and the temperature at around 27C. A plastic jar lid of suitable size is placed upside down in the centre of the cage, acting as a pedestal. The egg sac is then placed on the jar lid, preventing contact with the substrate. The main problem with this method is that you need to turn the sac over yourself several times a day. Neglecting this for just one day could jeopardise the whole egg sac as will rough handling (Schultz 1998). This method is apparently more successful than allowing the female to care for the eggs, but far less so than a full on incubator.

## 10.2 Incubation Temperature and Humidity

Most species can be incubated at 60-70% (with rainforest species at the higher end). The temperature should be maintained at 27C, although desert species have been successfully hatched at 28-30C (Schultz 1998). Temperatures under 25 or over 32 are certainly fatal to the eggs.

## 10.3 Perinatal Care

If the incubation period is known the egg sac should be removed from the incubator at or around that date. If this is not known you may begin to see movement in the sac after bout 50 days. In either case the sac should be removed for opening. Use a 2foot fish tank on its side as a corral and operating theatre. The egg sac needs to be carefully cut open using surgical scissors, make sure you have an assistant and hundreds of small jars already set up with moist peat moss. Upon cutting open the sac the spiderlings should appear coloured and moving around, if they are still white and barely moving carefully stitch the sac up and try again at weekly intervals.
The spiderlings should be active and will emerge quickly from the sac and should be quickly and carefully scooped up and placed into individual jars (Schultz 1998).

## 10.4 Desired % Egg Loss

As they produce so many eggs (most viable) you may find it hard to maintain 500 spiderlings individually so a certain percentage loss may be beneficial in the long run. To have a 25% survival rate for a beginner would be seen as successful, though as experience is gained and minor changes in technique are tried a 75% success rate is achievable.

## 10.5 Diet and Feeding Routine

Upon hatching the spiderlings will rely on their stored energy until they complete their first moult. Different species will emerge at varying levels of development so some species will moult before others. In any case they can be offered their first food within two weeks of hatching, or if incubated by the mother immediately after separation (Lund 1977).

As each needs to housed on its own and will require feeding about 3-4 times per week a fair amount of space and time needs to be committed to spiderling care. Wingless fruit flies, pinhead crickets and small mealworms are the food of choice, generally due to their availability and ease of breeding. Spiderlings that are kept at temperatures of 28-30C will develop quicker and grow into larger adults (Marshall 1996).

## 10.6 Behavioural Considerations

Spiderlings require higher humidity than adults do, as their small size makes dehydration easier. It is best to store several jars in a larger terrarium or even a warmed cabinet to help control the over all temperature and humidity. Eventually the substrate will dry out so a few millilitres of water must be added and this is best done with a syringe (pers. exp. Rearing *Atrax robustus* spiderlings).

Terrestrial species will almost certainly begin burrowing so it's best that the substrate is well tamped to assist construction. Arboreal species require a taller jar and will be happy with an upright piece of bark to perch on (deVosjoli 1991).

As tarantulas can grow very quickly to begin with, you may need to up-size their jars a couple of times before they are ready for a display case or you can get rid of them.

### 10.6.1 Hygiene

Due to the high humidity required for tarantula rearing hygiene is a crucial factor in warding off fungal and parasite infestations. All shed skins, faeces and food parcels should be removed immediately, and if mould is detected the tarantula should be rehoused and the substrate discarded. It is conceivable that those rearing native tarantulas in non-quarantine situations could potentially be subjected to ant invasions. Two solutions are available: the first is to house the jars in an ant-proof cabinet or fish tank; or the jars can be placed on pedestals, in trays of water.

## 10.7 Record Keeping

As there is so much to learn about the biology of many tarantula species recording events in a spiderlings road to maturity is highly worthwhile. The number and frequency of moults to maturity, temperature and humidity readings and web styles are all valuable pieces of information. Added to this, feeding regimes and growth rates (body length, leg span and weight) will help paint the picture of captive husbandry in this fascinating group.

# 11 Acknowledgements

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# 14 Glossary

**Abdomen:** the body of the spider also known as the opisthosoma.
**Anterior:** the forward side.
**Aranaemorphae:** the sub-order containing 'modern spiders', includes orb weavers, huntsmens, redbacks etc.
**Arthropoda:** the phylum that includes all animals possessing an outer skeleton and jointed limbs.
**Book Lungs:** respiratory organs located on the ventral surface of the abdomen- one pair in 'modern spiders' two pairs in 'ancient spiders'
**Carapace:** the chitonised dorsal plate of the cephalothorax
**Cephalothorax:** the fused head and thorax of the spider. Often called the prosoma.
**Chelicerae:** the jaws, consisting of fang and fang base (single Cheliceral)
**Coxa:** the first segment of the legs and palps, numbered from the cephalothorax.
**Dorsal:** refers to the upper side.
**Embolus:** spine like tube of male spiders, through which sperm passes from the palpal bulb.
**Epigastric Furrow:** a groove on the ventral surface of the abdomen between the first set of booklungs on tarantulas'.
**Epigyne:** reproductive opening on a female spider.
**Epistome:** the upper lip.
**Exuvia:** another term for the shed skin.
**Femur:** the third segment of the appendages.
**Fovea:** the small pit in the centre of the carapace representing the connection of the stomach muscle. Can be a protusion on some tarantula species.
**Instar:** a stage of development between moults, usually refers to juveniles.
**Labium:** a plate structure forming the floor of the mouth, attached to the sternum on the posterior end.
**Mygalomorphae:** refers to 'primitive spiders' including tarantulas, funnel-webs and trapdoors.
**Ocellus:** pl. ocelli, refers to simple eyes.
**Opisthosoma:** another term for the abdomen.
**Orthognathid:** the more correct term for 'primitive spiders'.

**Palps:** the second pair of appendages after the chelicerae also called pedipalps.
**Paraxial:** refers to the parallel fang arrangement of Mygalomorphs.
**Pedicel:** the flexible waist joining the cephalothorax to the abdomen.
**Pedipalp:** same as Palp.
**Posterior:** refers to the rear side.
**Prosoma:** see Cephalothorax.
**Rastellum:** a series of short teeth situated along the basal joint of the chelicerae used for digging.
**Rostrum:** see Epistome.
**Scopula:** a band of close hairs forming a brush, which aids in climbing smooth surfaces.
**Spermathecae:** A pair of pockets found inside the abdomen, designed to collect sperm that are connected to the epigyne.
**Spinnerets:** the external silk producing organs on the posterior of the abdomen.
**Sternum:** the ventral plate of the cephalothorax, attached to the coxae and labium.
**Tarsus:** the terminal segment of the appendages.
**Tibia:** the fifth segment of the limbs.
**Tibial Spurs:** a growth on the tibia of some male Mygalomorphs used to pin the females fangs down during mating.
**Trochanter:** the second segment of the limbs.
**Tubercle:** a low rounded projection (demonstrated in tarantulas' by the protusion the eyes are set in).
**Ventral:** refers to the underside.

# Appendix I

## The Name Game

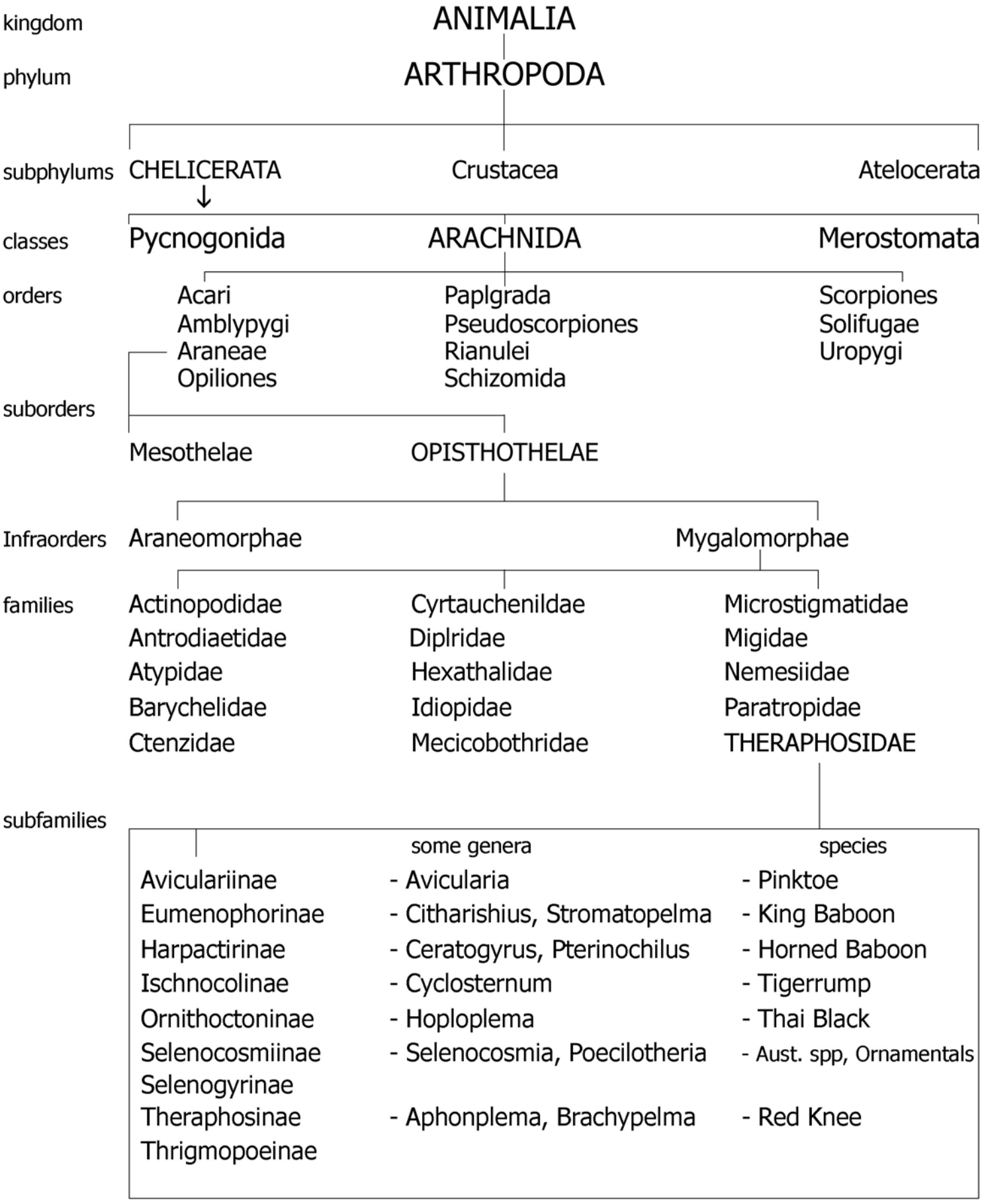
In the Middle Ages in a northern Italian town called Taranto, there began an outbreak of wild dancing which eventually spread through southern France, Dalmatia and Spain. The 'tarantella' dance was said to be the only antidote for the bite of a spider the locals called the tarantula. It has been said that the spider bite reason used by the peasantry was their excuse to dance- a practice that was outlawed by Church at the time (Martin 1995). In 1790 the spider was described as *Lycosa tarantula* (Rossi) which is a wolf spider. The name tarantula was indiscriminately used to describe any large spider and has become so ingrained in the literature that most people now accept it to refer to Theraphosids, totally ignoring *Lycosa tarantulas*' status.

To make matters worse the sub-order Mygalomorpha is also incorrect. The word Mygale was first used by the naturalist Georges Cuvier to describe a family of water shrews. This name is also ingrained in the scientific literature though the replacement name Orthognatha is slowly coming through (Raven 1985, Smith 1990).

Just when you thought it couldn't get any worse the word tarantula also describes a genus of scorpion! Combine all this with the fact that local names like Birdeater, Baboon Spider and Earth Tiger aren't universally accepted by the scientific community a very confusing picture is presented.

# APPENDIX II

## The Tarantula Family Tree



# Appendix III

# Quarantine

## 1 Function

This chapter is probably the most important if considering importing exotic arachnids for your institution, as many rules apply before you even begin. Below is a summary of our Arachnid Quarantine Facility Procedures Manual (AQIS, November 2000).

Under Australian law exotic arachnids can only be kept in an Australian Quarantine and Information Service (AQIS) approved 'High Security Quarantine Insectary Facility'. Our Arachnid Quarantine Facility (AQF) is designed to hold about 50 female arachnids (we currently have 24 tarantulas and 3 scorpions).

No specimen may leave the facility alive without the approval of AQIS and dead specimens must be treated or preserved in accordance to guidelines. Only feed insects may be brought into the facility and even uneaten insects must be destroyed and autoclaved.

Unfortunately the current laws preclude the possibility of breeding exotic tarantulas' in fact any juveniles that mature into males must be euthanised within 24 hours – as we sadly had to do with a handsome male Suntiger Tarantula (*Psalmopeous irminia*).

The reasons for this high level of quarantine are to protect the Australian environment from (a): exotic arachnid predators competing with our natives and (b): to prevent any exotic parasites imported within the arachnids escaping into the local environment.

## 2 Access

A Nominated Officer (N.O.), in our case the General Manager, is responsible for the correct use of the Quarantine Approved Premise (QAP).

**A)** Authorisation for personnel to enter must be provided to the N.O. A full list of authorised ARP staff to be posted on external door. Trades people must be fully versed on the principles of the quarantine facility.

**B)** A logbook is maintained in the first air lock to be filled out by anybody entering and leaving the facility. N.O. is to check weekly to ensure all entries are authorise

**C)** Any person entering the QAP must adhere to procedural guidelines.

**D)** Before authorisation, staff are to read the AQF Manual and be familiar with quarantine principles, handling animals and materials and implementation of protocols, e.g. waste disposal, security etc. Signing off is required by the N.O.

**E)** Non compliance to be dealt with at N.O. discretion.

## 3 Security

**A)** The external door to the facility to remain locked even when occupied

**B)** The alarm system includes indicators above each airlock door indicating when doors are open or not properly closed. If two doors are opened a loud, high-pitched alarm sounds. No enclose to be opened if alarm activated.

**C)** The electronic insect zapper in second airlock is to be operating at all times.

**D)** Effective insect traps are placed in both airlocks and main room.

**E)** Only authorised staff to hold keys.

**F)** Movement/Heat sensors operational after hours and are monitored by a contracted security company. Appropriate staff to be fully versed on procedures and principles.

**G)** Laminated safety glass is used as glazing on viewing windows.

**H)** Air vents to and from A/C are sealed and air must pass through stainless steel #100 quarantine filters to eliminate organisms larger than 1 micron.

**I)** The N.O. is responsible for the maintenance of all security aspects.

**J)** There will always be a double layer of glass between the arachnid and the public (the viewing window and vivarium wall). All other specimens to be housed individually on back wall shelves.

**K)** The N.O. to keep a record of any breaches on file.

## 4 General Hygiene

**A)** Any person entering QAP is to wear a Lab Coat. This is put on/removed in the first airlock only. Latex gloves are worn and removed in the main room only.

**B)** All persons departing QAP must check the mirrors in the second airlock for any feed insects attached.

**C)** Dark traps checked daily any insects destroyed and autoclaved.

## 5 Cleaning

**A)** All surface disinfection to use 340ppm sodium hypochlorite solution (SHS). Contact must be for at least 5 mins.

**B)** Cage furnishings and implements to be soaked in SHS for 5 mins before manually scrubbing. Equipment is then rinsed for 5 mins. then air dried.

**C)** Enclosures can be cleaned as above if small enough to fit in the sink or sprayed with SHS totally soaking it for 5 mins before rinsing and air-drying.

**D)** The sink collects to a sealed tub, which drains into a liquid waste drum for treatment.

**E)** Work benches and all floors to be disinfected each afternoon.

## 6 Liquid Waste Disposal

**A)** All liquid wastes, including disinfectant solutions, old drinking water and wastewater must pass through the sink.
**B)** The sink drains to storage tank 1. ( beneath the sink).
**C)** When required or at the end of each day:
   i. A valve is opened draining storage tank 1 into a smaller autoclave safe tank.
   ii. Container placed in autoclave
   iii. Autoclave preset for 120C at 18 kpa for 30 mins.
   iv. Allow sufficient cooling period, <100C before opening. Once opened waste tank must be immediately removed for disposal into sewerage system.

**D)** A logbook is to be maintained adjacent to the autoclave.

## 7 Solid Waste Disposal

**A)** Includes substrates, uneaten food, faeces, disposable gloves etc.
**B)** All are to be autoclaved as above. Removed in sealed heavy-duty garbage bags.
**C)** A separate logbook is to be maintained for solid waste disposal.

## 8 Feeding

Food items may be stored in the QAP or brought in as needed.

**A)** Any uneaten or surplus food items, either live or dead that need removing from the QAP must be destroyed and autoclaved as above.

## 9 Handling

Only ARP staff to handle specimens and very rarely at that

## 10 Record Keeping

**A)** Individual record cards are to be attached to each enclosure Record feeding, cleaning, health and behavior daily.

**B)** Each specimen is to be individually identified with characteristics to be entered on each specimen card.

**C)** QAP diary to be maintained with additional details not required on each card e.g. proposed changes to room temp. etc.

**D)** When removing records from QAP they are to be placed in a re-sealable bag after thoroughly checking for bugs etc. The bag is then checked in each airlock and once outside for contamination. If any contamination, repeat process or auto clave material.

## 11 New Arrivals

**A)** All packing materials to be autoclaved

**B)** Within 48hrs the parks consulting Entomologist will give each specimen a health check.

**C)** Any unusual health problems to be reported to AQIS immediately.

**D)** AQIS to decide on what actions can be taken regarding sick individuals.

**E)** Specimens to be checked daily and details entered on specimen cards.

## 12 Disease Outbreaks

**A)** Any signs of ill health must be reported to the N.O.

**B)** The specimen will continue to be kept in its own enclosure placed away from the others 'sick bay'.

**C)** If in any doubt of the seriousness of the situation ARP to consult an entomologist.

**D)** If entomologist deems the situation serious e.g. contagious pathogen:

i. AQIS notified

ii. Access to be restricted to one dedicated keeper only, this person can have no contact with the rest of the Parks animals.

iii. Consultation with AQIS must be maintained, if the condition is considered serious the animal must be euthanased immediately and isolated in a sealed bag. Disposal of the animal and any equipment is to be treated as solid waste.

v. Access will remain at an absolute minimum until the situation is fully resolved.

## 13 Deaths

**A)** The body is sealed in jar of 70% ethanol solution.
**B)** The N.O. to be notified.
**C)** The Parks entomologist will be called in to autopsy.
**D)** Once established the cause of death will be reported to AQIS